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Book of Abstracts

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Sessions

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Assistive technologies for older adults: a multidimensional perspective

Chairs: Maribel Pino^a, Anne-Sophie Rigaud^b ^aLusage Living Lab, Broca Hospital, France ^bAssistance Publique-Hôpitaux de Paris, France

In the years to come, population aging will result in an increased number of older adults living with disability. This is due to the fact that susceptibility to non-communicable diseases (*e.g.*, cognitive impairment, urinary incontinence, depression, and falls or immobility), which are major causes of disability, increases with age. Severe disability is strongly linked to the demand for long-term care and to expenditure on it. Consequently, early detection, prevention, and treatment of disability in older adults are a high societal priority. Assistive technologies (AT) have the potential to support independent living, increase older adults' quality of life, reduce care costs, and compensate the shortage of care personnel. AT solutions can serve different purposes: providing assistance in performing daily tasks; reminding medication taking; health monitoring; compensating for sensory, physical and cognitive impairment; supporting communication and social interaction and networking; stimulation and entertainment. AT solutions include telehealth applications, social and assistive robotics, virtual reality, and sensors, as well as hearing, vision, or mobility aids. AT solutions can be beneficial by providing services that meet the needs of older adults allowing permanent support that combines care and psychosocial monitoring. AT could allow older adults to continue to perform daily tasks that would no longer

be possible without assistance from a caregiver. AT solutions could also reduce medical costs through better compliance with pharmacological treatment and remote monitoring (telemedicine) which could contribute to reduce hospitalizations and delay institutionalization of older adults. These technologies are promising but raise different questions such as usability, acceptability, usefulness, ethics, and equity to access...

Design and Development of Assistive Technologies for the Ageing Population: a Systematic Literature Review

Jing Forrest^a, Alexandre De Masi^a, Katarzyna Wac^a, Mirana Randriambelonoro^b

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Read extended abstract page 97

[Track A | Auditorium 250 | Wed 08/30 | 11:00-12:30]

Abstract: Systematic literature review of papers published between 2012 and early 2022, to explore the potential of assistive technologies for supporting the ageing population, to understand the context and the ecosystem in which these technologies have been designed and developed, and to identify the challenges that need to be addressed in hope to promote the widespread Assistive Technologies (AT) usages.

Keywords: assistive technologies, AT, ageing population, seniors, older adults, design and development, challenges, guidelines

Assistive Technology in the Assessment and Care

of Loneliness in the Elderly: an Interdisciplinary Proposal for Rural Areas

Lorenzo Mariano Juárez^a, <u>Jose Garcia-Alonso^b</u>, Borja Rivero Jimenez^b, David Conde Caballero^a ^aUniversity of Extremadura, Department of Nursing, Spain ^bUniversity of Extremadura, Department of Computer and Telematic Systems Engineering, Spain

Read extended abstract page 99

[Track A | Auditorium 250 | Wed 08/30 | 11:00-12:30]

Abstract: The analysis of loneliness and social isolation is a relevant topic in public health policies. In recent years, an increasing number of studies have been carried out addressing the nature and extent of this phenomenon in different social groups. This paper describes an interdisciplinary project being carried out with the participation of anthropologists and computer engineers in a rural locality in Extremadura, Spain. In this context, the research began with ethnographic fieldwork to understand the meanings, experiences and social representations of loneliness.

Keywords: loneliness, assistive technology, ageing people

Aging Positively: Enhancing Positive Emotions in Older Adults through Natural and Social Experiences in Immersive Virtual Reality <u>Katarina Pavic</u>^{a,b,c}, Dorine Vergilino-Perez^a, Thierry Gricourt^c, Laurence Chaby^{b,d}

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 $[\mathsf{Track}\ \mathsf{A}\ |\ \mathsf{Auditorium}\ 250\ |\ \mathsf{Wed}\ 08/30\ |\ 11:00\text{--}12:30]$

Abstract: Recently, immersive technologies such as Virtual Reality (VR) have become believable candidates for enhancing individuals' well-being. However, there are several barriers to using VR to improve well-being, including design, and the availability of diverse video content. Thus, our study aimed to investigate the impact of immersion and virtual environment content (natural vs. social) on different age groups, as there is limited research on this aspect. 38 undergraduates and 25 older adults were recruited for the present study. They watched and rated 360° videos of natural and social contents under a highly immersive Head-mounted display (HMD) and a less immersive screen, while their skin conductance and heart rate were collected. Overall, preliminary findings suggest that while video content matters and leads to specific emotional responses in younger adults, older users reported high levels of positive emotions and arousal throughout most immersive experiences. As these are encouraging results VR for fostering positive emotions in elderly users, potential applications for a "successful aging" or vulnerable users will be discussed.

Keywords: Aging, Virtual Reality, Positive Emotions, Physiological responses

Perspectives of Older Adults Regarding the Use of Digital and Technology-Based Services: a Qualitative Interview Study

<u>Jeanne Cattoni</u>^a, Sébastien Dacunha^b ^aUniversité Paris Cité, France ^bAssistance Publique-Hôpitaux de Paris, France Read extended abstract page 103 [Track A | Auditorium 250 | Wed 08/30 | 11:00-12:30]

Abstract: The significant growth in the number of elderly people at a time when many everyday services are being digitised raises the question of the accessibility of new technologies for this group. It is important to consider the abilities and needs of these users when developing these tools, to avoid a digital divide. Twenty-six of the expected forty interviews were conducted in order to gain a better understanding of this population's perspectives on digitisation. Participants were asked about their use of the technology, as well as their difficulties, opinions, and advice for improving accessibility. They were also asked about the ethical and societal issues involved. The results show the effort that needs to be made in terms of the vocabulary to be used and the training to be provided to enable older people to overcome their apprehension about using a new system. Opinions are mixed on the benefits and the risk of a lack of human contact. The main advice was to use a less technical vocabulary and to offer free,

tailored training courses. These results and the way in which they address accessibility issues were discussed. **Keywords:** seniors, technology, accessibility

Correlation Between the Ability to Manipulate a Touchscreen Device and Hand Strength and Manual Dexterity Among Community-Living Older Individuals

Michal Elboim-Gabyzon^a, Alexandra Danial-Saad^{a,b} ^aUniversity of Haifa, Faculty of Social Welfare & Health Sciences, Israel

 ^bThe Arab Academic College for Education in Israel Read extended abstract page 106
[Track A | Auditorium 250 | Wed 08/30 | 14:00-16:00]

Abstract: There is lack of evidence regarding the correlation between the ability to manipulate touchscreens and the level of hand function among the elderly. The study aimed to examine the correlation between the ability to manipulate a touchscreen device, as assessed by using the touchscreen assessment tool (TATOO), hand strength, and manual dexterity among independent communityliving older individuals. Thirty-four community-living older adults (average age 79.4 ± 6.7 years) participated in single-session assessments lasting 45 min each. The assessment included hand strength measurement using manual hand dynamometry and hydraulic pinch gauge, a functional dexterity test (FDT), and TATOO. No significant correlations were observed between most of the TATOO items (22 out of 26), grip and pinch strength, and the FDT test. Yet, moderately significant correlations were demonstrated in more complex gestures in terms of accuracy (dragging task) and speed of movements (double tapping). The present study demonstrated that touchscreen manipulation ability among healthy elderly individuals was not correlated with grip and pinch strength and manual dexterity. Accordingly, the hand function assessment toolbox should be expanded to include new tools such as TATOO to measure the specific skills required to operate digital devices.

Keywords: Hand Strength, Manual Dexterity, Older Individuals

Using a Social Robot to Engage Older Adults Living in Residential Care Homes in Cognitive Training: Preliminary Results From the SHAPES Project

<u>Lisa Cesario</u>^a, Arianna Gherardini^a, Marco Pasin^a, Laura Bugo^a, Massimiliano Malavasi^a, Evert-Jan Hoogerwerf^a, Valentina Fiordelmondo^a, Esperança Lladó Pascual^b, Lorenzo Desideri^a

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[Track A | Auditorium 250 | Wed 08/30 | 14:00-16:00]

Abstract: The employment of socially assistive robotics (SAR) is increasingly being considered a credible solution to support healthcare systems in dealing with an aging society. In this contribution, we explore the experience of older adults (n = 11) living in a residential facility

with a cognitive training intervention conducted with the support of a SAR. Within the HORIZON2020 Project SHAPES, a mixed-method study has been conducted to collect preliminary evidence on users' engagement and acceptance of the proposed SAR-based intervention. The results suggest that the SAR-based cognitive training intervention conducted was accepted by all stakeholders. Data on enjoyment of participants indicate that users did not experience a "novelty effect" of the proposed innovation, but longer sessions are needed to confirm this result. **Keywords:** Older adults, aging, cognitive decline, social robots, cognitive training

Exploring AI Literacy Among Older Adults

Amrat Kaur, Weigin Chen

Oslo Metropolitan University, Norway

Paper in IOS Proceedings

[Track A | Auditorium 250 | Wed 08/30 | 14:00-16:00]

Abstract: Artificial Intelligence (AI) technology is increasingly being integrated into our daily lives and many aspects of society. Al is viewed as a new opportunity to promote independent living and well-being for older adults. Al literacy plays an important role in older adults' acceptance and use of AI-enabled products and services. However, to our knowledge, no research has investigated Al literacy among older adults. The study aims to address this gap by collecting and analysing data on older adults' knowledge and understanding of AI and their experiences and concerns regarding Al-enabled products and services. In total, 207 older adults, aged 60 years and over, participated in the study, including 182 who answered a survey and 25 who participated in semi-structured interviews. The results show a variety levels of AI literacy among the participants. Many are interested in learning more about AI so they can make informed decisions about AIenabled products and services. This study has not only produced insights into AI literacy among older adults but also contributed to increasing the awareness of AI among the participants and has provided recommendations on measures to enhance older adults' AI competencies.

Keywords: Artificial intelligence, Al literacy, older adults, digital literacy

Care Professionals' Needs Regarding Hospital Logistics and Perceived Usefulness of a Social Assistive Robot in Geriatric Institutions.

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Read extended abstract page 108 [Track A | Auditorium 250 | Wed 08/30 | 14:00-16:00]

Abstract: Over the last few decades, information and communication technologies have continuously boomed, making new uses possible in sectors that were previously unfamiliar with their use. The health sector is one of these fields with the advent of new technological devices in healthcare professionals' routine (e.g., new software, so-cial robots, logistics robots that support the execution of

logistical tasks for caregivers). All these tools are changing the practices of care workers and, at the same time, the overall framework of the care provided to patients. This research project aims to identify the conditions for a successful implementation of a hospital logistics robot considering the point of view of the future robot users. A total of 25 semi-structured interviews with care professionals were conducted at two geriatric hospitals, Broca Hospital (AP-HP, Paris, France) and Vaugirard hospital (AP-HP, Paris, France). These interviews enabled us to identify various logistics problematic situations encountered by the caregivers in their professional practice for which the help of a logistics robot would be welcomed and useful. 1) Locate and fetch care equipment on demand; 2) Transporting meal carts and bringing them to the patients; 3) Carry and store the cartons of IV containers and associated carts.

Keywords: Hospital logistics; geriatric hospitals ; care professionals; logistics robots

Design, Development and Testing of Dancemove: a Digital Solution to Promote Physical and Cognitive Training for Older Adults

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Read extended abstract page 110

[Track A | Auditorium 250 | Wed 08/30 | 14:00-16:00]

Abstract: This study aimed to design and develop a user-friendly digital solution called DanceMove, which combines physical and cognitive training for older adults. The study was divided into four phases: i) concept and ideation, ii) design and development of the prototype, iii) testing of functional mock-ups, and iv) testing of the prototype in the laboratory and real context. Nonfunctional mock-ups were generated, and two functional mock-ups were developed and tested. The final prototype of DanceMove was evaluated with community-dwelling older adults, showing both good acceptance and usability. Despite that, a few usability issues were identified, including login, help, music selection, and score consultation features, which needed improvement. Additionally, five older adults used DanceMove for four weeks at home, and the system was found to be usable and the intervention feasible and acceptable. However, barriers to use were identified, including digital literacy and digital solution-related issues. The research team addressed these barriers by including IT training and developing a user manual. The study provides valuable insights for future work, including a randomized control trial. Further improvements and adaptations are necessary to enhance its usability.

Keywords: Physical and cognitive training, Older adults, DanceMove, Dance-mediated technology

Evaluating the Energy Requirements of Assistive Technologies for Older Adults

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Wed 08/30 | 16:30-18:00]

Abstract: The successful adoption of assistive technologies for older adults requires considering and evaluating many different factors and dimensions such as effectiveness, usability, cost and equity of access, to name some of the most relevant. In line with this, the energy requirements to power such assistive technologies remains a hidden factor that might to some extent influence the success in their adoption and the user experience in a wider sense. Very often energy availability is taken for granted and its associated costs and operational requirements are mostly neglected. In this paper, the energy-related requirements of assistive technologies are analysed from a general perspective. This analysis is subsequently particularised for a use case within the SHAPES project, in the context of active and healthy ageing. This use case includes a wide variety of assistive technologies, namely: wearable devices, home sensors and a smart mirror, which provides connectivity and a set of software services. The energy requirements of all these technologies are evaluated and analysed to investigate their impact and relevance on the overall cost and user experience, following the proposed protocol.

Keywords: Assistive technologies, energy, wearable devices, smart mirror, evaluation, older adults

Technological and Organizational Challenges for the Use of a DiTV by Older Adults in Geriatric Settings

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^cHôpital Broca, AP-HP, Service Gériatrie 1&2, France Read extended abstract page 112

[Track A | Auditorium 250 | Wed 08/30 | 16:30-18:00]

Abstract: Digital Interactive Television (DiTV) systems could be a promising and accessible solution to help meet several psychosocial needs of Older Adults (OAs) living in geriatric institutions. A case study was conducted to identify barriers to DiTV use among geriatric residents and accessible specifications for the system. Semi-structured interviews were conducted within 3 French nursing homes

already equipped with a DiTV (OAs: n=18; professionals: n=6). Interviews were then processed using a thematic deductive analysis inspired by a European multidimensional health technology assessment model, with a focus on the technological and organizational domains. Results showed that DiTV systems can be well accepted by OAs who recognize the advantage of this system in terms of communication and entertainment. However, its use may be hindered by several technological (e.g., ergonomic issues) and organizational (e.g., workload) factors.

Keywords: Digital Interactive Television; Geriatric Institutions; Health Technology Assessment; Usability; Acceptability

Using Wearable Devices in a Healthcare Facility: an Empirical Study with Alzheimer's Patients

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Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{A}\ |\ \mathsf{Auditorium}\ 250\ |\ \mathsf{Wed}\ 08/30\ |\ 16{:}30{-}18{:}00]$

Abstract: Smart Wearables are considered a very promising solution for monitoring and helping people affected by cognitive decline or dementia and, in particular, Alzheimer Disease (AD). Nonetheless, the acceptability and wearability of such devices for AD patients pose certain challenges. To address this, an empirical study has been conducted with a group of patients with mild to moderate AD, wearing wristbands E4 by Empatica for a duration of three months. The experiment has been integrated into the regular healthcare activities, with active involvement from nurses and physicians. The paper reports the feedbacks of the caregivers and discusses wearability and acceptability issues.

Keywords: Dementia, Alzheimer's, wristband, bracelet, Assistive Technology, healthcare technology, nursing home, monitoring, caregiver

Introducing an Air-Disinfection Robot as Assistive Technology Into Residential Care Homes: a Proof-of-Concept Study in Ireland and Japan

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ⁱTokyo Medical University, Japan

Read extended abstract page 115

[Track A | Auditorium 250 | Wed 08/30 | 16:30-18:00]

Abstract: While there are high expectations for digitalization and automation of care work, bringing new technologies such as robots into a workplace remains a challenge regarding acceptance and usability, as well as reflection of user preferences and needs. Major obstacles include the process of learning new skills, arranging additional work, and embedding it into care processes. Against this background, an original air-disinfection robot was developed for our cross-boundary research project. The aims of this research therefore were to test how such a robot would be received by care professionals working in senior homes, and to explore the process by which the robots are adopted in different cultures. The robot was introduced first in Ireland, and following the completion of its eight-week long trial, the same equipment was transferred to and used in Japan for eight weeks. Prior to its installment in both locations, seven main users (physiotherapists, nurses and social care professionals) working full-time in each residential care home were trained. Semistructured interviews, focus groups, and system usability scale questionnaires were carried out before, during, and after the trials. The findings demonstrate that the users had positive perceptions of the robot, primarily because the robot provided an additional layer of organizational safety and it was easy to use. Initial differences existed in staff's confidence levels, depending on prior experience with technologies in Ireland, while no such differences were observed in Japan. The study provides promising learning opportunities for co-design, development and implementation of AT.

Keywords: assistive technology, digitalization, global aging, care work, technology adoption, robot, safety

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Assistive solutions for person-centred integrated care

Chairs: Mac MacLachlan^a, Michael Cooke^b ^aALL Institute, Maynooth University, Ireland ^bMaynooth University, Ireland

Increasingly governments in Europe and beyond are investing in digital solutions for improved person-centred integrated care. As a matter of fact, most people are keen on living in what they feel their own home with the highest level of independence and integrated in the community. So-called "assistive solutions" allow for a mix of traditional AT, interventions on the build environment, smart home technology, health and well-being apps, digital personal assistance and in-person human support. How this mix is reached is the key research question of the session. It is a challenge, as traditionally sectors such as the healthcare and social sector are good in developing strategies and policies inspired by the digitisation of processes in society, but less good in translating these in person-centred integrated care services.

Session promoted by the WeCareMore Centre of AIAS Bologna in collaboration with the SHAPES and SEURO project consortiums.

Mechanisms for the Participatory Governance of Technologically-Mediated Health and Social Care

<u>Melanie Labor</u>^a, Michael Cooke^a, Richard Lombard-Vance^a, Alexia Zurkuhlen^b, Bettina Meenen^b, Anna Schüttlerb^b

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: Increasingly, health and social care providers are adopting technology-mediated processes to optimise the delivery of care and to influence policy- and decisionmakers. However, fragmentation persists in and between health and social care, impeding the provision of rounded person-centred care. Health and care delivery for an ageing population involves many diverse stakeholders with a range of motivations and agendas. The creation of a functional and sustainable network may promote the achievement of a well-functioning and integrated health and care sector. This work-in-progress paper outlines the evolution of an optimal governance model for the SHAPES network.

Keywords: Socio-technical framework, integrated care, healthy ageing, participation, trust, network governance, digital health networks

Barriers to and Facilitators of Participation in Health and Social Care Governance: Categories and Cross-Cutting Themes From a Survey of SHAPES Project Partners <u>Richard Lombard-Vance</u>^a, Melanie Labor^a, Alexia Zurkuhlen^b, Michael Cooke^a

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: Good governance - aligned with human rights and rights-based care, participation, inclusion, and person-centredness - of digital care systems is integral to their ability to meet their objectives. To gain insight into existing governance structures and processes and participation experiences across Europe and lay foundations for the SHAPES Project's network governance (a healthy and active ageing Innovation Action consortium), our objectives included: 1) expand the list of known stakeholders, 2) explore how the range of stakeholders participate in health and social care governance, 3) develop an inventory of barriers and facilitators. Using an empirical, survey method, we consulted SHAPES Project partner organisations, with respondents invited to suggest specific participation barriers and facilitators. 16 organisations responded. Numerous additional stakeholders were identified. Circa 150 unique barriers and facilitators were reported, rationalised into 20 superordinate categories. Six cross-cutting themes were assembled: dimensionality and flux; power; opportunity and environments; interest, motivation, and choice; valuing governance participation, and duality. This work allows consideration of a wide range of stakeholders for the SHAPES collaborative governance model and future research, and for system design with the benefit of a detailed inventory of barriers and facilitators, and thematic contextualisation. Participation is modifiable and we suggest intervention targets and mechanisms.

Keywords: Governance, digital health, healthy ageing, participatory governance

SHAPES Ethical Framework and the Need for Support Services When Using Digital Tools

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^aLaurea University of Applied Sciences, Finland ^bMaynooth University, Ireland ^cEDGENEERING, Lda, Portugal

Read extended abstract page 117 [Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: This paper discusses the relevance and necessity of various support services as part of the digital care service provision. The focus of our analysis in this paper is on the SHAPES ethical requirements related to user support and governance. These requirements, stemming from ethical principles, values and rights, were further analysed from the viewpoint of the latest research on digitally-enabled care for older persons. This study showed that different support services are needed for endusers but also for care providers to promote the adoption and use of digital tools in care provision. Therefore, the focus on the research and development should be on the creation of needed services around the digital tools - instead of regarding digital tools as services as such.

Keywords: older persons, care providers, digital tools, support services

SHAPES Marketplace: Transparency, Trust and Fair Competition in the Healthy Ageing Market

Bárbara Guerra^a, <u>Marco Manso</u>^a, Melanie Labor^b, Michael Cooke^b, Malcolm MacLachlan^b, Evangelos Markakis^c, Ioannis Kefaloukos^c ^aEDGENEERING Lda., Portugal ^bMaynooth University, Ireland ^cHellenic Mediterranean University, Greece Paper in IOS Proceedings [Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: Access to digital health and care solutions and services that promote healthy ageing, independent living, and ageing in place is limited due to significant market barriers and challenges. The SHAPES project addresses the challenge of ageing populations by developing a sociotechnical ecosystem comprising a variety of health and care digital solutions, tools and services to enable and facilitate active, independent, and healthy ageing at home. Within the SHAPES project, the SHAPES Marketplace serves as a one-stop-shop for digital solutions and services designed for the Silver Economy that target the smart and healthy ageing and independent living markets. Delivering a dynamic catalogue of health and care digital solutions and services, the Marketplace promotes a transparent expansion of a trusted market offer on digital solutions and services for healthy ageing and independent living on a pan-European scale, thereby preventing vendor

lock-in and enhancing the agile and fair competitiveness of the health and care industry, particularly in Europe. This paper introduces the SHAPES Marketplace and considers its function as a market driver to raise awareness on the benefits and impact of health and care digital solutions and services, as well as to shape the healthy ageing market, upholding the Systems-Market for Assistive and Related Technologies (SMART) Thinking Matrix to stimulate transparency, trust and fair competition.

Keywords: Marketplace, Silver Economy, market shaping strategy, SHAPES, co-creation, ageing population, older adults

Can Assistive Technologies Improve Older Adults' Quality of Life? the Case of Remote Monitoring System with Interactive Communication Function

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ⁱTokyo Medical University, Japan Read extended abstract page 119

[Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: Do assistive technologies (AT) enhance QoL of older people and care professionals in long-term care facilities? We have previously reported the impact of a monitoring system with an infrared camera and communication robots. Further improvements were made to detection accuracy of the camera and functionalities for verbal interactions were added. This paper reports on these efforts in nursing homes and their impact. The study was conducted with 34 older people and 20 care professionals in nursing homes. An infrared sensor and a biosensor were installed on the ceiling of each room. When the camera detects movement of residents, it notifies the mobile terminal of care staff. Its detection accuracy was improved against sunlight and physical obstacles. A variety of qualitative and quantitative data (e.g. sleeping patterns and social participation of older people, system usability and staff task analysis) were collected before and after the installation. Communication functions were added to the system. False detection rates of the monitoring camera decreased significantly. Using the improved system for the duration of 34 days, 602 alerts were recorded in total and 430 staff visits to rooms during night shifts were spared. Task analysis revealed that time for direct caregiving increased, while indirect care activities decreased. After the introduction of communicative functions, the system usability decreased, primarily due to inaudibility. However, the qualitative data support the idea of an interactive system. The study indicates AT's potential for enhancing the quality of care for all.

Keywords: assistive technology, quality of life, older adults, afety, long-term care policy

A New Model of Home-Based Psychological Intervention After the COVID-19 Pandemic

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Read extended abstract page 121

[Track A | Auditorium 250 | Thu 08/31 | 08:30-10:30]

Abstract: The research proposes the use of social robots in a long-term intervention for children with NDDs. Having established the potential of remote technology, an ESDM-inspired protocol will be implemented at home in a feasibility study.

Keywords: COVID-19 pandemic, digital mental health, social robotic, neuro-developmental disorder, home therapy

A Study on Standard for Safety Requirements for Care Robots

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 11:00-12:30]

Abstract: Recently, care robots are being developed that incorporate robotics into assistive products that focus on daily care for the physically disabled or elderly with reduced physical function. However, although care robots can reduce the physical burden of human intervention, they can also be dangerous depending on their situational awareness. This study describes a standardization that defines safety requirements for care robots and includes verification methods to test their safety requirements. As an example of the application of this standard, a standard for the safety and performance method of a feeding robot is shown. This standardization study is expected to contribute to the spread of care robots in the future. **Keywords:** Care Robot, safety, standard, requirement

About Welfare Robot Project Activities AT Tokushima Bunri University

<u>Shoichiro Fujisawa</u>^a, Jiro Morimoto^a, Jyunji Kawata^a, Mineo Higuchi^a, Hisanori Amano^a, Kumiko Eguchi^b, Yukio Yanagisawa^b, Katsunori Tatara^b

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Read extended abstract page 124 [Track A | Auditorium 250 | Thu 08/31 | 11:00-12:30] Abstract: Based on the analysis results of a survey to grasp the needs of nursing care sites, we aimed to develop a monitoring and communication robot to solve the labor shortage in nursing care sites and to ensure the safety and security of users. Many on-site staff said that it was difficult to keep track of all the residents because they were busy with daily and complicated work. It is known that it is expected to manage the risk of users who cannot be observed on behalf of staff, and to monitor facial expressions over a long period of time and use them as criteria for dementia prevention. Therefore, in the welfare robot project of Tokushima Bunri University, we aimed to research and develop elemental technologies such as face recognition to realize the true needs of the field, and to construct and develop a mobile system that can move autonomously.

Keywords: Assistive Technology, Welfare Robot, Electric Wheelchair, Communication Support

Exploring the Potential of Conversational-Interfaces for Elderly Care: Insights From Stakeholder Workshops

Martin Biallas, Lu Guang, Mirjam Stieger, Richard Moist, Aliaksei Andrushevich, <u>Andrew Paice</u> Lucerne University of Applied Sciences and Arts, iHomeLab, Switzerland

Paper in IOS Proceedings [Track A | Auditorium 250 | Thu 08/31 | 11:00-12:30]

Abstract: This study aimed to explore the utilisation of conversational interfaces (CIs) by local care service providers (CSPs) and their potential applications in improving the quality of life for older adults. Two workshops were conducted with stakeholders to gather insights and requirements. Although currently not yet utilised by CSPs, stakeholders expressed their openness towards CIs and believed that older adults are very likely to appear receptive to them. Loneliness and isolation were identified as significant challenges, even among older adults living in care institutions. Key requirements for chatbots included complementarity to in-person interactions, user-friendliness, 24/7 availability, and seamless integration into daily life. Ethical considerations, data privacy, and security were emphasised, also highlighting the importance of transparency and limited data retention. Various use cases were discussed, such as assistance, selfmanagement tools, and reminders. The financing issues remained inconclusive, but health insurances showed their potential interest in solutions targeting loneliness.

Keywords: AAL, Active Assisted Living, conversational interface, user interface, chatbot, older adults, technology acceptance

Smart Nursing: the Use of Technology to Support Homecare Nurses with Their Care of Elderly

Ryanne Lemmens^a, Jorina Reekmans^a, Sam Van Rijn^b, Servaas Tilkin^b, Tim Dupont^b, Monique Reenaers^c, Kim Daniels^a

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 11:00-12:30]

Abstract: The demand for homecare services is on the rise, while simultaneously there is a shortage of homecare nurses who are burdened with increasingly heavier workloads. The introduction of assistive technologies has the potential to assist elderly individuals as well as (informal) caregivers. This study aims to facilitate nursing care with technology, within the framework of a proper daily structure for elderly people. Initially, a needs assessment was performed with homecare nurses to identify the most relevant daily structure patterns. Subsequently, a prototype comprising of a test setup and a mobile application was developed, followed by a case study involving participation from homecare nurses, informal caregivers, and patients. Both subjective experiences and standardized outcome measures (System Usability Scale, Usefulness Satisfaction and Ease of Use Scale and User Experience Questionnaire) revealed highly positive attitudes towards the test setup and application. Future research endeavours should focus on scaling up the technology and expanding its availability to other caregivers.

Keywords: Assistive technology, sensors, elderly, homecare nursing, daily structure

Evaluation of Commercially Available Fall Detection Systems

Dan Hrubý, Martin Černý

Vsb - Technical University Of Ostrava, Faculty of Electrical Engineering and Computer Science, Czech Republic

Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 11:00-12:30]

Abstract: Falls are a serious problem in the hospital setting and home environments. However, this problem does not only affect the elderly, but also people who have had surgery, have disabling problems, have associated diagnoses (such as poor eyesight, confusion, etc.) or are dizzy or have walking aids. The aim of research was to find, compare and implement fall detectors especially for the hospital environment. This paper summarizes possible fall detectors. Various technological solutions were selected for testing, including wearable technologies as well as contact-less technologies based on PIR detectors and mmWave technologies. The selected fall detectors were tested in living laboratory of HEALTHLab.vsb.cz and then in Hospital AGEL Třinec - Podlesí. The best result of the testing was the use of two Vayyar Home Care devices in one room, thus achieving a detection accuracy of 92.50%and a sensitivity of 92.50 %.

Keywords: fall detectors, mmWave sensors, contact - (less) detection

Privacy-aware and acceptable video-based assistive technologies

Chairs: Paco Flórez^a, Sara Colantonio^b, Martin Kampel^c ^aUniversidad de Alicante, Spain ^bISTI-CNR, Italy ^cVienna University of Technology, Austria

One major concern in the development of assistive technologies lies in the claim for responsible research and the consideration of ethical, legal and social implications of technology development. At a time in which technology developments – fostered by the huge and tremendously fast-evolving innovations through modern information and communication technologies – enter private spheres and come into close contact with individual, private, and intimate activities, it is a mandatory claim that any technology development should be carefully developed and balanced within societal, cultural and individual values, and norms.

Assistive technologies based on computer vision, multimedia data processing and understanding, and machine intelligence present several advantages in terms of unobtrusiveness and information richness. Indeed, camera sensors are far less obtrusive with respect to the hindrance that other wearable sensors may cause to people's activities. Currently, video-based applications are effective in recognising and monitoring activities, movements, and overall conditions of the assisted individuals as well as to assess their vital parameters (e.g., heart rate, respiratory rate). However, cameras are often perceived as the most intrusive technologies from the viewpoint of the privacy of the monitored individuals. This is due to the richness of the information that this technology conveys and the intimate setting where it may be deployed in. Therefore, solutions able to ensure privacy preservation by context and design as well as to ensure high legal and ethical standards are in high demand. Session supported by the visuAAL Marie Skłodowska-Curie Innovative Training Network (https://www.visuaal-itn.eu) and the GoodBrother COST Action (https://goodbrother.eu).

Blind Modalities for Human Activity Recognition

Julian Strohmayer, Martin Kampel

TU Wien, Computer Vision Lab, Vienna, Austria Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 15:00-16:30]

Abstract: Human Activity Recognition (HAR) has attracted considerable interest due to its ability to facilitate automation in various application areas, including but not limited to smart homes, active assisted living, and security. At present, optical modalities such as RGB, depth, and thermal imaging are prevalent in the field due to the effectiveness of deep learning algorithms like Convolutional Neural Networks (CNNs) and the abundance of publicly available image data. However, unconventional modalities such as radar, WiFi, seismic and environmental sensors are emerging as potential alternatives due to their capacity for contactless long-range sensing in spatially constrained environments and preservation of visual privacy. This work gives an overview of the HAR modalities landscape and discusses works that apply these emerging modalities in new and unconventional ways to inform researchers and practitioners about challenges and opportunities in the field of HAR.

Keywords: human activity recognition, person-centric

sensing, blind modalities

Understanding User Needs, Persona Scenarios for Privacy-Preserving Visual System Development

Tamara Mujirishvili, Francisco Flórez-Revuelta University of Alicante, Ambient Intelligence for Active and Healthy Ageing research group, Spain

Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 15:00-16:30]

Abstract: As the world's population ages, the demand for active and assisted living technologies that can support older adults maintain their independence, health, and quality of life is increasing. Video monitoring cameras can provide a sense of safety and peace of mind for both older adults and their caregivers. However, these visual sensing systems come with major privacy concerns. Researchers have developed various visual privacy preservation filters that can be used for video-based monitoring technology, such as blurring, pixelation, silhouette, or avatar. To understand the user's needs and fine-tune the system to their preferences, the persona scenario method was employed in this study. The goal-directed approach to persona design was followed. This scenario-based technique involves creating fictitious persona archetypes that represent the unique characteristics, needs, and goals of the target user group and other stakeholders involved in the process of care provision. A set of eight personas were created based on the qualitative data collected through interviews and focus groups in Spain. Data from 62 participants were analyzed, which represented different contributor groups such as older adults, direct caregivers, healthcare experts, and other stakeholders. The final personas are accessible to the public on a Blueprint persona repository.

Keywords: Persona method, Active and Assisted Living, video-based technology, visual sensing systems, privacy, older adults, user-centered design, user needs.

Video-Based AAL and Intimate Pictures - Criminal Liability in European, Irish, and Polish Law

Maksymilian Michał Kuźmicz

Stockholm University, The Swedish Law and Informatics Research Institute, Sweden

Paper in IOS Proceedings

[Track A | Auditorium 250 | Thu 08/31 | 15:00-16:30]

Abstract: Active and Assisted Living (AAL) technologies offer solutions for addressing healthcare challenges associated with ageing societies and a shortage of care personnel. At the same time, these technologies raise significant privacy issues, which may constitute a barrier to the sustainable adoption and acceptance of AAL. In particular, concerns arise from the presence of cameras in intimate situations, including nudity, and the potential production and dissemination of intimate pictures, which constitutes a risk for AAL users. The paper compares the regimes of criminal liability for making and disseminating intimate pictures under EU, Irish, and Polish law. The study aims to help AAL users understand their legal protection, and give providers and developers more insight into their legal responsibilities. The paper first presents different understandings of an intimate picture in each jurisdiction, followed by a discussion of what the crime entails and who may be liable for it. The conclusion includes a checklist of rules concerning criminal liability, which may be useful for AAL users and providers, and conclusions de lege ferenda.

Keywords: Active and Assisted Living, intimate pictures, criminal law

Privacy by Design Solution for Robust Fall Detection

Michael Brandstötter^a, Jennifer Lumetzberger^b, <u>Martin Kampel^b</u>, Rainer Planinc^a ^aCogvis software & consulting GmbH, Austria ^bVienna University of Technology, Computer Vision Lab, Austria

Paper in IOS Proceedings

 $[{\sf Track}\ {\sf A}\ |\ {\sf Auditorium}\ 250\ |\ {\sf Thu}\ 08/31\ |\ 15:00\text{--}16:30]$

Abstract: The majority of falls leading to death occur among the elderly population. The use of fall detection technology can help to ensure quick help for fall victims by automatically informing caretakers. Our fall detection method is based on depth data and has a high level of reliability in detecting falls while maintaining a low false alarm rate. The technology has been deployed in over 1,200 installations, indicating user acceptance and technological maturity. We follow a privacy by design approach by using range maps for the analysis instead of RGB images and process all the data in the sensor. The literature review shows that real-world fall detection evaluation is scarce, and if available, is conducted with a limited amount of participants. To our knowledge, our depth image based fall detection method has achieved the largest field evaluation up to date, with more than 100,000 events manually annotated and an evaluation on a dataset with 2.2 million events. We additionally present an 8-months study with more than 120,000 alarms analysed, provoked by 214 sensors located in 16 care facilities in Austria. We learned that on average 2.3 times more falls happen than are documented. Consequently, the system helps to detect falls that are otherwise overseen. The presented solution has the potential to make a significant impact in reducing the risk of accidental falls.

Keywords: fall detection, depth data, evaluation, practice

Audio-Conversion of Biomedical Signals - a Possible Approach to Improve Remote Monitoring of Elderly and Visually Impaired People

<u>Ivo Iliev</u>, Serafim Tabakov, Galidiya Petrova *Technical University of Sofia, Faculty of Electronic Engineering and Technologies, Bulgaria* Paper in IOS Proceedings

[Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: Long-term remote patients monitoring implies minimal discomfort and reliability throughout the study period. These requirements are fulfilled by portable (wearable) patient devices, with low consumption, which transmit data wirelessly, at a short distance, to a mobile communication device (GSM) and through it, to a remote end recipient - doctor, medical center or a hospital server. The data transfer technology requires the monitored person to perform a sequence of actions, such as: selecting the appropriate application on the mobile phone, establishing a connection between the patient module and the phone, recording the data in the phone's memory, starting the data transfer from the phone to the final receiver. Practice shows that often this sequence of activities is difficult for elderly people and especially for visually impaired people, which as a result compromises the remote monitoring process. In this paper are presented an approach and conceptual implementation of a system for remote monitoring of cardiac activity, using the most popular way of remote connectivity - voice (sound) communication. In addition to the ease of use, this type of communication does not require special data protection, due to the lack of RF interfaces for short-distance data transmission. The presented results of laboratory studies, as well as conducted tests under medical supervision of patients in a cardiology clinic, confirm the workability of the proposed approach for remote monitoring of patients by audio conversion of the ECG signal.

Keywords: Remote patient monitoring, patients telemetry, ECG monitoring, ECG sonification

Verification of Optimal Sensor Placement System for Gait Assessment in Living Space

Moeko Yamane^a, Yosuke Kawasaki^a, Masaki Takahashi^b, <u>Ami Ogawa^b</u> ^aKeio University, School of Science for Open and

Environmental Systems, Japan

^bKeio University, Department of System Design Engineering, Japan

Read extended abstract page 126

[Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: This study aims to validate our system that calculates the optimal placement of a sensor for evaluating gait in living spaces by measurement experiments conducted in actual living environments. The proposed system optimized sensor placement based on the following three evaluation criteria: (1) the system can measure walking motions, (2) the system does not interfere with the subject's walking, and (3) the system does not cause discomfort to the occupants. As a result, our system selected the flow line spaces for the sensor's positions in all the subjects' houses. Although the number of measured data varied among subjects, straight walking was measured for more than 40 % of the total data in all subjects. In addition, the number of data that could not be used for gait evaluation, such as dual tasks, was large, and the available data ranged from 10 to 30 % of the total walking data.

Keywords: Optimal sensor placement, Living space,

home-based sensing, physical function assessment, Non-contact sensor $% \left({{{\left({{{{\bf{n}}_{{\rm{c}}}}} \right)}_{{\rm{c}}}}} \right)$

Legal Problems of Assistive Technologies: the Case of Inheritance Laws Addressed to Speech-Impaired People

Domenico Napolitano^a, <u>Anita Mollo^a</u>, Luigi Maria Sicca^b ^aScuola Superiore Meridionale, Department of Law and Organizational Studies for People with Disability, Italy ^bUniversity of Naples Federico II, Department of Economy, Management and Institutions, Italy Read extended abstract page 128

[Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: In this contribution we will focus on the conflicts deriving from the lack of coordination between technology, law and society when considering the case of inheritance laws addressed to speech-impaired people. In fact, succession law systems in the world prevent speech-impaired persons from expressing their will through speech synthesis. Through the analysis of voice technologies and the legal frameworks, we will highlight the limits of narratives of "technological enhancement" typical of AI in the face of juridical frameworks where the augmentative possibilities of those devices are not recognized and complied. We argue that this kind of contradiction exasperates the discomfort inherent speechimpairment and produces exclusion from social and juridical institutions. In response to these problems, we propose a legal framework that overcomes testamentary formalism in accordance with the UN Convention on the Rights of Persons with Disabilities.

Keywords: Inheritance law, speech synthesis, digital will

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Acces to STEM content

Chair: Dominique Archambault *Université Paris 8, France*

Extracting Contextual Semantic From a Concordance Containing Mathematical Definition

Akashdeep Bansal^a, <u>Volker Sorge^b</u>, Meenakshi Balakrishnan^a *^aIIT Delhi, India*

^bUniversity of Birmingham, Great-Britain Paper in IOS Proceedings [Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: With the increased penetration of screen reading software, effective audio rendering of equations can significantly assist in making many electronic mathematics documents accessible. However, linear syntactic rendering of equations not only creates a considerable cognitive load, even for relatively simple equations, but also becomes crucial in more advanced mathematical subjects where the precise and correct interpretation of symbols is essential. To overcome this challenge, we are working on a procedure to extract contextual semantics for mathematical expressions from the surrounding text. In this paper, we will present one of its modules: the Semantic Extractor. This module aids in extracting semantics from the concordance that contains valid mathematical definitions. This approach enables contextually aware audio rendering of complex mathematical expressions, rather than relying solely on syntactic rendering.

Keywords: Syntactic Rendering, Equation, Audio Rendering, Cognitive load, Visually Impaired, Contextual Semantic

On Support for Dyslexic Students in Senior-High School and Higher Education

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Paper in IOS Proceedings

[Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: It is very difficult to provide dyslexic students in senior-high school or higher education with all necessary textbooks in ordinary accessible format such as multimedia DAISY. Here, a new approach to provide them with a new type of accessible textbooks named "Fixed-Layout DAISY" is shown. In it, the whole page is treated as a multi-layer picture, the front layer of which has the same form as the original PDF. A DAISY (EPUB3) player can read out any texts together with highlighting them. It does not have the reflow function. The page layout is always kept as same as the original. It does not have information either in which order texts on the page should be read out, and readers need to click a text block on a page where they want to read. Dyslexic people can see and click a place where they want to read, and obviously, Fixed-Layout DAISY should work for them. Fixed-Layout DAISY can be produced almost automatically from an original "e-born PDF" by making use of our OCR system, and it should be very helpful for the dyslexic students to get accessible version of their textbooks.

Keywords: EPUB3, Fixed-Layout DAISY, e-born PDF, dyslexia

Multilingual Support for Accessibility in Powerpoint STEM Contents

<u>Toshihiko Komada</u>^a, Katsuhito Yamaguchi^b, Masakazu Suzuki^c

^aNihon University, Junior College Funabashi Campus, Japan ^bNihon University, College of Science and Technology, Japan ^cKyushu University, Faculty of Mathematics, Japan

Paper in IOS Proceedings

[Track A | Auditorium 250 | Fri 09/01 | 08:30-10:30]

Abstract: Many online educational materials for sighted students such as presentation slides, PDF materials, MP4 videos, etc. are produced with Microsoft PowerPoint (PPT). In terms of non-technical contents, accessible PPT contents can be produced in a certain level; however, as far as STEM contents are concerned, there is still a serious difficulty. Our new add-on for PPT allows users to make efficiently/easily PPT STEM contents accessible. By making use of it, alt text/aloud reading by a TTS voice can be added to any technical part such as mathematical expressions included in PPT slides. An accessible MP4 video for STEM education also can be produced efficiently. By making use of multilingual support in Infty software, this add-on has been recently improved so that users can use it for PPT contents in various local languages other than Japanese or English.

Keywords: Online education, PowerPoint, add-on, STEM, multilingual contents

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Assistive Technology for neurological development

Chairs: Cecília Sik Lanyi^a, Renáta Cserjési^b ^aUniversity of Pannonia, Hungary ^bEötvös Loránd University, Hungary

Social inclusion is an important element of well-being for people with Autism Spectrum Disorder (ASD) and/or Intellectual Disability (ID). Research has highlighted that social inclusion is facilitated through access to education and employment. Moreover, AT could help in early neurological development.

Assistive Technology for neurological development session brings together academic scientists, researchers, Ph.D. students, and research scholars to exchange and share their experiences and research results on all aspects of AT including VR-based Serious Games helping people with neurological problems like autism and/or intellectual disability. How could these ATs help in their neurological development? The target groups of these AT users are not only little children or teenagers but adult people too. This session also provides an interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations and trends. Moreover, to share concerns, practical challenges encountered and solutions adopted in the fields of AT and Serious Games.

The Effectiveness of Using Eye-Gaze Assistive Technology in the Verification of Diagnosis of Children with Profound Intellectual Disabilities in Poland - a Case Study

<u>Aneta Maria Kochanowicz</u>

WSB University, Department of Education, Poland

Read extended abstract page 130 [Track A | Auditorium 250 | Fri 09/01 | 11:00-12:15]

Abstract: The subject of the presented research is to verify the level of intellectual development of six children with profound intellectual disability (without speech) aged 5-12, with the use of eye-gaze assistive technology (EGAT). The diagnostic and exploratory purpose of the research is the assessment and verification of diagnoses (certificates) issued by Psychological and Pedagogical Counselling Centres in Poland which diagnose children without the use of eye-tracking technology (NEGAT). The practical goal is to define the types of exercises from the Look to Learn software and eyeLearn software that enable the examination of visual-spatial skills (perception ability, visual-auditory coordination, the precision of vision), language skills (comprehension and expression), logical thinking (from cause-effect action to choosing from several elements). In Poland, Psychological and Pedagogical Counselling Centres should be equipped with EGAT to correctly diagnose children with suspected profound intellectual disability. Research shows that issuing a certificate of profound intellectual disability ought to be abandoned and a functional diagnosis/assessment should be introduced.

Keywords: verification of diagnoses, profound intellectual disability, eye-gaze assistive technology (EGAT), non eye-gaze assistive technology (NEGAT), eye-gaze controlled computer (EGCC), eyeLearn software, Look to Learn software

Eye-Gaze Control for Children with Cerebral Palsy: Contribution of Functional Vision Skills

<u>Tom Griffiths</u>^a, Michael T. Clarke^b, John Swettenham^c ^aUniversity of Dundee, School of Computing, Great-Britain ^bSan Francisco State University, Department of Speech, Language & Hearing Sciences, United States of America ^cUniversity College London (UCL), Department of Language & Cognition, Great-Britain

Read extended abstract page 133 [Track A | Auditorium 250 | Fri 09/01 | 11:00-12:15]

Abstract: Limited research exists on the early skills that impact on children's learning to use eye-gaze technology. This paper will examine the impact of functional vision skills on children's performance with a novel eyegaze task. The results, obtained using a freely available measure designed for non-vision specialists, suggest that good functional gaze control skills were related to better performance. Implications for clinical practice will be discussed.

Keywords: Cerebral palsy, Eye-gaze technology, computer access, accessibility, functional vision

Virtual Reality Based Intervention to Improve Neurocognitive Function in Post-Covid Syndrome: Preliminary Results

Kinga Nedda Pete^{a,b}, Sarolta Imre^b, Orsolya Gőbel^c, Cecília Sik Lanyi^d, János Tamás Varga^c, Veronika Müller^c, Renáta Cserjési^b ^aELTE Eotvos Lorand University, Doctoral School of Psychology, Hungary ^bELTE Eotvos Lorand University, Institute of Psychology, Hungary

^cSemmelweis University, Department of Pulmonology, Hungary

^dUniversity of Pannonia, Department of Electrical Engineering and Information Systems, Hungary

Read extended abstract page 135

[Track A | Auditorium 250 | Fri 09/01 | 11:00-12:15]

Abstract: The main focus of this research is to present the protocol and preliminary results of a 6 week long virtual reality (VR) based cognitive intervention developed for post-COVID patients. All cognitive VR game scores significantly improved throughout the intervention. Participants judged cognitive VR games as challenging, they demonstrated high levels of perceived immersion, presence, enjoyment, motivation and perceived usefulness of VR games. Neuropsychological tests compared to a control group demonstrated a significant main effect of time in attention, verbal fluency, post-COVID functional status and perceived health status. An interaction between time and group was found for perceived cognitive status.

Keywords: virtual reality, post-COVID, neurocognitive functions

AT Service Delivery

Chair: Renzo Andrich EASTIN (The Global Assistive Technology Information Network), Italy

Factors Contributing to Innovation Readiness in Health Care Organizations: a Scoping Review

Monique W. Van Den Hoed^{a,b}, Ramona Backhaus^{a,b}, Erica De Vries^{a,b}, Jan P.H. Hamers^{a,b}, Ramon Daniëls^{a,b,c}

^aMaastricht University, CAPHRI Care and Public Health

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^cZuyd University of Applied Sciences, Expertise Centre for Innovative Care and Technology, The Netherlands

Read extended abstract page 138 $\,$

[Track B | Auditorium 150 | Wed 08/30 | 11:00-12:30]

Abstract: The adoption and implementation of technology in healthcare organizations largely depend on the abilities of these organisations to innovate. This scoping review aims to clarify the concept of innovation readiness and identify which factors contribute to innovation readiness in health care organizations. Innovation readiness indicates the level of maturity of an organization to succeed in any type of innovation. Analysis of 44 included let to four main factors; strategic course for innovation, climate for innovation. Research into innovation readiness of health care organizations is a rather new field. Future research could be directed towards defining the concept of innovation readiness and the development of a framework for innovation readiness.

Keywords: Innovation readiness, scoping review

The Assistive Technology Passport: a User-Centred Approach to Empowering AT Users to Play a Central Role in Identifying and Addressing Their Own AT Needs

Siobhán Long^a, Sarah Gavra Boland^b, Joan O'Donnell^c ^aNational Assistive Technology Training Service, Enable Ireland

^bSt John of God Community Services, Ireland ^cMaynooth University, Ireland

Read extended abstract page 140

 $[\mathsf{Track}\ \mathsf{B}\mid\mathsf{Auditorium}\ 150\mid\mathsf{Wed}\ 08/30\mid 11{:}00{-}12{:}30]$

Abstract: AT services internationally are frequently fragmented and opaque. Prospective AT users often struggle to understand how assistive technology can contribute to their independence and are frequently unable to source or access skilled AT services in a timely manner. In 2016 Enable Ireland and the Disability Federation of Ireland (DFI) published Assistive Technology for People with Disabilities and Older People: A discussion paper, which made 7 key recommendations around the establishment of a national AT ecosystem. An AT Passport has been proposed as a foundation stone to the development of this national AT ecosystem.

Keywords: co-design, user centred, passport

Person-Centered Model for the Assessment of Communication Assistive Solutions: an Italian Case Report

Michela Frascione^{a,b}, Marina Ramella^b, Francesco Rizzo^b, Marco Pastori^b, Elena Bortolozzi^b, Rosa Maria Converti^b, <u>Claudia Salatino^b</u> ^aConsorzio Universitario Humanitas, Italy

^bIRCCS Fondazione Don Carlo Gnocchi ONLUS, Italy Read extended abstract page 142

[Track B | Auditorium 150 | Wed 08/30 | 11:00-12:30]

Abstract: The identification of complex assistive solutions should be part of a rehabilitation project. A case report of the AAC Assistive Technology assessment path is here described, developed by the SIVALab of the DAT (Home Automation, Aids, Occupational Therapy) Unit of Fondazione Don Carlo Gnocchi in Milan, in collaboration with the Healthcare Residential Facility for Disabled, in line with the "participation model". The assessment path has been implemented by a multidisciplinary team, composed by physiatrists, engineers, therapists, educators, keeping in mind the complexity of communication needs and its systemic implications, the need to put the person and his/her main caregivers at the centre of the process, in all the phases of assessment and selection of the assistive solution, with the aim of providing the most appropriate solution, both in terms of effectiveness and efficiency and costs.

Keywords: AAC AT, AT assessment, rehabilitation

Process Evaluation of the Optimized Provision of AT Devices for Impaired Upper Extremity Function Within the Omarm Study

Uta Roentgen, Loek Van Der Heide, Edith Hagedoren, Ramon Daniëls

Zuyd University of Applied Sciences, Research Centre Technology in Care, The Netherlands

Paper in IOS Proceedings

 $[\mathsf{Track}\ B \mid \mathsf{Auditorium}\ 150 \mid \mathsf{Wed}\ 08/30 \mid 11{:}00{-}12{:}30]$

Abstract: A quality standard for the ICF-oriented provision of arm supports and robotic arms was designed. To facilitate this new working method, tools were developed in co-creation with all stakeholders. Professionals received training and were asked to apply the new working method among their clients who participated in the intervention group of the OMARM project. To find out whether the provision had changed following the introduction of the quality standard, and to gain insight into the usage of tools and the perceived added value, a process evaluation was conducted after 3, 6 and 9 months by an online survey. In sum, the new working method was applied to 43 of 137 clients, and tools were used 105 times. Opinions on perceived changes, benefit, and practicability varied widely. Although tools were developed in co-creation with all stakeholders, several professionals' satisfaction with the developed way of working is lower than expected and its adoption lags.

Keywords: Quality standard, AT provision, dynamic arm supports, robotic arms, process evaluation

MS@Work in Flanders: the Development of a MS Toolkit for a Stable Employment

Sharona Vonck^a, Goele Theuwissen^a, Roel Bosmans^b,

Kim Daniels^a, Annemie Spooren^{a,c} ^aPXL University of Applied Sciences and Arts, Centre of Expertise in Innovation in Care, Belgium ^bPXL University of Applied Sciences and Arts, Centre of Expertise in Smart-ICT, Belgium ^cHasselt University, Reval, Belgium Paper in IOS Proceedings

[Track B | Auditorium 150 | Wed 08/30 | 11:00-12:30]

Abstract: Persons with MS have the highest unemployment rates compared to other chronic diseases. We want to develop a MS Toolkit with several aids for persons with MS to help them gain a sustainable employment with sufficient and permanent attention and guidance for the daily obstacles in the workplace. Therefore, the opportunities and bottlenecks were mapped through a survey with persons with MS and employers, a diary and expert interviews. There were 3 major problems identified: Persons with MS find it difficult to ask for help in time; they have little or no concrete knowledge about who they can turn to for support and healthcare professionals do not always possess the expertise to guide their patients through problems experienced on the work floor. These problems were used as fundaments in a cocreation session to create the content of the MS Toolkit: a screening tool and dashboard. The screening tool ensures an annual reflection of the work situation. The dashboard links each problem to the most appropriate service.

Keywords: Multiple sclerosis, employment, MS toolkit, screening, prediction, dashboard

Global AT Service Delivery Challenges

Chair: Luc de Witte

The Hague University of Applied Sciences, The Netherlands

The Global Report on Assistive Technology of the WHO and UNICEF, published in 2022, has highlighted the challenges that countries worldwide meet in assuring access to assistive technology. Clearly, raising awareness and providing information on AT is just a first step, which has to go hand in hand with market stimulation and the development of provision systems under universal health coverage. These provision systems can only be effective if there are service delivery systems in place that guarantee that solutions meet needs and that public money is spent effectively. But what is an effective service delivery system and which indicators it could use to measure outcomes, including its own? What do we know about the resilience of AT service delivery systems cope with the continuous technological and cultural changes that impact on the AT field? Finally, how relevant is it that some emerging countries in AT choose strong social sector involvement in AT provision and what can the health sector learn from an intersectoral approach?

Scoping Review of Quality Guidelines for Assistive Technology Provision

Natasha Layton^{a,b}, Alice Spann^c, Silvana Contepomi^{d,e}, Md Mehedi Hasan Khan^f, Evert-Jan Hoogerwerf^g, Diane Bell^{h,i}, Luc De Witte^j

 ^a Monash University, RAIL Research Centre, Australia
^b Australian Rehabilitation and Assistive Technology Association (ARATA), Australia
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^d Argentine Assistive Technology Association, Argentina
^e Asistiva, Argentina
^f Kobe Gakuin University, Japan
^g Global Association of Assistive Technology Organisations (GAATO), Switzerland
^h GDI Hub, Great-Britain
ⁱ University College London, Great-Britain
^j The Hague University of Applied Sciences, The Netherlands Read extended abstract page 144 [Track B | Auditorium 150 | Wed 08/30 | 14:00-16:00]

Abstract: This rapid scoping review of quality assistive technology service provision guidelines was conducted by an international research team during Feb - March 2023, aiming to inform the development of globally useable provision guidance. Systematic search strategies yielded 8,626 results. Screening identified 41 publications for full review, drawn from both the published literature and expert sources. Publications spanned 40 years, with most published in the last 15 years. Study designs varied widely: 20 % were written with some sort of systematic guideline process, 40 % were commentaries, and the rest used various qualitative methods. General AT provision principles and specific AT service delivery steps can be found in multiple sources including policy documents; the competency standards of different professions; and within sections of

ISO product standards addressing clinical evaluation and useability. Strong consensus is evident regarding the key ingredients of service provision, despite the use of different vocabulary and variations in the focus placed on service delivery steps. Repeated calls are made for widely applicable guidance for the provision of AT. In conclusion, there is a strong case for globally applicable AT provision guidelines with the literature providing a firm foundation for their development.

Keywords: Assistive technology, services, provision guideline, standard, quality, documentation

Digital Enabling Assistive Technology through the Provision Lens – a Global Perspective in a Nordic Context.

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Paper in IOS Proceedings

[Track B | Auditorium 150 | Wed 08/30 | 14:00-16:00]

Abstract: The Nordic healthcare system is wellestablished, taxation-based, and locally administered, featuring person-centered care as a social welfare pillar. Public provision of assistive technology and welfare technology within healthcare systems means every citizen has equal access to services. But how well are policies and procedures keeping pace with demographic changes and technology developments?. This study critically analyses qualitative data from 24 stakeholders involved in municipal-level procurement and allocation of assistive and welfare technology in Sweden with a specific focus on emerging digital technology. An extant analysis framework was used: the World Health Organization-GATE 5P framework for strengthening access to AT. Recommendations are made for agile procurement and an outcomebased decision frame. The voice of the AT user may be a valuable addition to inform policy.

Keywords: Assistive technology, welfare technology, Ecosystem, provision, ICF, ISO 9999

Assistive Technology Outcomes: Global Consensus on Key Challenges

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^aMaynooth University, Assistive Living and Learning (ALL) Institute, Ireland

^b Monash University, RAIL Research Centre, Australia Read extended abstract page 146

 $[\mathsf{Track}\ B \mid \mathsf{Auditorium}\ 150 \mid \mathsf{Wed}\ 08/30 \mid 14{:}00{-}16{:}00]$

Abstract: Assistive technology is critical to realizing the United Nations Convention on the Rights of Persons with Disabilities and to promoting participation and health for people with functional limitations. However, with only 1 in 10 globally having access to the assistive products and related services they need, we are facing a global challenge in ensuring access to these rights. Chief among the challenges is a gap in our understanding of the need for assistive technology, the outcomes and impacts of assistive technology provision, and data to inform policy. The purpose of this initiative was to capture a wide range of perspectives from assistive technology stakeholders in all six of the WHO health regions, and to develop consensus regarding the key challenges in assistive technology outcomes. We identified six key thematic 'grand challenges' which must be addressed: measuring need, documenting inputs, measuring outcomes, measuring impacts, sharing data, and informing policy. Addressing these challenges will allow the development of improved evidence generation in the field, and provide the necessary data to improve access to AT for all.

Keywords: Assistive Technology, Outcomes, Consensus, GAATO

An Interim Evaluation of the Assistive Technology Service Delivery in the Faroe Islands From a User Perspective

Turið Jacobsen^a, Ása Róin^{a,b}

^aUniversity of the Faroe Islands, Faculty of Health Science, Faroe Islands

^bAlmannaverkið, Faroe islands

Read extended abstract page 148

[Track B | Auditorium 150 | Wed 08/30 | 14:00-16:00]

Abstract: Purpose: This study provides a preliminary evaluation of the AT services in the Faroe Islands from a user-perspective by using recommendations from the Horizontal European Activity on Rehabilitation Technology study (HEART) Materials and methods: The study enrolled 101 persons aged 8-95 (mean 69 years). A study specific questionnaire was used to describe the AT service provision process. The satisfaction was assessed with KWAZO and the service subscale of QUEST. The steps in the AT provision process were described with frequency distribution. The KWAZO and QUEST results were analysed item-by-item and grouped in 'Satisfied' and 'Not fully satisfied'. A threshold of 33 % was used to identify the proportion of 'Not fully satisfied'. Results: Below the threshold were 'Instruction', 'Professional services' and 'Follow-up'. The AT centre performed application and implementation in 9.6% and 12% of the cases, respectively, and other institutions in 62.3% and 43.7%of the cases. No contact had been with professionals in the application-phase and the implementation-phase in 28.7 % and 37.6 % of the cases. Conclusions: The provision system appeared fragmented, which the low satisfaction with related quality-items reflected. Often the role of the AT centre seemed reduced to delivering AT. The findings confirm the importance of ensuring user-centeredness and coordination in AT delivery.

Keywords: Assistive Technology provision, evaluation, user perspective, quantitative study

Setting Up a Mobility Assistive Technology Centre in an Underserved Part of India: Challenges & Impact

<u>Rohini Gaur</u>, Suvlaxmi Gurumayum Kara Medical Foundation, India

Read extended abstract page 150

[Track B | Auditorium 150 | Wed 08/30 | 14:00-16:00]

Abstract: There are 26.8 million Persons with Disabilities (PwDs) in India out of which approximately 8.7% reside in Bihar. Out of this, approximately 18 million PwDs (69% of the disabled population) live in rural India out of which 39% have locomotor and vision impairments. PwDs from lower-income groups, and those residing in remote rural areas have limited or no access to assistive products and expertise. The aim of the program was to set up an Assistive Technology (AT) Centre in Bihar, India where a beneficiary can get a host of comprehensive solutions such as neurorehabilitation (which includes physiotherapists and occupational therapists), AT aids and appliances, peer mentoring, counselling etc. under one roof. This centre is mainly for the benefit of PwDs who are below the poverty line or from low-income households. This paper will discuss the methods, challenges and outcomes of establishing an AT centre in Bihar - one of the poorest states of India.

Keywords: Assistive Technology, Service Delivery Challenges, India, Mobility, Vision
The advancement of AT and AAC for children in Eastern Europe and Central Asia

Chairs: Evert-Jan Hoogerwerf^a, Maurice Grinberg^b ^aAAATE, Italy ^bASSIST-Assitive Technologies, Bulgaria

The scope of the session is to bring together researchers and practitioners that work for the advancement of Assistive Technology and AAC for children in Eastern Europe and Central Asia. Increasingly countries in those areas adopt national legislation that aims to promote early childhood intervention, inclusive education and the provision of AT to children, but often there are difficulties in implementing those policies due to lack of AT capacity, ecosystems and services required to support the transitions involved.

AAATE and the Regional Office for Europe and Central Asia of UNICEF have started to collaborate with the aim to support the wider uptake of AT and AAC in Eastern Europe and Central Asia, starting from the development and consolidation of a network of experts.

Designing Inclusive Learning with the Use of Assistive Technology: Teachers' Capacity Development in Eastern Europe and Beyond.

<u>Katerina Mavrou</u>^a, Nora Shabani^b ^aEuropean University Cyprus ^bUNICEF Read extended abstract page 152

[Track B | Auditorium 150 | Wed 08/30 | 16:30-18:00]

Abstract: This contribution presents the method and rationale behind the development of a teachers' and school teams' guide for the use of assistive technology for inclusive education in Eastern European countries, which is supported by UNICEF. The design and development of the guide structure and is informed by academic work, UNICEF existing resources, real-case scenarios from educational practice and consultation with and feedback from groups and individuals as potential users of the guide. **Keywords:** assistive technology, inclusive education, chil-

dren, capacity development

Reflections on Building a Multi-Country AAC Implementation Guide

E.A. Draffan^a, Charlie Danger^a, David Banes^b ^aGlobal Symbols, Great-Britain ^bAccess and Inclusion Services, Great-Britain Paper in IOS Proceedings

 $[\mathsf{Track}\ B \mid \mathsf{Auditorium}\ 150 \mid \mathsf{Wed}\ 08/30 \mid 16{:}30{-}18{:}00]$

Abstract: Augmentative and Alternative Communication (AAC) implementation at any level is a multifaceted process that requires selection of relevant and appropriate systems to suit individual users who may have complex communication needs and other co-occurring difficulties. Careful and systematic action may be required to develop

skills and abilities in the use of chosen technologies with suitable ongoing support within a wide range of settings. The wider milieu in which services are provided must also be considered in order to provide a firm foundation for capacity building alongside considerations for multilingual and multicultural factors. UNICEF with the Global Symbols team supported by local professionals working with AAC users, their families and carers set out to collaboratively provide an implementation guide based on their experiences in several Eastern European countries. The aim of the guide was to illustrate work already being undertaken in the area and to ensure the sharing of knowledge and resources where gaps were discovered. The result became a series of linked webpages in an online framework that covered practical aspects for the development of policies and procedures to support early intervention for those with severe speech, language and communication needs across countries of differing cultures and languages. The actual AAC implementation required ingenuity on all sides with translations for pictographic symbol and software adaptations with Cyrillic and Latin alphabets, new synthetic voices alongside deployment and capacity development. Considerable local support was forthcoming and captured with interviews by those working with AAC users as technology was introduced and outcomes measured. As the guide was completed several videos were shared publicly by carers with examples of AAC and assistive technology use. Policies and procedures were also shared in the form of tables, charts, symbol sets, communication boards and software that illustrated not only the occurrence of knowledge transfer and the use of open licenses, but also differences in strategies and the way they were adapted to suit the range of settings in the various countries.

Keywords: Implementation, AAC, Augmentative and Alternative Communication, disability, symbols, assistive technology, multi-country

Eight Years of AAC in Bulgaria: Achievements and Problems

Maurice Grinberg, Evgeniya Hristova ASSIST – Assistive Technologies, Bulgaria

Read extended abstract page 154 [Track B | Auditorium 150 | Wed 08/30 | 16:30-18:00]

Abstract: In 2014, the term Augmentative and Alternative Communication (AAC) was unfamiliar in Bulgaria. It was first introduced in 2015 by ASSIST – Assistive Technologies a foundation created to increase awareness about AAC and ensure its provision in Bulgaria. Since then, significant progress has been made, and the use of AAC is now officially part of the programs for developing inclusive education in Bulgaria. Full or partial financial support for AAC devices has been available for several years from the social institutions like the Ministry of labour and social policy. At the same time, although reasonable funding is available via various mechanisms, paradoxically the adoption of AAC by professionals – SLPs, resource teachers, occupational therapists, psychologists and others – is not at the level of the existing possibilities and more impor-

tantly the existing needs of children with communication needs. The presentation and analysis of the process of introduction and development of the use of AAC in Bulgaria can be interesting and instructive for other emergent countries in this field and help them benefit from the existing experience and avoid some errors.

Keywords: AAC, countries emergent in AAC

Assessment of AT and AAC Capacity for Children in Ukraine

Evert-Jan Hoogerwerf

Independent consultant for UNICEF, Italy

Read extended abstract page 156

[Track B | Auditorium 150 | Wed 08/30 | 16:30-18:00]

Abstract: The presentation will report the main outcomes of a country assessment regarding Ukraine's capacity to respond to the needs of children with disabilities regarding Assistive Technology (AT) and Augmentative and Alternative Communication (AAC). The assessment was commissioned by UNICEF's Regional Office for Europe and Central Asia (ECARO) and conducted in the period May-October 2022 by the author with the support of colleagues in Ukraine.

Keywords: Ukraine, AT Capacity, UNICEF

User participation in design

Chair: Dominique Archambault *Université Paris 8, France*

How to Consider the Real Benefit of an Assistive Technology for Visually Impaired People: Test in Real-Life with a Controlled Environment.

<u>Caroline Kurek</u>, Charlotte Leflaëc, Paul Thomas, Caroline Garner, Karine Becker, Chloé Pagot *Streetlab, France*

Read extended abstract page 158 [Track B | Auditorium 150 | Thu 08/31 | 08:30-10:30]

Abstract: Consideration of the effectiveness of new technologies known as electronic headmounted aids for visually impaired people (e-LVAs) is based primarily on functional vision tests. While the focus should be on the ability of these systems to provide visual benefits, it is also necessary to ensure that these benefits can be translated into practical use. Indeed, e-LVAs are intended to help with activities of daily living and therefore also to meet the requirements of the environment. In this study, we test one of these e-LVAs through activities of daily living in vivo (at home) and in a controlled-apartment (Homelab - Vision Institute, Paris XII), to understand how and where this type of assistive technology can help visually impaired users in their daily lives.

Keywords: Real-life testing, low vision, electronic headmounted aids, usability

The Importance of the User'S Cognitive Skills and Opinions in Evaluating the Outcome of Assistive Technologies – the Attain Protocol

<u>Cristina Costantini</u>^{a,b}, Roberta Daini^{a,b}, Marina Ramella^b, Johanna Jonsdottir^b, Rosa Maria Converti^b, <u>Claudia Salatino^b</u>

^aUniversity of Milan-Bicocca, Department of Psychology, Italy

^bIRCCS Fondazione Don Carlo Gnocchi ONLUS, Italy Read extended abstract page 160

 $[\mathsf{Track}\ \mathsf{B}\ |\ \mathsf{Auditorium}\ 150\ |\ \mathsf{Thu}\ 08/31\ |\ 08:30\text{-}10:30]$

Abstract: The longitudinal observational pilot study AT-TAIN (Outcomes of ICT Assistive Technology in RehabiliTAtloN Pathways) aims to improve the quality of prosthetic intervention and verify the adequacy of assistive devices and measurement outcomes. Fifty patients needing prosthetic interventions for Augmentative Alternative Communication, computer accessibility, and environmental control are being recruited within the DAT Unit of the Fondazione Don Carlo Gnocchi "IRCCS S.Maria Nascente" in Milan. At baseline (T0), a physician and a psychologist perform a clinical evaluation and the AT outcome assessment. The participants will be contacted for the follow-up phase (T1) 3 to 6 months after receiving the assistive solution. At T1, clinicians will re-administer the AT outcome assessment. In order to make the assessment accessible to all participants, these tests and questionnaires are administered on Windows PCs, using Grid3 software, or on a specifically created accessible web page.

Keywords: ICT AT, AAC AT, AAL AT, Assistive Technology, Outcome Assessment

Cocreation with Community-Dwelling Older Adults to Develop a Mobile Health Application for Promoting Physical Activity and Healthy Active Lifestyle

<u>Kim Daniels</u>^a, Els Knippenberg^{a,b}, Jan Baerts^c, Nastasia Marinus^{a,b}, Sharona Vonck^a, Ryanne Lemmens^a, Bruno Bonnechère^{b,d}

^a PXL University of Applied Sciences and Arts, Department of PXL-Healthcare, Belgium

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^dHasselt University, Technology-Supported and Data-Driven Rehabilitation, Belgium

Read extended abstract page 163

[Track B | Auditorium 150 | Thu 08/31 | 08:30-10:30]

Abstract: This study explores a co-creative process to develop a mobile health application promoting physical activity among elderly. The resulting app includes personalized tips, workouts and a community calendar.

Keywords: Physical Activity, Older adults, mHealth, digital technology, cocreation

Design Thinking Used to Develop a VR Protocol for Arm and Hand Rehabilitation After Stroke

Milou Dupuits^a, Renée Van Den Heuvel^{a,b},

Karin Slegers^a, Henk Seelen^b, Ramon Daniëls^a

^aZuyd University of Applied Sciences, The Netherlands

^bAdelante Zorggroep, Rehabilitation Center, The Netherlands Read extended abstract page 165 [Track B | Auditorium 150 | Thu 08/31 | 08:30-10:30]

Abstract: The method of design thinking was used to develop a VR protocol for arm and hand rehabilitation after stroke. Stakeholders included researchers, physical therapists and occupational therapists, and VR specialists. A working prototype where real life activities could be performed in a garden, was tested with both stroke patients and health care professionals. Using VR in arm and hand rehabilitation proves to be promising. Further research on effectiveness and implementation is necessary.

Keywords: rehabilitation, stroke, virtual reality

Is It Reproducible?: a Case Study on a Dissemination of the Cad Method for the Visually Impaired

Kazunori Minatani

National Center for University Entrance Examinations, Japan Read extended abstract page 167

[Track B | Auditorium 150 | Thu 08/31 | 08:30-10:30]

Abstract: One visually impaired (VI) person became interested in the CAD methods for the (VI) that the author is researching. This paper describes the skills he acquired through e-mail correspondence and explores dissemination of CAD for the VI.

Keywords: LATEX, Visually impaired, 3D CAD, 3D printing, E-learning, DIY assistive technology

Assistive Technology to Promote Participation in Sport for People with Disabilities

Ana Geppert^{a,b}, Emma M. Smith^b, Damian Haslett^c, Jennie Wong^d, Ikenna D. Ebuenyi^{b,d}, Malcolm MacLachlan^b ^a University of Iceland, Iceland ^b Maynooth University, Assisting Living and Learning Institute, Ireland ^c Loughborough University, Great-Britain ^d University of Pittsburgh, Rehabilitation, Science and Technology, United States of America

Paper in IOS Proceedings

[Track B | Auditorium 150 | Thu 08/31 | 08:30-10:30]

Abstract: Participation in sports is identified in the UN Convention on the Rights of Persons with Disabilities as a fundamental right and is facilitated by the use of specialized Assistive Products (AP). However, little is known about the role everyday AP plays in promoting sport participation. Purpose: This study explores how the 50 priority APs on the World Health Organization's Assistive Products List can promote participation in sports. Materials and methods: We used an online survey with APusers, caregivers, and coaches (n=96). Subsequently, we performed a thematic analysis for qualitative responses describing the use of APs in facilitating sport participation. Results: Our results suggest everyday APs are required for sport participation for persons with disabilities. We present a conceptual model of AP use for sport participation. We found people with disability participate in a range of sports, contributing to community engagement. Conclusions: Access to everyday APs is integral to achieving the rights of persons with disabilities for participation

in sport.

Keywords: Assistive products, Assistive Technology, sport, disability, parasport, social inclusion

Learning About Assistive Technology From High School

Thais Pousada García, Betinia Groba Gonzàlez, Laura Nieto-Riveiro, Nereida Canosa Dominguez, <u>Javier Pereira Loureiro</u> *University of A Coruña, TALIONIS Research Group, CITIC, Spain*

Paper in IOS Proceedings

[Track B | Auditorium 150 | Thu 08/31 | 11:00-12:30]

Abstract: This communication will present an educative and research project that has linked the creation of 3D Assistive Technology (AT) for people with disabilities with the training of students of secondary education. STEMBach educational program aims to provide quality scientific education to secondary school students in the fields of science, technology, engineering, and mathematics (STEM) through research projects. Specifically, the text focuses on one project proposed by the TAL-IONIS research group, which uses 3D printers to design and create assistive technology (AT) for people with disabilities. The project involves students from eight different high schools and ten individuals with disabilities from four non-governmental organizations. The students design and print the AT using software such as Tinkercad and Cura Software. After testing the AT, outcome measurement instruments are used to validate their effectiveness. The project is based on a Learning-by-doing methodology with a structure of service-learning, and the involvement of the students is voluntary. The objectives of the project are to involve the students in research and innovation, to generate resources and AT for people with disabilities, and to determine the effects of AT on the lives of its users. Finally, the project leads to identifying new needs of people with disabilities that could be addressed through further research work.

Keywords: STEM, Learning-by-doing, Assistive Technology, 3D Printer

Eyedrone Project

Samuel Huyet-Blau

Institut National des Jeunes Aveugles - Louis Braille, France

[Track B | Auditorium 150 | Thu 08/31 | 11:00-12:30]

Abstract: EyeDrone project is an Educational Learning Programme in Computer Science that takes place in INJA-Louis Braille since September 2022. As a teacher in INJA - Louis Braille (previously Institut National des Jeunes Aveugles), I teach Computer Science for visually impaired students aged between 16-18 years old. I set up a team of 6 skilled students in mathematics. We purchased a fleet of 6 programmable drones DJI TELLO EDU. Our goal is to program a drone that can replicate the guide dog's actions and perform other ones that we build by coding in Python language. By making visually impaired students coding themselves, the educational interest is major. They find their problematics and what they need for their everyday life that don't exist, they code in Python what the drone should do, and the drone describes what it sees in its frames. By making the students coding for their own purposes, they wish to learn and the synergy is on. Besides, coding in Python is an inclusive matter, as studying computing science is a major factor of integration in society, and provides attractive jobs for them in the future.

 $\ensuremath{\textit{Keywords:}}$ drone, visually impairment students, education

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Cognitive Disabilities and Accessibility

Chairs: Susanne Dirks^a, Christian Bühler^a, Tomas Murillo-Morales^b, Klaus Miesenberger^b ^a Technical University Dortmund, Germany ^b Johannes Kepler University Linz, Austria

Digital technologies more and more allow adapting and personalizing content or the way to interact with content to increase legibility, readability, understandability and finally usability / user experience. The more our society gets digital, the bigger the potential for people with cognitive disabilities to benefit from this increased adaptability and for participation and inclusion.

Cognitive Accessibility, after many years of lagging behind in the accessibility and inclusion movement, gets at focus. All domains as therapy, training, communication, education, job, leisure, culture, politics, ... may benefit from a more flexible and adaptable design, development and use of digital content, systems and services. Remarkable progress has been made over the last years both in terms of guidelines/standards/techniques but also in terms of technical solutions and applications for supported and automated accessibility. People with Cognitive Disabilities can experience better inclusion when services and support are provided at and with the original digital content which adapts to personal requirements but allows interaction and communication with the same users and user groups and more inclusive participation in the same activities.

And not to forget: Cognitive Accessibility considerably contributes in general to a better usability in our digital society.

This potential has been and still is just a promise, but the increasing number of initiatives in R&D, innovative service provision and other domains demand for increased exchange and cooperation.

Can Time Assistive Technology Help Persons with Dementia Improve Their Daily Time Management? a Randomized Controlled Trial

Ann-Christine Persson

Karolinska Institutet, Danderyd Hospital, Sweden Read extended abstract page 169 [Track B | Auditorium 150 | Thu 08/31 | 11:00-12:30]

Abstract: This study provides knowledge of effective time-related interventions for persons with dementia, knowledge that is important for clinicians and policymakers if access to assistive technology for persons with dementia is to improve.

Keywords: Ageing, Alzheimer's disease, Time aid, Time orientation, Time processing ability

Right to Connect: Case Study Exploring the Role of Co-Researcher in the Co-Designing of an Accessible Elearning Platform.

Sarah Gavra Boland^a, Patrick Fitzgerald^b, Fatima Badmos^a, Peter Gallagher^b ^aSaint John of God Liffey Services, Ireland

^bSaint John of God Research Foundation, Ireland Read extended abstract page 171

[Track B | Auditorium 150 | Thu 08/31 | 11:00-12:30]

Abstract: Introduction There is a growing need for more people with disabilities to be co-researchers, especially in accessibility projects. People with intellectual disabilities

can give us good ideas about how to make things better and work for more people. (Di Lorito, 2018) This case study talks about how people with intellectual disabilities can help with research. It tells us about the good things that can happen and some hard things. It also tells us how we can help more people become co-researchers. Background As a part of the European Funded Right to Connect project, a group of people with intellectual disabilities are co-designing an accessible eLearning platform and creating accessible courses to support their peers in courses exploring 'using digital technology, Internet Safety, social media and being part of our communities. The project hired co-researchers to help the team first discover more about the needs of adults with intellectual disabilities before the co-design happened. Then, the co-researcher discovered what is and is not working during the co-design. Finally, they learned more about participants' experiences through interviews with other co-designers. (RTCN) People with intellectual disabilities (PwID) helped make the e-learning platform from start to finish. So, when we did the research, we wanted to involve co-researchers with intellectual disabilities too. They were part of the research team and helped with the tasks. We used assistive technology to support the co-researchers' understanding of the topics and accessible communication to ensure everyone was understood. This case study will share the tasks the co-researcher did and how they did it. It will share the positive and negative impacts for co-researchers and

what the research team did to ensure the co-research was satisfied with their role.

Keywords: Co-researchers with intellectual disabilities, Inclusive and Accessible Research

JournalMate: an Accessible Academic Reading Tool for Third-Level Students with ADHD

Jennifer Gallagher, Marian McDonnell

Institute of Art Design and Technology, Ireland Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{B}\ |\ \mathsf{Auditorium}\ 150\ |\ \mathsf{Thu}\ 08/31\ |\ 15:00\text{--}16:30]$

Abstract: This paper outlines the research activities undertaken to design and evaluate an accessible academic reading tool to support third-level students with attention deficit hyperactivity disorder (ADHD). This research project was conducted in three phases, using a User Centred design (UCD) approach. The initial research phases explored cognitive processing difficulties related to reading habits and user needs that are associated with ADHD. A series of interviews with 3 subject matter experts and 8 students with ADHD aimed to identify pain points and problems hindering users from carrying out academic reading efficiently and confidently. Phase two involved ideating solutions based on data collected in the first phase and applying universal design principles while focusing on developing an electronic reading tool. After the ideation activity, the resulting prototyped solution was evaluated by 10 users. The data gathered during this evaluation provides insight into the performance of the application and will aid in any subsequent design iteration. The output of the study is an accessible academic reading tool for third-level students with ADHD, using a user-centred design process. Future practical implications and limitations are discussed. Results will provide additional data to build on current study findings and existing theories

Keywords: Keywords. ADHD, Accessibility User centered design, academic reading

AI Supporting AAC Pictographic Symbol Adaptations

<u>E.A. Draffan</u>, Mike Wald, Chaohai Ding, Yuanyuan Yin *University of Southampton, Great-Britain*

Paper in IOS Proceedings

[Track B | Auditorium 150 | Thu 08/31 | 15:00-16:30]

Abstract: The phenomenal increase in technological capabilities that allow the design and training of systems to cope with the complexities of natural language and visual representation in order to develop other formats is remarkable. It has made it possible to make use of image to image and text to image technologies to support those with disabilities in ways not previously explored. It has opened the world of adaptations from one picture to another in a design style of a user's choosing. Automated text simplification alongside graphical symbol representations to enhance understanding of complex content is already being used to support those with cognitive impairments and learning difficulties. Symbol sets have become embedded within applications as dictionaries and look up

systems, but the need for flexibility and personalization remains a challenge. Most pictographic symbols are created over time within the bounds of a certain style and schema for particular groups such as those who use augmentative and alternative forms of communication (AAC). By using generative artificial intelligence, it is proposed that symbols could be produced based on the style of those already used by an individual or adapted to suit different requirements within local contexts, cultures and communities. This paper explores these ideas at the start of a small six-month pilot study to adapt a number of open licensed symbols based on the symbol set's original style. Once a collection has been automatically developed from image to image and text descriptions, potential stakeholders will evaluate the outcomes using an online voting system. Successful symbols will be made available and could potentially be added to the original symbol set offering a flexible personalized approach to AAC symbol generation hitherto not experienced by users.

Keywords: artificial intelligence, pictographic symbols, cognitive impairment, augmentative and alternative communication, symbol adaptations

Cognitive Accessibility of Indoor Navigation Apps

Jonathan Dees ^a, <u>Susanne Dirks</u>^b

^aUniversity of Cologne, Rehabilitation Science, Germany ^bTU Dortmund University, Rehabilitation Technology, Germany

Paper in IOS Proceedings [Track B | Auditorium 150 | Thu 08/31 | 15:00-16:30]

Abstract: Advances in smartphone technology have made it possible to develop mobile apps that assist people with cognitive or learning disabilities in navigating indoor spaces more easily and independently. This paper reviews the state of the art in smartphone-based indoor navigation for this population and describes a usability trial that was conducted with four individuals in a German city hall. The trial was based on simulated tasks that required the use of the indoor navigation app XXX, during which data about different use cases were gathered. A guided interview was conducted to gather further feedback about the accessibility and the perceived usefulness of the app. The paper highlights the potential of smartphone-based indoor navigation apps for enhancing the independence and quality of life of individuals with cognitive or learning disabilities. The usability trial provided insights into the effectiveness and usability of these apps in real-world settings.

Keywords: Indoor navigation, Accessibility, People with cognitive disabilities, Smartphone-based navigation, Human-computer interaction, Usability testing

Assess Eye Tracking as a Controller's Effect on Player's Experience and Feel

Benjamin Misiak^{a,b,c}, Lila Atifi^b, Hugo George^c, Fabienne Cazalis^b, Dominique Archambault^a ^aUniversité Paris 8-Vincennes-Saint-Denis, CHArt Laboratory, France ^bEHESS, CNRS, CAMS, France Read extended abstract page 173 [Track B | Auditorium 150 | Thu 08/31 | 15:00-16:30]

Abstract: Because of eye tracking's effect on cognitive load and its simplicity of use, we hypothesized that positive effects of eye tracking as a controller would be higher for players with low focus abilities such as players coming from cognitive diversity or with low numeric literacy. Objective: We want to verify the effects of eye tracker as a controller on player's experience and check if these effects' intensity are more pronounce or not on players identifying as part of cognitive diversity or with low numeric literacy. Methods: We developed a module allowing to select, activate, move and link items on a 2d game using ET as a video game controller. We designed two interaction solutions based on the literature and developed them both as options in a Unity3D package. Participants will be asked about their digital literacy and difficulty to use informatics and if they identify as part of cognitive diversity. Results: Data are currently being collected and will be ready for the conference.

Keywords: Accessibility, alternative controller, eye tracking, video game

Neuro Service Dogs Impacts on

Community-Dwelling Persons with Mild to Moderate Dementia and Their Caregiver

<u>Claude Vincent</u>^{a,b}, Frédéric S. Dumont^b, Bertrand Achou^{b,c}, Cary Brown^d, Suzette Bremault-Philips^d

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^dUniversity of Alberta, Occupational Therapy Department, Canada

Paper in IOS Proceedings

[Track B | Auditorium 150 | Thu 08/31 | 15:00-16:30]

Abstract: Since there were no research data on the use of neuro service dogs (NSD) in 2018, a comparative case study research design was done. The cases comprised of a caregiver with a person with mild to moderate dementia, and either an NSD (n=5), a companion dog (n=28), or no dog (n=23). Monitor activity and online questionnaires were administrated. Interesting qualitative data on the roles of a NSD, advantages and inconvenients were fully described and published. Quantitative data could not confirm that NSD is benefit-cost, neither that it increases quality of sleep or level of exercise, compared to companion dogs.

Keywords: service dog, Alzheimer, dementia, living at home, caregiver, assistive dog

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The Assistive Potential of Digital Consumer Technology

Chairs: Bryan Boyle^a, Sabine Lobnig^b, David Peter Banes^c, Fiachra O'Brolcháin^d ^a Trinity College Dublin, Ireland ^bAAATE. Austria ^cAccess and Inclusion Services. Great-Britain ^dInstitute of Ethics, DCU, Ireland

Increasingly, digital consumer technologies are building in ever greater functionality in efforts to appeal to as wide a range of users as possible. These mainstream technologies such as smartphones, tablets and digital voice assistants have been increasingly referred to as accessible technologies as distinct from what has traditionally been referred to as assistive technologies. Aimed at a general market as opposed to being restricted to people with a disability and older people, consumer products, with their lower cost thresholds, can significantly reduce costs and provide a good ratio of social return on investment. The adaptive nature of much of mainstream consumer technologies provides greater opportunities for people with disabilities and older people to benefit from access to digital services and our increasingly online social and professional life. Increasingly, manufacturers and technology developers are recognising that people with disabilities and older people are demanding access to the same information and services as the general population without incurring additional cost. Panel discussions at the #ICCHP_AAATE_2022 conference explored how smartphones and other technologies

are quickly establishing a market space delivering a range of assistive features for people with disabilities and older people on a mainstream platform. This session provides a platform to continue these discussions by inviting participation from users with disabilities, technology developers and practitioners as well as those involved in technology service delivery systems from across Europe.

Understanding the Potential of Home-Based Digital Digital Voice Assistant, Internet of Things Voice Assistants for People with Disabilities.

Fiachra O'Brolcháin^a, Bryan Boyle^b ^aDublin City University, Ireland ^bUniversity College Cork, Ireland Paper in IOS Proceedings

[Track B | Auditorium 150 | Fri 09/01 | 08:30-10:30]

Abstract: As the numbers of people with disabilities actively using technology to support their day-to-day activities increases the benefits afforded by these technologies are ever more evident. Much of the technology used by people with disabilities is often characterised as Assistive Technology (AT) which is designed and developed to address the specific needs of people with disabilities. In contrast to AT which is focused on serving the needs of people with disabilities, consumer digital technology refers to those technologies that are developed for use by the general public. The aim of this study was to explore the assistive potential of a range of exemplar consumer digital technology, namely, digital voice assistants and internet of things. A qualitative study was conducted in the context of a field-trial of a range of digital consumer technologies which included a Digital Voice Assistant alongside voiceoperated Internet of Things technologies.

Keywords: Consumer Technology, Assistive Technology,

Doing More with Dialogue: Harnessing Virtual Assistants and Artificial Intelligence to Discuss **Disabilities, Provide Support and Overcome Barriers**

Tim Coughlan

The Open University, Institute of Educational Technology, Great-Britain

Read extended abstract page 175

[Track B | Auditorium 150 | Fri 09/01 | 08:30-10:30]

Abstract: Conversational user interfaces such as chatbots and virtual assistants can support disabled students to talk about needs, barriers, technologies and strategies. This has great potential to tackle the administrative burden associated with assessing needs and gaining appropriate support, and the lack of support for the use of assistive technology. As artificial intelligence advances, new forms of advisors and assistants could help students to overcome a wider range of barriers due to their potential to hold an adaptable dialogue and play multiple roles in making learning more accessible. Taylor, a virtual assistant that has been introduced to support Open University UK students to disclose disabilities and ask questions about study and support, will be used to highlight

some of this potential. Evaluation findings and areas for enhancement to Taylor will be described, along with areas for further exploration such as how to map disabilities and barriers to technologies and strategies, and the positioning of these innovations in relation to individual and institutional responsibilities. In our current work, we want to develop collaborations and co-create designs to explore this space further.

Keywords: Education, Artificial Intelligence, Virtual Assistants, Chatbots, Student Support

HRI and Personality Perception: Comparison of the Personality Evaluation of a Teleoperated Humanoid Robot and Human Interlocutor

Sophie Sakka

INSHEA, France

Paper in IOS Proceedings

[Track B | Auditorium 150 | Fri 09/01 | 08:30-10:30]

Abstract: This paper deals with the personality perception of a humanoid robot when talking to it in a natural manner, using the wizard of Oz. An experiment involving 20 subjects was performed, to compare two heteroevaluation characteristics: identity perception of human vs. humanoid, and identity perception differences when interacting with a human directly or with the same human through the robot mediation. The experiment was organized in three interactions: with a woman, with a man, and with a humanoid robot. The evaluation uses the OCEAN inventory. The results show that the subjects create for the teleoperated robot an identity of its own, which differs from the one attributed to the teleoperator. The robot was generally perceived as having less interest in art, lacking more imagination or ingenuity, being less open-minded than the human controlling it. The perception of emotional stability is greater: the absence of the human envelope allows a person to appear more stable. We identified two statistical groups in the robot evaluation, depending on the consideration of the robotic technology by the subjects: their perception of the robot conscientiousness, extroversion and agreeableness varies according to the subjects, unlike the personality of the teleoperator.

Keywords: HRI, humanoid robot, personality evaluation, wizard-of-oz

Digital Assistive Technology: the Online Assistance for a Peaceful Driving in Automated and Connected Vehicles

<u>Julie Lang</u>^a, Daniel Gepner^a, Svitlana Matiichak^a, Charles Tijus^b, François Jouen^a ^aCHArt, EPHE-PSL, France ^bCHArt-LUTIN, Université Paris 8-Vincennes-Saint-Denis, France

Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{B}\ |\ \mathsf{Auditorium}\ 150\ |\ \mathsf{Fri}\ 09/01\ |\ 08{:}30{\text{-}}10{:}30]$

Abstract: In line with the progressive development of digital technologies, this theoretical article is about the conception of a digital twin - based assistant to increase

the serenity of the journey of the occupants of a connected car, automated or not. Its main functions are (i) to manage the Human (driver and/or passenger) - Machine (vehicle) Interaction, (ii) to inform the occupants and support decision-making by avoiding stressful situations. This is done by appropriate prevention and remediation. We advocate that the virtual assistant functions for being empathetic can be done by taking the user's point of view. Thanks to the knowledge about tasks, practices, needs and constraints, we describe how car-user's individual features can be used to get her digital twin description. Based on ontologies, this features model, providing assistance is then to simulate online the next steps of the task realization, informing about conditions, prerequisites, post-requites and subtasks to be fulfilled. Expected effects of this cognitive technology dedicated to personalized assistance are a decrease in stress, in frequency of incident and accident situations, according to a monitoring, as complete as possible, of the car-driver's conditions and situations dedicated to a serene driving. Keywords: Digital Assistant, User Needs, Automotive User Interface, Ontologies, Digital Twin

Beyond Helping: Uncovering the Ethical Considerations of Deploying Digital Voice Assistants to Support Participation by People with Disabilities and Older Citizens.

Fiachra O'Brolcháin^a, Bryan Boyle^{b,c}

^aDublin City University, School of Theology, Philosophy and Music, Ireland

^bUniversity College Cork, Ireland

^cLulea Technological University, Department of Occupational Therapy, Sweden

Read extended abstract page 177

[Track B | Auditorium 150 | Fri 09/01 | 08:30-10:30]

Abstract: As the numbers of people with disabilities actively using technology to support their day-to-day activities increases the benefits afforded by these technologies are ever more evident (Enable Ireland & Disability Federation of Ireland, 2016). Much of the technology used by people with disabilities is often characterised as Assistive Technology (AT) which is designed and developed to address the specific needs of people with disabilities (Boot et al., 2018; Copley & Ziviani, 2004; Draffan et al., 2015). In contrast to AT which is focussed on serving the needs of people with disabilities, consumer digital technology refers to those technologies that are developed for use by the general public. The aim of this study was to explore the assistive potential of a range of exemplar consumer digital technology, namely, digital voice assistants and internet of things. A qualitative study was conducted in the context of a field-trial of a range of digital consumer technologies which included a Digital Voice Assistant alongside voice-operated Internet of Things technologies. This field-trial saw a total of ten participants with disabilities recruited and the technology listed above installed in their homes for a six-week period from April till June 2022. Each participant engaged in pre and post-trial, semi-structured interview. Both the pre and post interview data were analysed thematically

using the method outlined by Braun and Clarke (2006). Thematic analysis yielded three major themes; 1) how technology changes the nature of the home, 2) the joy of exploring possibilities and 3) technology as a member of the family. Further sub-themes uncovered participants' views and perceptions as to how people with disabilities made optimal use of the technology available, the processes by which they set-up and embedded technology use in the routines of the household and ways in which technology changed their lives and the functioning of their homes. The use of Digital Voice Assistants and other consumer Internet of Things technologies by people with disabilities is likely to increase over the forthcoming years as the inter-connectedness and assistive functionality of such devices increases. Although the development of such technology is not aimed explicitly at meeting the needs of people with disabilities and older people, developers and manufacturers of consumer technologies understand that reflecting the diversity of users will increase their market share. Furthermore, this study showed also that there are hitherto unanticipated benefits that can be accrued by people with disabilities and older people simply by making the technology available to them and supporting them to use it. As developments in networked capacities increase people with disabilities and older people will look to extend their use of voice-controlled technology for convenience, entertainment, and for connecting with real and virtual communities.

Keywords: Consumer Technology, Assistive Technology, Digital Voice Assistant

Unlocking Opportunities; a Q-Methodology Informed Examination of the Ways in Which Adults with Disabilities Utilise Their Smartphones to Assist with Daily Living.

Ailís O'Mahony, Sinéad Clancy University College Cork, Ireland Read extended abstract page 180 [Track B | Auditorium 150 | Fri 09/01 | 08:30-10:30]

Abstract: The importance and use of assistive technology for adults with disabilities is well documented. However, there is limited research in the area of mainstream technology and adults with disabilities. The function of a smartphone and its associated uses is progressing at a rapid rate offering features that can be essential for daily living. It is important that the research remains up to date with this rapid expansion of technology. The aim of the study is to analyse the subjective views that adults with disability have on smartphone use, and to explore the possibility of how the use of smartphones could enhance the quality of life for adults with disabilities in Ireland. It is suggested that mixed methods research is useful when seeking to gain a better understanding when investigating complex problems in healthcare. This study is guided by the Q methodology, a mixed-methods approach. This study suggests that the mainstream nature of the technology, the diversity of functionality and the ability to personalise a smartphone contributes to a subjective positive impact upon a person with a disabilities' quality of life.

Keywords: Smartphone, Quality of Life, Adult, Disability, Mixed Methods, Q Methodology, Ireland

Application of the Cognitive Orientation to Daily Occupational Performance Approach (Co-Op)Tm to Training in the Service Delivery of Mainstream Smart Home Technologies

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^bUniversity of Pittsburgh, Department of Rehabilitation Science and Technology, United States of America

Read extended abstract page 182

[Track B | Auditorium 150 | Fri 09/01 | 11:00-12:15]

Abstract: The Autonomy, Safety, and Social Integration via Smart Technologies (ASSIST) Project was initiated to develop an evidence-based, best-practice service delivery model for Mainstream Smart Home Technologies (MSHT). The project has been implemented in several phases and is nearing its conclusion in serving the needs of persons with complex physical disabilities. The service delivery model our team has developed includes a comprehensive assessment, technology selection, implementation, training, and follow-up. This presentation focuses primarily on the training aspect of the ASSIST Service Delivery model, which has applied the CO-OP ApproachTM. The CO-OP ApproachTM is client-centered and enables persons to actively engage in problem-solving. Verbal selfguidance serves to aid in the generalization of skills with the support of the therapist providing the training. The session will highlight several case studies of research participants who benefitted from the CO-OP ApproachTM in effectively using MSHT in their daily lives.

Keywords: Smart home, mainstream technologies, physical disabilities

Accessible Consumer Electronics Are Essential to Closing the Gap in Assistive Technology Provision

David Banes^a, Sabine Lobnig^b

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Paper in IOS Proceedings

 $[\mathsf{Track} \ \mathsf{B} \ | \ \mathsf{Auditorium} \ 150 \ | \ \mathsf{Fri} \ 09/01 \ | \ 11:00\text{--}12:15]$

Abstract: According to the Global Report on Assistive Technology (2023) [1] more than 2.5 billion people require one or more assistive products – a number that is expected to grow to over 3.5 billion by 2050 due to the aging of our societies. Over the past decade, the design of products that empower people with a disability has shifted from specialized and dedicated products designed only for those with a disability to features and functions integrated into cost-effective consumer technologies for the benefit of all. The opportunity to expand the availability of such technologies is at risk of being ignored due to models of AT delivery that are founded in medical devices, and which have failed to reflect trends in our understanding of technology and the choices and preferences expressed by persons with a disability. This research suggests that

such expansion offers significant benefits to people with a disability and better both economic and social return on investment for authorities.

Keywords: Assistive Technology, accessible technology, consumer technologies, provision, policy, funding

Japanese Braille Translation Using Deep Learning -Conversion From Phonetic Characters (Kana) to Homonymic Characters (Kanji) -

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^bKinjo University, Faculty of Social Work, Japan ^cKanazawa University, Advanced Manufacturing Technology Institute, Japan

Paper in IOS Proceedings

[Track B | Auditorium 150 | Fri 09/01 | 11:00-12:15]

Abstract: A blind student writes and submits reports in

Braille word processor, which is difficult for teachers to read. This study's purpose is to make a translator from Braille into mixed Kana-Kanji sentences for such teachers. Because Kanji has homonyms, it is not always possible to get correct results when converting. To overcome this difficulty, we used deep learning for translation. We built a training dataset composed from 15,000 pairs of Braille codes and mixed Kana-Kanji sentences, and a validation dataset. In training, we got an accuracy of 0.906 and a good Bleu score of 0.600. In validation, we found 5 mistaken words in selecting homonymous Kanji by examining translation mistakes from 100 pairs of the verification sentences. The choice of homonymous Kanji depends on the context. For decreasing such type of errors, it is necessary to introduce of translation of paragraphs by increasing the scale of the network model in deep learning, and to expand the network structure.

Keywords: Japanese braille, homonym, translation system, deep learning

Assistive Technology in low- and middle-income countries (LMICs)

Chairs: Tone Øderud, Arne H. Eide *SINTEF Digital, Norway*

Access to Assistive Technology (AT) and relevant services is of great importance for inclusion of persons with functional difficulties in education, employment, and social life. The Global Report on Assistive Technology, published in 2022 by WHO and UNICEF has confirmed large unmet needs for AT across the world, particularly in LMICs. In poor and vulnerable populations, access to AT and related services may be a key element in poverty reduction and development of inclusive societies.

Ensuring access to AT for all in need is an important element in reaching several of the Sustainable Development Goals. While there is currently an international momentum for a radical shift to improve the situation globally, this is no doubt a huge task in terms of funding and prioritising, building relevant services and capacity in LMICs. Bearing in mind the large socio-economic and socio-cultural variation between countries, we need to develop knowledge-based strategies and solutions that are adapted to various contexts. Research and innovation can contribute to map use of and need for AT and develop technological solutions and service delivery models adapted to LMICs.

AT is an interdisciplinary field, and it is time for researchers, innovators, users, businesses, governments, nongovernmental and international organisations to work together towards closing the gap between access to and need for AT.

Unpacking 'What Works': a Commentary of the Key Learnings for ICT From the AT2030 Program

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Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 11:00-12:30]

Abstract: The AT2030 programme was launched in 2018 to test 'what works' in getting assistive technology (AT) to people globally, specifically in low-and middle-income countries (LMIC), where there is often a systematic lack of provision. After four years, this paper reviews the project outcomes, focussing on published material. It provides the backdrop to the AT2030 program, contextualises current developments in global AT global and funding, and unpacks the key learnings of what works to get AT to the people that need it around the world, with a focus on ICT. The paper does this by applying Global Disability Innovation Hub's mission-led and transformative approach, concluding with contemporary actions to improve access to AT to illustrate the value of embracing

complexity for AT ecosystem stakeholders, including researchers, practitioners, AT users and policymakers. **Keywords:** scale, access, assistive technology, innovation, disability, ICT

Theories, Models and Frameworks for Understanding Barriers to the Provision of Mobility Assistive Technologies: a Scoping Review

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Read extended abstract page 184

[Track C | Room 100 | Wed 08/30 | 11:00-12:30]

Abstract: There is good evidence that Mobility Assistive Technologies (MATs) improve occupational performance, social participation, educational and employment access, and overall Quality of Life (QoL) in people with disabilities. However, people with disabilities still face barriers to accessing MATs. The aims of this scoping review were to summarise and synthesise: 1) Theories, Models and Frameworks (TMFs) that have been used to understand MAT access; and 2) specific determinants of access. We used the 5-stage approach developed by

Arksey and O'Malley. We searched MEDLINE, Embase and CINAHL. We included 14 articles, using 6 TMFs which were synthesised into nine interconnected propositions The synthesised theory emphasises that mobility is essential for human flourishing and certain health conditions may impose restrictions on mobility. This impact can be ameliorated by two direct determinants: the provision of suitable services and their comprehensive provision. These services are influenced indirectly by policy and cost. Socio-cultural factors and personal factors also affect access to these services. Ineffectively addressing these determinants could limit access to MAT and subsequent disability. Our synthetic model describes the logic of providing evidence-based MATs, and we identify determinants of access which can act as targets for future work to improve MAT service provision.

Keywords: Assistive technology, Mobility, Barriers, Theories, Scoping review

Harmonising Assistive Technology Assessment Data: a Case Study in Nepal

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Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 11:00-12:30]

Abstract: There is a practical demand to maximise existing data to understand and meet the assistive technology (AT) needs in dynamic populations. Harmonisation can generate new insight by integrating multiple datasets that were not previously comparable into a single longitudinal dataset. We harmonised AT assessment data from three population-based surveys collected several years apart in Nepal: the Living Conditions of Persons with Disabilities (2014-2015), the Multiple Indicator Cluster Survey (2019), and the rapid Assistive Technology Assessment (2022). The harmonised dataset demonstrates a method that can be used for unifying AT surveys in other settings and conducting trend analyses that are necessary for monitoring a population's dynamic AT needs. We set out to explore AT data's potential for harmonisation, and learned there is indeed value in this approach for situating disparate datasets, though the methodology proposed will need further validation.

Keywords: Survey Data, Harmonisation

Barriers for Accessing Assistive Products in Lowand Middle-Income Countries (LMICs)

<u>Arne H. Eide</u>^a, Sébastien Muller^a, Wei Zhang^b, Chapal Khasnabis^b, Konstantinos Antypas^a, Mats Blakstad^a, Johan Borg^c

^aSintef Digital, Norway

^bWorld Health Organization, Switzerland ^cDalarna University, Sweden

Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 11:00-12:30]

Abstract: WHO implemented the Rapid Assistive Technology Assessment in 2021. This is a household survey on self-reported use, need and barriers for accessing AT in 35 countries globally. In order to obtain comparable data, all surveys followed guidelines developed by WHO, including national two-stage random sampling of households. The 2021 rATA survey included 32 of a total of 140 LMICs globally. Around 40 % of the total respondents (all countries) estimated travel distance to be <5 km, varying from less than 10% to almost 60% among the countries. Around 15% had to travel more than 50 km, varying from 1.3% to 37.5%. More individuals living in rural as compared to urban areas had to travel more than 25 km to get their main assistive product. Gender differences were marginal. By far the most prevalent barrier to access assistive products was "Cannot afford", amounting to 39.9% and varying from 6.7% to 79.1% among countries. This was followed by "No support" with 14.3%, varying from 2.3 % to 36.9 %, and "Not available" with 8.1%, varying from 1% to 21.5%. More barriers were reported in rural than urban areas and women report more barriers than men. Variation between countries in both travel time and barriers is substantial and country-specific service development is needed to guide service development.

Keywords: Assistive products, access, low- and middleincome countries

Insights From Integration of Vision Screening and Provision of Glasses Into Liberia's National Community Health Assistant and School Health Programs – a Novel, Sustainable, Government-Led Approach to Increasing Access to AT

Abigail Mcdaniels, Maggie Savage, Elizabeth Smith EYElliance, United States of America

Read extended abstract page 186 [Track C | Room 100 | Wed 08/30 | 11:00-12:30]

Abstract: Leveraging proven models, the Government of Liberia, in partnership with EYElliance, is integrating vision screening and eyeglass provision in school and community health programs. Over 295,000 students, 8,300 teachers, and 6,300 community members have received vision screenings and eyeglasses if needed. Learnings include prioritization, integration feasibility, scale-up strategies, healthcare worker motivation, and sustainability. These insights have broader implications for integrating assistive technology in government programs.

Keywords: Refractive error, eyeglasses, community eye health, school eye health, systems change

Hearing Loss and Access to Hearing Aids and Services in Low- and Middle-Income Countries

<u>Tone Øderud</u>^a, Linn Sofie Mork^b, Cosmas Mnyanyi^c, Peter Shija^d, Isaack Myovela^e, Sophia Madaha^e, Mselem Mnyanyi^c, Jon Øygarden^a, Tron Vedul Tronstad^a ^aSINTEF Digital, Norway

^bThe Norwegian University of Science and Technology (NTNU), Norway

^c The Open University of Tanzania, Tanzania

Read extended abstract page 189 [Track C | Room 100 | Wed 08/30 | 14:00-16:00]

Abstract: WHO reports that nearly 80 % of persons with disabling hearing loss live in low- and middle-income countries (LMICs), and it is estimated that 34 million children have a hearing loss. Furthermore, 60% of hearing loss in children is due to avoidable causes that can be prevented. The aim of this study is to explore the prevalence and cause of hearing loss among children in primary schools in Tanzania and their access to hearing aids. A cross-sectional study including 1081 primary school children in class II and III was conducted to determine the prevalence of hearing loss, using both self-reporting questions and pure-tone audiometry (PTA). Assessment using PTA documents the prevalence of hearing loss to be between 11,5% and 23% depending on the selected hearing threshold. Self-reported hearing loss was reported to be 1%. None of the children with hearing loss had access to hearing aids. The study documents that access to hearing aids and hearing services is limited in semirural area of Tanzania.

Keywords: Hearing impairment, hearing services, prevalence, low-and middle-income countries, hearing aids

Implementation of Tele-Assessment and Delivery of Wheelchairs in a Low/Middle-Income Country

Rajendra Prasad, Vivek Kumar Sinha, Suvlaxmi

Gurumayun, Rohini Gaur, Shagufta Nayar Kara Medical Foundation, India

Read extended abstract page 191

[Track C | Room 100 | Wed 08/30 | 14:00-16:00]

Abstract: According to WHO, 1.3 billion people (16% of the world's population) are living with some form of disability. Of this population, about 80 % are from developing countries. The challenges of delivering wheelchairs to persons with disabilities (PwDs) in these countries, many of whom are from the lower socioeconomic group include affordability, multiple trips required for both measurements and delivery of Assistive Technology (AT) products, non-availability of caregivers, lack of integration of neuro-rehabilitation in AT services, lack of awareness and lack of healthcare professionals working in this field. Most of the wheelchair donated in the past and still is through government agencies and other NGOs is through mass camps where standard-size wheelchair are given to all beneficiaries. In our experience, most of our beneficiaries have received multiple such wheelchairs but did not use them because of reasons like ill-fitting of wheelchairs and lack of mechanisms to address trouble-shooting. It is with this background, that our NGO explored the possibility of conducting a pilot study to see if telehealth is an option for assessing beneficiaries for customizing wheelchairs and to check the satisfaction level using the Functioning Every Day with a Wheelchair (FEW) instruments.

Keywords: Teleassessment of wheelchairs, Low/Middle Income Countries, Distribution of wheelchair through teleassessment

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Advanced Technologies for Inclusion and Participation in Education and Labour

Chairs: Christian Bühler, Susanne Dirks *Technical University Dortmund, Germany*

People with disabilities still have limited opportunities for participation in all areas of life. The fields of education and labour are particularly relevant in this respect. Despite all progress, environments as well as processes still provide accessibility barriers for people with different kinds of disabilities.

Digital technologies and tools offer great potential to overcome access and usage barriers. However, new obstacles can also be created by insufficient accessibility, incompatibility with existing technologies and wrong assumptions of the users' knowledge and skills.

Rob'autism Project: Social Learning at the Center of the Therapy

Sophie Sakka

INSHEA, France

Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 14:00-16:00]

Abstract: Rob'Autism project was started in 2014, it aims at setting a therapy support for ASD (Autistic Spectrum Disorder) teenagers based on robot, art and culture mediations. The objective of the therapy support is to improve social skills. At its center is the improvement of the capacity to build and destroy affective links with the environment, or generate and drop communication relation with the external world. Three points were addressed to restore social links management: individual, collective and social communication. The experiments were organized in 20 working sessions of 1 hour per week and involved 6 teenagers, 3 robots and 6 accompanying people. During the sessions, a repetitive scenario is performed proposing a fixed frame in which controlled events can occur, in such way that the subjects environment remains simplified. During the 20 sessions, the subjects are supervised to build a show, which is presented to an external public. Up to now, eight groups were studied (48 subjects in total by groups of 6). The results show a redefinition of the subjects' identity and their legitimacy as members of the society.

Keywords: Rob'Autism; Autistic Spectrum Disorder; social learning; robot extension paradigm; robotic mediation

Exploring Practical Metrics to Support Automatic Speech Recognition Evaluations.

<u>E.A. Draffan</u>^a, Mike Wald^a, Chaohai Ding^a, Yunjia Li^b ^aUniversity of Southampton, Great-Britain ^bHabitat Learn, Great-Britain

Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 14:00-16:00]

Abstract: Recent studies into the evaluation of automatic speech recognition for its quality of output in the form of text have shown that using word error rate to see how many mistakes exist in English does not necessarily help the developer of automatic transcriptions or captions. Confidence levels as to the type of errors being made remain low because mistranslations from speech to text are not always captured with a note that details the reason for the error. There have been situations in higher education where students requiring captions and transcriptions have found that some academic lecture results are littered with word errors which means that comprehension levels drop and those with cognitive, physical and sensory disabilities are particularly affected. Despite the incredible improvements in general understanding of conversational automatic speech recognition, academic situations tend to include numerous domain specific terms and the lecturers may be non-native speakers, coping with recording technology in noisy situations. This paper aims to discuss the way additional metrics are used to capture issues and feedback into the machine learning process to enable enhanced quality of output and more inclusive practices for those using virtual conferencing systems. The process goes beyond what is expressed and examines paralinguistic aspects such as timing, intonation, voice quality and speech understanding.

Keywords: automatic speech recognition, error correction, word error rate, cap-tions, transcriptions, disability

Intersectoral Development of an Evaluation Tool for the Socio-Professional Rehabilitation Process Adapted to People with Autism

<u>Claude Vincent</u>^{a,b}, Frédérique Mercure^b, Frédéric S. Dumont^b, Maude Lemieux^b, Martin Caouette^{b,c}, Sylvain Letscher^{b,d}, Normand Boucher^{b,e}, Francine Julien-Gauthier^{b,f}, Juliette Bertrand-Ouellet^b ^aUniversité Laval, Department of Rehabilitation, Canada ^bCentre of Interdisciplinary Research in Rehabilitation and Social Integration, Canada

^cUniversité du Québec à Trois-Rivières, Department of Psychoeducation, Canada

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^fUniversité Laval, Department of Education, Canada Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 14:00-16:00]

Abstract: Since there was no French tool adapted to the reality of people with autism enrolled in a work integration program in Quebec, we have modified the Profile of Rehabilitation and Adaptation in a Work Context for People with Intellectual Disabilities according to the scientific literature on autism. Content validity (n=17) and applicability (n=5) were done with success. Result is an Excel compiler containing 3 informative tabs, 10 tabs on the dimensions of work rehabilitation (59 items) and 4 tabs used to compile the results. Socio-professional practicians are welcomed to use this new tool to pursue construct and internal validity.

Keywords: autism, evaluation tool, work integration program, content validity, socio-professional competencies

Strengthening the Inclusiveness in Citizen Science to Improve the Participation of People with Disabilities.

Daniel Krüger^a, Bastian Pelka^b, <u>Ann Christin Schulz</u>^a ^aUniversity of Dortmund, Department of Social Sciences, Germany

^bUniversity of Dortmund, Department of Rehabilitation Sciences, Germany

Read extended abstract page 193

[Track C | Room 100 | Wed 08/30 | 16:30-18:00]

Abstract: At AAATE participants are introduced to the project "IncluScience". They will learn about the basic methodological approach, which is essentially based on inclusive Citizen Science. Together with the participants, this approach will be discussed. Furthermore, the example of the Wheelmap will be presented with the addition of accessibility criteria of specific types of places. The participants will get an exemplary overview of how people with disabilities experience participation. As in the part about the methodological approach, this will also be discussed with the participants. The following questions are conceivable:

- What visions (concerning educational settings) do you see through "IncluScience" with regard to the inclusion of people with disabilities?
- What benefits do you see concerning the consequently consideration of people with disabilities in Citizen Science projects regarding the inclusiveness? Do you also see risks?

Keywords: Inclusiveness, Citizen Science, Methodology, Inclusive Research

Cross-Cultural Evaluation of a Web Application to Support Communication and Collaboration Among

Stakeholders of the School Inclusion of Children with ASD

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Read extended abstract page 195 $\,$

[Track C | Room 100 | Wed 08/30 | 16:30-18:00]

Abstract: The schooling of children with autism spectrum disorder is a challenge that relies on all stakeholders (families, schools, and medical-social professionals). In many countries, the Individualized Education Plan (IEP) is a monitoring tool of the schooling process, implemented by the aforementioned stakeholders, but they face several barriers to the co-education process. The CoEd web app was designed using participatory methods in France, with interactive services for the children's follow-up and the three-way collaboration. CoEd applicability was assessed in Belgian cultural context (Walloon territory), as they experiences similar issues. The results showed comparable results between the two countries. The Belgian audience appreciated CoEd and would be ready to use it in real conditions, as is currently the case in France. Thus, this participatory design work developed a tool that meets the needs expressed by the French participants and those of stakeholders beyond French borders.

Keywords: cross-cultural assessment, collaboration, coeducation, inclusive education, participatory design, autism spectrum disorder

Design and Prototyping of a Serious Game on Interactive Tabletop with Tangible Objects for Disability Awareness in Companies

Yosra Mourali^a, Benoit Barathon^b, Maxime Bourgois Colin^c, Sondes Chaabane^a, Raja Fassi^c, Alice Ferrai^d, Yohan Guerrier^a, Dorothée Guilain^d, Christophe Kolski^a, Yoann Lebrun^e, Sophie Lepreux^a, Philippe Pudlo^a, Jason Sauve^f

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Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 16:30-18:00]

Abstract: This paper presents elements of user-centered design and prototyping of a serious game. Produced within the framework of the SG-HANDI project, the serious game aims to raise awareness about integration, prevention of professional displacement and job retention of people with disabilities. This serious game is developed on an interactive RFID tabletop with tangible objects. It is intended to be used in a collective context involving one or more facilitators specialized in employment and disability, as well as the company's stakeholders to be

made aware of the issue.

Keywords: Serious game, Disability, Accessibility, Employment, Interactive tabletop, User-Centered Design, Tangible interaction, RFID

Using Persona Scenarios to Raise Acceptance of Digital Tools in Social Organizations – Introducing the Easy Reading Framework

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^aTU Dortmund University, Germany

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Paper in IOS Proceedings

[Track C | Room 100 | Wed 08/30 | 16:30-18:00]

Abstract: The Easy Reading Framework is a digital tool that can be used to make existing web pages accessible to the individual needs of a wide range of people. The core of this Framework is a toolbar, which currently includes 13 different functions. The potential for multiple applications of the Easy Reading Framework is being investigated and promoted in the recent Easy Reading follow-up project "EVE4all". In this project, Personas play an important role in the first project phase to raise end-user acceptance. Personas represent specific target groups and share the same characteristics, traits, social environments, and circumstances as the intended target group. Working with this method enables developers and project participants to identify with the users of their products and their lifeworld. Our project shows that this method can be used to reflect on and use the introduction of any technology in institutions in a theoretically well-founded way. Thus, this paper aims to illustrate how this method can be successfully transferred into the pedagogical context and show how this method's usage can contribute increasing user acceptance.

Keywords: Technology acceptance, assistive technology, Easy Reading, Digital Media, Persona, inclusive methodology

Design of Instructional Videos for People with Autism who Want to Learn About Grocery Store Work: a Community, Business, Educational and Health Partnership

<u>Claude Vincent</u>^{a,b}, Juliette Bertrand-Ouellet^b, Francine Julien-Gauthier^{b,c}, Frédéric S. Dumont^b, Chantal Desmarais^{a,b}, Alexandra Lecours^{b,d}, Valérie Poulin^{b,d}, Jocelyne Kiss^{b,e}, Tiffany Hu^b, Laurence Blouin^b ^aUniversité Laval, Department of Rehabilitation, Canada ^bCentre of Interdisciplinary Research in Rehabilitation and Social Integration, Canada ^cUniversité Laval, Department of Education, Canada ^dUniversité du Québec à Trois-Rivières, Département d'ergothérapie, Canada ^eUniversité Laval, École de Design, Canada Paper in IOS Proceedings [Track C | Room 100 | Wed 08/30 | 16:30-18:00]

Abstract: To facilitate the integration of people with autism into the food industry labour market, this cross sectoral project aimed to design, validate and test instructional videos to concretely demonstrate various tasks in the grocery store, and to probe interest and assess knowledge about these tasks. Results are the delivery of 21 instructional videos validated for individuals with autism and 21 for mentors in grocery.

Keywords: autism, employment, grocery, mentorship, coaching, instructional video

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Digital Inclusion and Competence Development

Chairs: Katerina Mavrou^a, Evert-Jan Hoogerwerf^b ^aEuropean University Cyprus, Cyprus ^bAAATE, Italy

Competences are key for digital participation. Both persons that meet accessibility challenges, as well as their support workers and educating professionals, need competences to allow for effective and meaningful participation of all in digital environments. A number of studies around the digital divide concentrate on its different dimensions, including access to technology and the internet, technical and content accessibility, digital literacy and digital competence development, socio-economic, policy and cultural factors (see ENTELIS network projects and publications). With the recent impact of the COVID-19 pandemic, as well as the rapid advances in digital and assistive technology, efforts around digital literacy are currently increasing. There seems to be a variety of recently developed digital competence frameworks and training efforts for learners and educators across sectors, which however are still to be validated.

The diversity of dimensions around digital divide and competence development reveals the complexity of the issue, and need to continue discussions, research and development in order to remove barriers and create new opportunities for digital inclusion, through collaborations and co-design.

Digital Inclusion for Persons with Intellectual Disabilities: a Comprehensive Literature Review From "Right to Connect"

<u>Maria Mouka</u>^a, Aashish Kumar Verma^b, Katerina Mavrou^a, Klaus Miesenberger^b, Spyros Spyrou^a, Eleni Theodorou^a, Omor Ahmed Dhali^c

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[Track C | Room 100 | Thu 08/31 | 08:30-10:30]

Abstract: This paper draws on work carried out in the framework of the Erasmus+ co-funded project "Right to Connect: digital inclusion for persons with intellectual disabilities". The aim of the comprehensive literature review described herein was to record the state-of-the art knowledge in terms of challenges of digital literacy and social media usage by adults with intellectual disabilities and followed a comprehensive literature review approach.

Keywords: digital literacy, social media, intellectual disabilities

Training a Child with Blindness on the Basic Use of Computer with the Aim of Internet Socialization; an Intervention Program

<u>Sofia Michailidou</u>, Eleni Koustriava University of Macedonia, Department of Educational and Social Policy, Greece

Paper in IOS Proceedings

[Track C | Room 100 | Thu 08/31 | 08:30-10:30]

Abstract: In the present intervention program an elevenyear-old student with visual impairments was introduced in the basic use of a computer for the first time. The key tools for achieving this goal were the screen reading software "NVDA" as well as the development of a well-structured educational program. The purpose of the intervention was to enhance the student's technological skills, to make him familiar with the use of assistive technology and to enable him to exploit these new skills for his internet socialization. The evaluation of the intervention program's results was completed on three stages: a) after testing the student's knowledge and skills in the basic use of a computer (pre- and post-assessment), b) after measuring his social network, his self-esteem and the perceived social support, and c) after analyzing the content of the student's written speech based on a series of criteria. (pre- and post-assessment). The results showed that the basic use of a computer was acquired and internet socialization increased his level of self-esteem, his social network and simultaneously created a sense of belonging. Finally, there was an improvement in his writing.

Keywords: blindness, visual impairments, assistive technology, intervention program, internet socialization

Building Capacity of Early Childhood Educators for the Use of ICT and Assistive Technology in Inclusive Education: the Skate Competency Framework

<u>Katerina Mavrou</u>^a, Lorenzo Desideri^b, Jo Daems^c, Bert Bonroy^c, Tessa Delien^c, Hilde Pitteljon^d, Xanthipi Aristidou^a, Marianna Efstathiadou^a, Arianna Gherardini^b, Ilaria Valoti^b, Gordana Blagojevska^e, Kristijan Lazarev^e, Dance Todorovska^e

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[Track C | Room 100 | Thu 08/31 | 08:30-10:30]

Abstract: The paper presents the development of a competency framework for educators on the use of ICT and Assistive Technology for Inclusive Early Childhood Education and Care, under the SKATE project. A co-design approach was followed involving various stakeholders though which the structure and the content of the framework was decided.

Keywords: digital competencies, digital literacy, inclusive education, ICT-AT, early childhood education

Engage Ppi Toolkit : Co-Designing an Accessible Ppi Toolkit with Adults with Intellectual Disabilities to Support Inclusive Research

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^bSaint John of God Research Foundation, Ireland

[Track C | Room 100 | Thu 08/31 | 08:30-10:30]

Abstract: The Engage PPI Toolkit project was done in response to the growing need for accessible resources to support Patient & Public Involvement (PPI) in research, especially in health and social care in order to deliver person-centered care. Many people in Research know the importance of early, meaningful, and regular involvement of individuals supported. Doing this remains a challenge. We carried out a Literature review by reading research papers and reviewing toolkits about Public and Patient Participation.

We found many existing toolkits and resources to support PPI in research, but we could not find one that supported people with disabilities to fully engage in PPIdriven research and support co-researchers in a meaningful way. Such tools are not readily accessible and for this reason many people with disabilities are excluded from important researcher. The ENGAGE project started in St John of God Liffey Services (SJOG) and funded by the St John of God Research Foundation. The aim was to co-design an inclusive toolkit that could support people of all abilities to participate at every stage of the research process.

In this PPI toolkit we have included how we codesigned and produced accessible videos and multimedia guides to support more people to understand research and how to be good PPI advocates. The videos offer step by step instructions on the actions that need to be taken in carrying out inclusive PPI research. It focuses on What We Do activities, What We Make outputs and how it can support others, along with some Outcomes and what we learned from the ENGAGE project. Key lessons learned from previous research.

- Neighbours, community members, educators or individuals who work with or people who support others are important people to talk to and they can share important information about individuals' supported needs and challenges.
- 2. PPI reporting in literature previous research differs from researcher to researcher. Some research shares detailed accounts of how PPI contributors were effectively involved in research to brief comments on PPI contributors' role. PPI as a process is not clear in the literature. It is vital that researchers think about what is vital to their research and talk to the PPI participants (Co-researchers) when applying or adapting existing PPI tools.

Keywords: Co-researchers with intellectual disabilities, Inclusive and Accessible Research, PPI

Assessing Impact of Including People with Intellectual Disabilities as Our Digiacademy Teachers

Esther Murphy^a, Sara Fiori^a, Orla Shiels^a, Rea Fulgosi-Masnjak^b, Lea Masnjak Šušković^b, <u>Alisa Fabris</u>^b, Ana-Marija Bohaček^b, <u>Daniela Bratković^b</u> ^a Trinity College Dublin, The University of Dublin, Itreland ^b University of Zagreb, Faculty of Education and Rehabilitation Sciences, Croatia Read extended abstract page 201

[Track C | Room 100 | Thu 08/31 | 08:30-10:30]

Abstract: There are around 8 million people in Europe with an intellectual disability. They face disproportionate health, well-being and inclusion difficulties, significant barriers to use and interact with technology in comparison to neuro-typical peers. Exacerbating existing health, well-being and inclusion vulnerabilities. Research about people with intellectual disabilities' digital access experience demonstrated a lack of prior support and training for people with intellectual disabilities, support, and health care staff. Digi-ID PLUS, an EIT Health funded multidisciplinary European collaborative partnership with people with intellectual disability and autism from Ireland, France, Sweden, Spain, and Croatia, is developing a digital skills education platform to address these challenges: DigiAcademy. Embedded within the project team is our Citizen Advisory Panel, individuals with intellectual disabilities and accessibility needs who are paid experts by experience recruited to co-design our programme and train as our DigiAcademy teachers. The focus of this presentation is introducing the role of our European Citizen Advisory Panels in our co-design process, exploring the DigiAcademy teacher role by listening to Irish and Croatian teachers' experiences directly and demonstrating the impact membership had on them, the community and the DigiAcademy app we are co-creating together.

Keywords: Intellectual Disability, Technology, Inclusion

Digital Transition in Vocational Education for All: Lessons From Dig-I-Ready

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[Track C | Room 100 | Thu 08/31 | 11:00-12:30]

Abstract: This paper draws on work carried out in the framework of the Erasmus+ co-funded project DIG-i-READY: Digital Readiness of Vocational Educational Institutions in an Inclusive Environment which aims to examine how the vocational sector in education may better respond to the inclusion of students with disabilities during extreme circumstances. The project studied good practices on inclusion in the vocational sector producing a Catalogue of Good Practices on the basis of which a digital competence framework will be developed. This presentation focuses on sharing the results from the lessons learned from looking at good practices, with a particular emphasis on how these were used to develop the digital competence framework for users with disabilities in the vocational sector.

Keywords: Digital inclusion, vocational education, digital competences

Digital Capabilities of Older People and Uptake of Online Healthy Ageing Interventions: an Australian Study

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^bIndependent Living Assessment Incorporated, Australia Paper in IOS Proceedings

[Track C | Room 100 | Thu 08/31 | 11:00-12:30]

Abstract: The promise of digital health interventions is tempered by the realities of digital capabilities and infrastructure, especially for older persons. This paper critically examines learnings from a rapid evidence review of digital information tools along with a study evaluating the uptake of a digitally-based healthy ageing intervention by 53 older Australians. Findings suggest that digital literacy is an important precursor to engagement with digital information tools, and that digital information tools must be designed with digital literacy in mind. To achieve digital health equity and realise the potential outcomes that digital tools offer, it may well be necessary to support consumers with the basics of mastering digital platforms.

Involving, Empowering and Training End Users with Disabilities to Fully Participate in the Web Accessibility Directive Objectives. First Results From the Upowerwad Project.

<u>Lukas Baumann</u>^a, Susanne Dirks^a, Peter Kemeny^b, Susanna Laurin^b, Sergio Martin Zapata^c, Lars Bosselmann^c, Golfo Kateva^d, Andri Kyriacou^d, George Isaias^d, Christian Bühler^a

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Paper in IOS Proceedings [Track C | Room 100 | Thu 08/31 | 11:00-12:30]

Abstract: In this paper, we present the first results from the UPowerWAD Project - a project which aims to raise awareness and to empower and train people with disabilities to take active participation in the implementation of the Web Accessibility Directive (WAD). We give an overview of the results on how to capture and categorize feedback from users in the context of web accessibility and present best practices for structuring and reporting web accessibility issues. The results will be discussed focusing on the relevance and implications for further steps in the project.

Keywords: Web Accessibility Directive, Feedback Mechanism, Digital Participation, Digital Accessibility

Empirical Evaluation of Metaverse Accessibility for People who Use Alternative Input/Output Methods

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Korea Advanced Institute of Science and Technology (KAIST), SATLab, Korea

Paper in IOS Proceedings [Track C | Room 100 | Thu 08/31 | 11:00-12:30]

Abstract: This research has analyzed the accessibility of the current metaverse platforms from the perspective of screen reader and switch scanning interface users, using the mixture of quantitative and qualitative assessments. To this end, the two representative metaverse platforms, ZEPETO and Roblox, were targeted. As a result, it was found that the current metaverse platforms are not carefully designed with accessibility in mind. Many content elements and controls in the metaverse environment suffers from the lack of alternative text description and appropriate markups which are essential to make it perceivable and recognizable by assistive technology. People with severe disabilities are very likely to find it difficult or impossible to independently navigate the current metaverse environment, because they do not provide any viable means of orientation and mobility in the 3D virtual space at all. The UI/UX of the current metaverse platforms also do not provide adequate feedback to help people with limited sensory/motor functions to understand the purpose and function of it. Overall, thereby, the current metaverse environment is not robust enough to reliably work with a wide range of assistive technologies.

Keywords: Metaverse, screen reader, switch scanning interface, accessibility

Digi-ID Plus: Sharing Digital Inclusion Experiences of People with Intellectual Disabilities in Ireland, France, Sweden and the Netherlands

Esther Murphy^a, Sara Fiori^a, Darren Mccausland^a, Orla Shiels^a, Helena Bergstrom^b, Hanna Noorlandt^c, Ida Korfage^c, Eva Flygare-Wallén^b

^a Trinity College Dublin, The University of Dublin, Itreland ^bKarolinska Institut, Sweden

^cErasmus Medical Center Rotterdam, The Netherlands

Read extended abstract page 206

[Presentation cancelled]

Abstract: Research conducted during the Covid-19 Pandemic has highlighted the widening problem of digital exclusion among people with intellectual disabilities. To address these challenges, Digi-ID PLUS, a multidisciplinary European research programme, was designed with the aim to address issue of digital access and inclusion and increase empowerment among people with an intellectual disability. Co-creation focus groups were structured and designed as social activities within the collaborating service community. Participants in France, Ireland and the Netherlands provided quantitative data in relation to technology use in their daily lives. Qualitative data from focus groups and interviews in Ireland, Sweden and the Netherlands, identified two main themes, (1) Technology for Health and (2) Online Activity for Social Inclusion. Thematic analysis was conducted on data that emerged from focus groups. 3 sub-themes were identified arising from Theme 1 and 2. Key findings from co-creation focus groups were collated and connected to new sub-themes. An overview of the results of two core themes will be presented and discussed.

Keywords: Digital Inclusion, Intellectual Disability, Experience

Technologies to enhance Mobility, Accessibility and Participation

Chairs: François Routhier^a, Krista Best^b

^a Center for interdisciplinary research in rehabilitation and social integration, Canada ^bUniversité Laval, Canada

The United Nations Convention on the Rights of Persons with Disabilities ratified in 2006 aims to promote, protect, and ensure full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their dignity. However, people with mobility issues continue to experience inequitable access and restricted participation in meaningful activities, often leading to marginalization or exclusion from desired social roles in their communities. Assistive technologies and related services or policies are critical to facilitate mobility and community participation for people with disabilities. Technologies may range from low-tech interventions that consider human behaviour and learning to ground-breaking technologies in engineering and tech design to facilitate environmental and social access, such as participation in activities of daily living, employment, education, personal relationships, social roles, and leisure activities.

This session invites to present and discuss innovative ideas, visions, experiences, projects involving different stakeholders, best practices reviews and research ideas, development and evaluation on topics related, but not restricted to, wheelchairs and other assistive mobility devices, navigation technologies, pedestrian environment, and public transport.

The session is organized and promoted by Social Participation and Inclusive Cities and Mobility Access Participation, two partnership research teams working to improve community access for people with disabilities in all dimensions of urban territories through research with and empowerment of the disability community. Participatory action research approaches are being followed to ensure people with disabilities and relevant partners have a voice in the research and resulting outcomes. Deliverables result in innovative solutions that reduce or eliminate environmental, social, and physical barriers to the community participation of people with disabilities.

Measuring Economic Benefits of Built Environment Accessibility Technologies for People with Disabilities

Siny Joseph^a, Vinod Namboodiri^b

^aKansas State University, Department of Integrated Studies, United States of America ^bWichita State University, School of Computing, United

States of America

Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{C}\ |\ \mathsf{Room}\ 100\ |\ \mathsf{Thu}\ 08/31\ |\ 15{:}00{-}16{:}30]$

Abstract: Given the challenges of wayfinding in large indoor built environments, especially for persons with disabilities (PWDs), a new class of accessible technologies called built environment accessible technologies (BEAT) are being developed. Such technologies are envisioned to help achieve product and opportunity parity for PWDs. The impact and adoption of these BEATs depends largely on clear and quantifiable (tangible and intangible) economic benefits accrued to the end-users and stakeholders. This paper describes the results of a survey conducted to measure potential benefits in terms of quality of life and quality of work life (work productivity) by increased accessibility provisions within built environments as it relates to navigation for PWDs and those without disabilities. Results of this work indicate that BEATs have the greatest potential to improve mobility and exploratory activities for people with disabilities, exploratory activities for people without disabilities, and improve job security for everyone.

Keywords: Assistive & Accessible Technology, Built environment, Indoor navigation, Economic Benefits, People with Disabilities

Uses of Wayfinding Tools by People who Are Blind and Low Vision

Mahmut Erdemli, K.C. Collins

Carleton University, Canada Paper in IOS Proceedings [Track C | Room 100 | Thu 08/31 | 15:00-16:30]

Abstract: This paper presents the results of a research study of people who are blind or low vision about their experiences using wayfinding tools. The results present the accessibility issues when using wayfinding tools and assistive technology to learn about new locations. An online survey followed by a series of interviews was conducted

with ten people who identify as blind and six with low vision to learn their opinions and concerns about accessibility of three types of wayfinding tools, digital maps, navigation apps and camera apps.

Keywords: accessibility, wayfinding, maps, visual impairment

Social Participation and Physical Activity Incentive at Home in Stroke Survivor: Contribution of Technologies

Stéphane Mandigout^a, Maxence Compagnat^{a,b}, Justine Lacroix^a, Jean-Christophe Daviet^{a,b} ^aUniversité de Limoges, HAVAE, France ^bUniversity Hospital Center, Limoges, Department of Physical Medicine and Rehabilitation, France

Paper in IOS Proceedings

[Track C | Room 100 | Thu 08/31 | 15:00-16:30]

Abstract: Increased physical activity has been demonstrated as a relevant treatment after a stroke, with positive effects on impairment recovery, activity limitation, social participation and quality of life. Furthermore, PA is now recommended as part of the stroke recovery pathway, starting during inpatient care and extending through rehabilitation and community integration. The purpose of this presentation is to describe how current technologies may facilitate a continuity of care for stroke survivors. We present a synthesis of 8 studies that we have conducted to date to assess and monitor the activity level of post-stroke patients at home. The results of these studies show that home rehabilitation of post-stroke patients requires the use of individualized monitoring criteria to optimize patient care. To encourage the patient to increase his level of moderate physical activity and reduce his sedentary time, it would be recommended to propose a regularly monitored and structured program.

Keywords: Stroke, Home, Physical activity, Activity tracker

Public Transportation Training: a Low-Tech Approach to Facilitate Using the Bus for People with Disabilities

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Université Laval, Centre interdisciplinaire de recherche en réadaptation et en intégration sociale (CIRRIS), Canada

Read extended abstract page 209

[Track C | Room 100 | Thu 08/31 | 15:00-16:30]

Abstract: People with disabilities face physical and societal barriers to accessing public transportation, such as using the bus. Public transportation training represents a low-tech approach to improve how people with disabilities use public transportation services (the bus) and the associated technology (using apps for route planning). A multi-methods study was conducted in partnership with a local public transit service provider. Public transit training was completed by all participants, which integrated didactic information with practical experiences. Self-efficacy, satisfaction and community mobility were evaluated and semi-structured interviews were conducted. Data were analyzed descriptively, statistically and thematically. 12 people with disabilities experienced improvements in selfefficacy, skills and autonomy for using the bus, which in turn enhanced community mobility and social participation. Low tech training programs may enhance adoption and sustained use of technologies.

I Know My Rights!! a Longitudinal Study of Discrimination Due to Physical Inaccessibility From the Perspective of Wheelchair Users

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^aKarolinska Institutet, Division of occupational therapy, Division of Neurobiology, Care Sciences, and Society, Sweden ^bKristianstad University, Sweden

Paper in IOS Proceedings

[Track C | Room 100 | Thu 08/31 | 15:00-16:30]

Abstract: It is a fundamental right to be able to access society and the services in it. From the perspective of disability rights, people with mobility-related disabilities who use wheelchairs must have equal opportunities to participate in and contribute to society - whether it is school, work, or (activity) leisure. This ongoing study is a longitudinal document study with qualitative content analysis. The document study is based on incoming complaints of discrimination due to inaccessibility received by the DO in Sweden, 2015 - 2023. The study explores how the users of wheelchairs and scooters experience discrimination due to their inaccessibility, using the ICF framework, among reported complaints to the DO from 2015-2023. The preliminary results show an increase in the number of complaints about discrimination across the entire period of 2015-2023. Responding to peoples' lived perspectives has often been cited as crucial to understanding how inclusion and exclusion play out in real life. A more accessible world depends on the extent of our knowledge and the politics of knowing-making, according to recently published research. Analyzing complaints about lack of accessibility over time generates essential knowledge for how discrimination against people who use wheelchairs can be prevented. This project also contributes to essential knowledge for social sustainability, economic sustainability, and a sustainable, accessible environment for people who use wheelchairs.

Keywords: Assistive technology, discrimination, accessibility, participation, disability, wheelchair, document analysis, mobility

Are Manual Wheelchair Users Free to Visit Natural Landscapes?

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^a University of Pisa, Department of Information Engineering, Italy

^bUniversity of Pisa, Department of Civil and Industrial Engineering, Italy

Read extended abstract page 212

[Track C | Room 100 | Fri 09/01 | 08:30-10:30]

Abstract: EU's Statistics Office Eurostat suggests an estimate of 5 million wheelchair users in Europe. Among

this population, this paper focuses on users able to selfpropelled the wheelchair by using push-rims fitted on rear wheels and in particular the ones who are travelling around the world. Self-propelled wheelchairs are difficult to drive in off-road paths or in situation of slope greater than 8%. Electric wheelchairs are difficult to transport, and frontwheel drive kits are not suitable because of wheel slippage due to the rearward-shifted barycentre. From these problems, the idea has been the realization of an innovative kit that is plug-and-play and affects rear wheels. The kit is composed of a mechanical support, motors, control unit and a human-machine interface. The kit makes use of two motors which are pushed towards the rear wheels through a spring. Once the motors turn, rotation is transmitted to the wheels by friction. A prototype has been realized and tested.

Keywords: Wheelchair, Plug-and-Play kit, AT for Turism

A Novel Geospatial Assistive Navigation Technology for a Seamless Multimodal Mobility

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Paper in IOS Proceedings

[Track C | Room 100 | Fri 09/01 | 08:30-10:30]

Abstract: Mobility is fundamental for social participation of people with disabilities. Unfortunately, traditional design of urban environments, including infrastructure and services are developed based largely on a standard perception of an independent, fully functional citizen without disability which limits the mobility social participation of PWD. This paper presents the design and development of a novel geospatial assistive navigation technology to support multimodal mobility of people with disabilities, especially those using manual wheelchair in urban areas. **Keywords:** Multimodal, Mobility, Navigation, Wheelchair, Bus, MobiliSIG

Co-Design of an Interactive Wellness Park: Ideating Designs for a Multimodal Outdoor Physical Web Installation

<u>Fatima Badmos</u>^a, Damon Berry^a, Emma Murphy^b ^aTechnological University Dublin, School of Electrical Electronic Engineering, Ireland

^bTechnological University Dublin, School of Computer Science, Ireland

Read extended abstract page 214

[Track C | Room 100 | Fri 09/01 | 08:30-10:30]

Abstract: Existing research and physical activity guidelines highlight the benefits of outdoor physical activities for ageing populations. We propose that smart and interactive systems in open public spaces specifically designed to engage older adults hold great potential to support physical activities and motivate rehabilitation. Older adults and other stakeholders will participate in co-design workshops to iteratively design an interactive system using the physical web. In this present study, we aim to explore the perceptions and experiences of older adults in relation to their physical activity routines and to ideate some initial design ideas for the proposed novel physical web interface.

Keywords: Physical web, older adults, Participatory design, Co-design, Physical activities, Design thinking

Don't Hold Back: Removing the Braking Component in Wheelchair Propulsion with a Steering-by-Leaning System

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K. Vegter^b, William R. Taylor^a

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^bUniversity of Groningen, Human Movement Sciences, Netherlands

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[Track C | Room 100 | Fri 09/01 | 08:30-10:30]

Abstract: Manual Wheelchairs do not steer but are turned by braking unilaterally. Changes or adjustments of the direction of travel slow down the movement and force users to re-accelerate. The resulting energy loss contributes substantially to the inefficiency of wheelchair propulsion, is possibly hazardous to users' health and can be frustrating. Our steering-by-leaning system allows wheelchair users to control the direction of travel through a laterally tiltable backrest that functions as a steering wheel. We tested the system in an adapted Illinois Agility test course with 16 experienced wheelchair users as well as 15 able-bodied novices and compared it against conventional wheelchair usage. The system was able to remove the need for braking for directional control which drastically reduced the energy requirement for completion of the course. We therefore believe that steering-by-leaning systems can make a meaningful contribution to the mobility of manual wheelchair users.

Keywords: wheelchair, propulsion, steering, leaning, agility, turning, cross-slope, tilted

Towards a Model for the Transfer of Technology Driven Innovation in Accessible and Inclusive Public Transport

Evert-Jan Hoogerwerf, Riccardo Magni, Alexey Andrushevich, David Banes

AAATE, Austria

Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{C}\ |\ \mathsf{Room}\ 100\ |\ \mathsf{Fri}\ 09/01\ |\ 08{:}30{\text{--}}10{:}30]$

Abstract: This article reports on work undertaken by AAATE researchers in the framework of the EU-funded TRIPS Project. The project (2021-2023) has aimed to contribute to transforming public transport in Europe and beyond toward more inclusive models, leaving no one behind. The reported findings refer to a specific aspect of the transformation process that has been investigated by the authors, namely the factors that impact the transfer of innovation in accessibility by the public transport providers. A framework model was created due to a process of factor extraction from existing literature and their validation by a sample of decision-makers in the public transport sector. **Keywords:** Accessible public transport, inclusive mobility, technology transfer, transfer of innovation, accessibility

Robotics at the Service of Wheelchair Mobility for People with Disabilities: Story of a Clinical-Scientific Partnership

Emilie Leblong^{a,b}, Bastien Fraudet^{a,c}, Louise Devigne^b, François Pasteau^b, Sylvain Guegan^b, Marie Babel^b ^aPôle MPR St Hélier, France ^bINSA Rennes-CNRS, INRIA, IRISA, France ^cLiving Lab ISAR, France Paper in IOS Proceedings [Track C | Room 100 | Fri 09/01 | 08:30-10:30]

Abstract: The mobility of people with motor disabilities

combined with sensory or cognitive disabilities, sometimes leads to safety issues that make independent travel impossible. In this context, teams based in Rennes in the west of France have been working together for several years to design two devices: - an power wheelchair simulator to promote learning to drive in an immersive virtual environment, - a driving assistance module that can be added to an power wheelchair to pass and avoid obstacles. This transdisciplinary work was made possible by the geographical and human proximity of the scientific, technical and clinical teams in order to best meet the needs of the end users who were integrated into this co-design approach. This article describes the evolution of this work and future prospects.

Keywords: power wheelchair, driving assistance, driving simulators, neurological impairments

Robots for Children

Chairs: Pedro Encarnação^a, Lorenzo Desideri^b ^aUniversidade Católica Portuguesa, Portugal ^bAIAS Bologna onlus, Italy

In the last few decades, there has been a significant interest in the use of robots with children with disabilities. Robots are programmable mechanisms that move within a physical environment exhibiting a degree of autonomy. Its physical presence enables them to act upon the environment and to interact with people directly. Being programmable, capable of sensing the environment and of exhibiting different degrees of autonomy, robots can be used for different goals and adapt their behaviour in response to the environment and/or to the person they're interacting with. Robotic systems may also be a valuable tool in objectively assessing educational or therapeutic goals by registering all variables of interest during interventions. These features, along with the fact that, in general, children are attracted by robots, have motivated the development of robotic tools to assist children with disabilities. Applications include the use of robots in a) inclusive education, allowing children to actively participate in the curricular activities (robotic assistive technologies to support manipulation), providing a direct application medium for the theoretical concepts under study (educational robotics), or interacting with children to support their learning (social robots acting as teachers or peers); b) cognitive therapy (social robots that foster social skills and language development); c) physical therapy (robots designed to engage children in physical therapy); d) stress and pain management (social robots acting as companions of children with a chronic illness or undergoing medical and/or mental care); e) promoting play for the sake of play (robots being the play object or providing a means to access to play). The possibility of implementing different levels of autonomy may enable robots to provide the just-right amount of support, only taking control when the child is not able to, thus enabling each child to develop up to the maximum of her potential.

A Case Study of Social Robotics Addressed to Students with Autism in Upper Secondary School

Ivan Traina

University of Verona, Department of Human Sciences, Italy Read extended abstract page 218

[Track C | Room 100 | Fri 09/01 | 11:00-12:15]

Abstract: This paper presents a case study on the use of social robotics for students with autism in upper secondary school. The methodology used was described and results discussed.

Keywords: Social robotics, students with autism, upper secondary school, case study

A Role-Based Investigation of Socially Assistive Robots in a Paediatric Rehabilitation Clinic

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^c The Royal Children's Hospital, Australia

Read extended abstract page 220 [Track C | Room 100 | Fri 09/01 | 11:00-12:15]

Abstract: There are many benefits to be found in the use of socially assistive robots in rehabilitative efforts, although much of the research focuses on testing specific

functionality and observing the effects. Another outlook that can be taken is from a role-based perspective, understanding what roles a robot can take and the outcomes generated from taking on those roles. To broaden our understanding, we propose an in-situ study partnered with a major hospital focusing on the roles of socially assistive robots and how these roles can change or improve our use of robots and our design process.

Keywords: Socially assistive robots, paediatric rehabilitation, rehabilitation robotics, hospitals

Vocal Behavior Acquisition with a Toy Operating by Sound Detection

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^bDaiichi Institution of Technology, Japan
^cNippon Bunri University, Japan
Paper in IOS Proceedings
[Track C | Room 100 | Fri 09/01 | 11:00-12:15]

Abstract: We investigated a speech training support system targeting students in special needs education classes who are engaged in training to acquire a binary relationship where their vocalizations elicit reactions from others. Previously, there was a challenge in maintaining interest

and achieving learning effectiveness when teachers intervened to encourage vocalizations using teaching aids such as picture books. To address this, we designed and integrated an electronic circuit with a movable toy that captures the interest of the supported students. The circuit includes a switch that turns on and activates a secondary circuit only when vocalizations are detected. In this paper, we report on the training using the developed speech support system and validate its functionality.

Keywords: Mastering vocalization with toys, Special needs education, Voice detection equipment

Building Policies and Initiatives for inclusive educational contexts

Chairs: Silvio Pagliara^a, Katerina Mavrou^b ^aAusilioteca Mediterranea Onlus - GLIC Associate Board Member, Italy ^bEuropean University Cyprus, Cyprus

How ICT and AT can support and foster inclusion in policies (regulations), local initiatives, best practices in Education context

The goal of this session is to gather experiences and create a framework based on national and regional research, case study examples, best practises, laws, and policies regarding the adoption of technology to promote inclusivity in educational contexts from primary to high education.

Requirements, Barriers and Tools for Inclusion in an Educational Digital Environment

Melanie Schaur, Reinhard Koutny

Johannes Kepler University, Linz, Austria

Paper in IOS Proceedings

[Track D | Room 50 | Wed 08/30 | 11:00-12:30]

Abstract: An inclusive digital environment in education is considered a cornerstone for a modern society and particularly important for learners with disabilities. This paper delves into this topic and presents the findings from a one-week "Learning, Teaching and Training Activity" (LTTA) conducted as part of the Erasmus+ project on the "Digital Readiness of Vocational Educational Institutions in an Inclusive Environment." The LTTA involved discussions on the requirements, barriers, and applicable tools for digitalization in Vocational Educational Institutions (VET) with educators and self-representatives (learners with disabilities). The feedback from participants was analyzed and included evaluations of various tools in terms of their effectiveness and usefulness. These tools encompassed document accessibility, onboard Windows accessibility features, AI in the form of large language models (LLM) as assistive technology, and image recognitionbased assistive technologies. Results, presented in this paper, indicate that especially learners with disabilities can benefit from participation in an inclusive digital environment.

Keywords: inclusive digital environment, education, vocational education, accessibility, people with disabilities

An Intervention Model for Inclusive Educational Pathways with Assistive Technologies: Some Experiences From Southern Italy

Silvio Marcello Pagliara^{a,b}, <u>Francesco Zanfardino^{b,c}</u>, Antonio Spera^b, Giuseppa Cinquemani^d ^aUniversità degli studi di Cagliari, Italy ^bManè Impresa Sociale, Italy
^cUniversità degli studi di Napoli Federico II, Italy
^dASL Napoli 1 Centro, Italy
Read extended abstract page 222

[Track D | Room 50 | Wed 08/30 | 11:00-12:30]

Abstract: This article presents the model of operation of the support desk for the introduction of assistive technologies in inclusive educational paths provided by the nonprofit social cooperative Ausilioteca Mediterranea Onlus. The desk, active since 2010 in the province of Naples and since 2016 in that of Salerno, is aimed at curricular and support teachers of Italian public schools of all levels. The introduction of assistive technologies in educational paths can provide valuable support to students with disabilities, helping them access educational content and fully participate in activities in an inclusive way.

Keywords: Assistive technologies, disabilities, education, enabling environments.

MSc Educational Assistive Technology: Training an Emergent Professional Group

Rohan Slaughter, Annalu Waller, Tom Griffiths University of Dundee, School of Science and Engineering,

Great-Britain

Paper in IOS Proceedings

 $[\mathsf{Track} \ \mathsf{D} \ | \ \mathsf{Room} \ \mathsf{50} \ | \ \mathsf{Wed} \ \ \mathsf{08}/\mathsf{30} \ | \ \mathsf{11:00-12:30}]$

Abstract: The MSc Educational Assistive Technology (EduAT), is a recently established course, having welcomed the first cohort in January 2021, this group have recently completed their studies. At time of writing (summer 2023) the course is actively recruiting it's fourth cohort who are due to commence in January 2024. The course is now an established part of the AT training offer as the curriculum has been developed and delivered. This paper supports the presentation prepared for AAATE 2023. The EduAT approach uses the ESCO definition

of the Assistive Technologist role, which is briefly summarised. The paper continues with how and why MSc EduAT was developed and explores how this MSc fits into a wider AT training ecosystem, noting roles that EduAT has been designed to support. An overview of the curriculum developed to train assistive technologists is included alongside a summary of what has been learned since the course began. The paper concludes by briefly summarising AT and AAC research group plans that have been informed by the experience of developing and delivering the MSc EduAT, and through the contributions students have made to the authors wider understanding of the assistive technology landscape in the UK and beyond. **Keywords:** Assistive Technologist, EduAT, Education

Building Policies and Initiatives for Inclusive Educational Contexts: the Glic Italian Experience

Silvio Pagliara^{a,b}, Massimo Guerreschi^a, Claudio Bitelli^a, Francesco Zanfardino^a, Riccardo Magni^a, Paolo Boscarato^a ^aGLIC, Italy ^bUniversità degli Studi di Cagliari, Italy

Paper in IOS Proceedings [Track D | Room 50 | Wed 08/30 | 11:00-12:30]

Abstract: Inclusive education has emerged as a global priority, and the integration of assistive technology (AT) is recognized as a crucial component for creating inclusive educational environments. However, the successful implementation of AT hinges on supportive policies and initiatives. This article delves into the experience of the GLIC Association in collaboration with the Italian Ministry of Education, exploring their efforts in developing policies and initiatives to facilitate the introduction of AT in educational contexts. The GLIC Association has devised a service provisioning model in state schools that ensures adequate support for the integration of AT, thus promoting inclusive education.

Keywords: GLIC, Assistive Technology, Inclusive schools, Italian experience

Tool for Digital Inclusion in Italian Schools: the

Use of Self-Assessment Framework From ENTELIS Project

Silvio Pagliara^{a,b}, Marta Sanchez Utge^c ^aUniversità degli Studi di Cagliari, Italy ^bAusilioteca Mediterranea Onlus, Italy ^cUniversità degli Studi di Roma "Foro Italico", Italy Paper in IOS Proceedings

[Track D | Room 50 | Wed 08/30 | 11:00-12:30]

Abstract: The use of technology in education has the potential to create more inclusive environments for all students, including those with disabilities. In Italy, the Ministry of Education has recognized the importance of digital literacy in schools and has issued several documents outlining the steps necessary to build a more inclusive educational system. However, in order to achieve these goals, it is important to assess the current situation and identify areas for improvement. The Entelis Self-assessment framework, particularly the Italian short version, can be used as a tool to help schools assess their digital inclusion practices and develop strategies for improvement. In 2015, the Ministry of Education issued the new Law 107/2015, called "La Buona Scuola", which included the New National Plan on School Digital Literacy - PNSD (MIUR, 2015) and the Three-year plan of in-service teachers' education and training. These documents aimed to consolidate the path of innovation and digitization in schools through a strategy that invested in the technological, epistemological, and cultural dimensions. The PNSD focused on the initial and in-service training of teachers, recognizing that educational innovation through digital technologies requires a reformulation of traditional teaching-learning methods to include pedagogical accessibility and inclusion. However, the success of these initiatives depends on the readiness of teachers to implement new technologies in their classrooms. The European Union (EU) identified teacher training as a critical factor for the success of ICT-related educational innovation in 2003. Teachers themselves recognize the need for training, with TALIS results (OEDC, 2014) showing that the need for training related to teaching with information and communication technology (ICT) skills and using new technologies in the workplace was a priority for teachers. Keywords: Inclusive education, ICT, teachers training

Culture

Chair: Dominique Archambault Université Paris 8, France

Will This Book Fit My Reading Needs?

Gautier Chomel

European Digital Reading Laboratory (EDRLab), Paris, France.

Read extended abstract page 224 [Track D | Room 50 | Wed 08/30 | 14:00-16:00]

Abstract: Publishers are producing more and more born accessible eBooks, but to reach their publics those books must be identified as fitting the reader's needs. What sentences must be displayed by online book selling or landing platforms? To find answers we had to dive into the diversity of books features as well as print disable readers practices. The project leads us to advocate for redefinition of metadata sets, build a feature dictionary and publish reading use cases.

Keywords: Publishing, Ebook, Metadata, Reading, Digital Accessibility, Inclusion

Inclusion for Cultural Education in Museum, Audio and Touch Interaction

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Abstract: Inclusive access to culture for all people in institutions, such as museums, is an important issue specified in French laws and is also recognized internationally. This article investigates inclusion of blind and partially blind visitors in museums. The pilot study conducted involves blind, partially blind, and sighted people and observes their perception of audio descriptions and different tactile representations within a museum. 12 participants were asked to experience three different conditions for 3 scenes of the Bayeux Tapestry using inclusive and co-created audio descriptions, simplified swell paper representations, and high relief representations. Overall, a high level of interest was found across all conditions, with multimodality through audio and tactile stimulus found to have enriched participants' experience. However, more guided tactile exploration would be better. From participants' feedback, some observations have emerged which could be explored for the development of new technologies to better respond to museum visitors' expectations. **Keywords:** Blind, partially blind, inclusion, cultural education, multisensory, museums

Designing for Accessibility in Cultural Heritage – Exploring Tangible Technologies for Enhancing the Museum Visit Experience for Blind Visitors

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^eThe Hecht museum University of Haifa

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Read extended abstract page 226 [Track D | Room 50 | Wed 08/30 | 14:00-16:00]

Abstract: The development of 3D scanning and printing technologies opened new opportunities for improving the engagement of visually impaired people in general and blind people specifically, when experiencing cultural heritage. However, in spite of numerous recent studies, developing cultural heritage experiences for visually impaired visitors is not straightforward, and multiple factors, including knowledge about the available opportunities, desires, barriers, and abilities affect their participation. In this short paper, we present an approach for exploring techniques for designing and developing such experiences in the framework of a graduate multidisciplinary course with the active involvement of museum staff, and visually impaired visitors with the aim of making the cultural heritage accessible according to the universal design principles to enhance the museum visit experience of blind people.

Keywords: Human-centered computing, Accessibility, Accessibility systems and tools

Online Art Therapy Based Self-Help Intervention for Emotional Betterment

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 ^a Eötvös Loránd University Budapest, Department of Doctoral School of Psychology, Hungary
^b Eötvös Loránd University Budapest, Department of Affective Psychology Psychology Institute, Hungary Read extended abstract page 228

[Track D | Room 50 | Wed 08/30 | 14:00-16:00]

Abstract: ELTE EMIND Research Group conducted a series of studies on the investigation of effectiveness and characteristics of the art therapy-based online self-help tasks (ATB-SHOT) to support university students during stressful times. This digital, individual method was easily accessible for all students via structured instructions given in google forms via email. Art tasks required no artistic skills. According to qualitative and quantitative analysis of 54 participants, students were able to enhance mood, lower anxiety, gain more self-awareness, control, and feelings of safety and competence. Correlation analysis revealed that emotional betterment can be enhanced even with higher trait anxiety, and somatic complaints due to ATB-SHOT. Some tasks' texts and images were uniquely investigated from different viewpoints: "Squiggle tasks" was observed to seek an understanding of how a simple creative task fosters coherent self-consciousness; "Object task" was investigated to see how instructions modify the experience of a self-help intervention. **Keywords:** art therapy-based online self-help, digital mental health service

Developing an Android-Based Game for Children with Blindness or Low Vision

Cecília Sik Lanyi^a, <u>Patrícia Szabó^{a,b}</u>

 ^aUniversity of Pannonia, Department of Electrical Engineering and Information Systems, Hungary
^bEötvös Loránd Research Network, Hungary Read extended abstract page 231

[Track D | Room 50 | Wed 08/30 | 14:00-16:00]

Abstract: The purpose of our research was to create a skill-based game running on the Android platform that is primarily intended for children around the age of 7-12 years. The game is designed to improve the dexterity and hand coordination of the children and can be played by users with blindness or low vision. It can be also applicable in instances where a variety of disabilities caused by neurological differences, such as autism, may result in blindness.

Keywords: Skill-based game, smartphone, Android, Unity, blind and low vision
AT Outcomes

Chair: Dominique Archambault Université Paris 8, France

A Pilot Study on the Relationship Between Hand Load and Gait During Walking While Holding on to Furniture in Patients with Hemiplegia Stroke

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Read extended abstract page 234 [Track D | Room 50 | Wed 08/30 | 16:30-18:00]

Abstract: Focusing on the hand load is essential in analyzing walking while holding onto furniture. However, installing sensors inside a house to measure pressure is difficult. Therefore, this study investigated the relationship between gait and hand load, aiming to estimate the hand load from the gait. Two stroke paraplegic patients participated and walked across a parallel support stand instead of furniture. Each evaluation indicator was calculated based on the data acquired by the 3D motion capture system and pressure sensors. In common with all hand load evaluation indicators, strong positive correlations were observed with maximum trunk lateral flexion angle, maximum pelvis depression angle, stride length, and vertical range of movement of the center of gravity, which showed walking characteristics while holding on to something. Therefore, the above four indicators are likely to be useful reference indicators for estimating hand load from the gait.

Keywords: Maintenance Rehabilitation, Stroke, Gait Analysis, Marker-less Sensing, Non-contact Sensor

Head Gesture Interface for Mouse Stick Users by AAGI

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Research Institute, Japan

Paper in IOS Proceedings

 $[\mathsf{Track} \ \mathsf{D} \ | \ \mathsf{Room} \ \mathsf{50} \ | \ \mathsf{Wed} \ \ \mathsf{08}/\mathsf{30} \ | \ \mathsf{16}{:}\mathsf{30}{-}\mathsf{18}{:}\mathsf{00}]$

Abstract: We developed a gesture interface (AAGI) for individuals with motor dysfunction who cannot use standard interface switches. These users have cerebral palsy, quadriplegia, or traumatic brain injury and experience involuntary movement, spasticity, and so on. In this paper, we describe a disabled user who utilizes a mouth stick for laptop PC input in daily life. Our objective is to lower the burden on his body by using gestures. To this end, we developed a "home position" for the head that enables gestures to coexist with the mouse stick usage. The results of basic experiments with five healthy participants indicate that our system has reached the level where it can be applied to actual disabled persons. Finally, we applied the system to a user with cerebral palsy asked him to perform web browsing.

Keywords: Gesture interface, support for the disabled, mouth stick, AAC, human sensing

STAACS³: Simulation Tool for AAC with Single-Switch Scanning

Lisa Hoiry^a, Cherifa Ben Khelil^b, Frédéric Rayar^b, Anaïs Halftermeyer^c, Jean-Yves Antoine^b, Mathieu Raynal^a ^aIRIT, University of Toulouse, France ^bLIFAT, University of Tours, France ^cLIFO, University of Orléans, France Paper in IOS Proceedings [Track D | Room 50 | Wed 08/30 | 16:30-18:00]

Abstract: Communication for people with motor impairments is a difficult, yet necessary, task in daily activities. To do so, soft keyboards, digital counterpart of physical keyboards, are used. Depending on their features, several designs can be considered, however their thoughtful evaluation in real-life is not feasible. Therefore, it becomes necessary to filter the possible configurations wisely, taking advantage of simulation tools. This paper presents STAACS³, a Simulation Tool for AAC with Single-Switch scanning, that allows to model and simulate the performance of any type of scanning strategy or prediction systems.

Keywords: Augmentative and Alternative Communication, Soft keyboards, Single-switch scanning, Simulation

Proposal and Prototype of an Esophageal Speech

Training Device Using Myoelectric Signals

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and Electronic Systems Engineering, Japan

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Read extended abstract page 236

[Track D | Room 50 | Wed 08/30 | 16:30-18:00]

Abstract: Patients who undergo a laryngectomy, for treatment of laryngeal cancer, lose their vocal source function and therefore lose their voice. Esophageal speech is used to help these patients regain their voices. Although this method can be used hands-free and has high speech intelligibility, it is difficult to learn, requiring more than six months of practice, and the percentage of patients who learn it is as low as 60-70 %. This is thought to be because an objective practice method has not been established. Therefore, we have been developing a device to analyze and visualize the muscles' activity in esophageal speech, which will enable efficient practice. In this report, we describe the results of our study of signal processing methods for measuring the myoelectric potential signals of the hyoid muscle and diaphragm, which are active during esophageal speech. In addition, we have developed a prototype myoelectric measurement device using an Arduino and tested its operation.

Keywords: Esophageal speech, Myoelectric signal, Training device, Speech production substitutes

Acoustic Properties of Hearing Aid Processed and Unprocessed Speech Sound: an Evaluation of Hearing Aid Performance

Mohammad Shamim Ansari

Ali Yavar Jung National Institute of Speech & Hearing Disabilities, Department of Audiology, India

Read extended abstract page 239 [Track D | Room 50 | Wed 08/30 | 16:30-18:00]

Abstract: Hearing aids are expected to improve speech intelligibility for listeners with hearing impairment. An appropriate amplification fitting tuned for the listener's hearing impairment is critical for good performance. The modern DSP hearing aids, though restores the sensitivity or audibility, but failed to restore frequency selectivity in persons with hearing impairment. It has proven difficult to identify the poor performance of hearing aids to restore normal auditory perception through psychophysical examinations. Therefore, in this paper, an attempt is made to explore an alternative approach to study the alterations in the speech signal processing in hearing aid. So that future processing strategies in hearing aid can be improved to avoid tradeoff between input and output signal of the hearing aid.

Keywords: Hearing Aid, Acoustic Parameter, Pro-cessed Speech, Unprocessed speech

Universal Design in Education (UDE) across the Entire lifecycle

Chairs: Gerald M. Craddock^a, Silvio Pagliara^b, Donal Fitzpatrick^a ^aCentre for Excellence in Universal Design, Ireland ^bAusilioteca Mediterranea Onlus - GLIC Associate Board Member, Italy

Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. An environment (or any building, product or service in that environment) should be designed to meet the needs of all people who wish to use it. This is not a special requirement, for the benefit of only a minority of the population. It is a fundamental condition of good design. If an environment is accessible, usable, convenient and a pleasure to use, everyone benefits. By considering the diverse needs and abilities of all throughout the design process, universal design creates products, services and environments that meet peoples' needs. Simply put, universal design is good design.

The recent Covid pandemic has meant unparalleled changes to the delivery of education. Many activities which used to occur in a face-to-face setting moved online, and the role of digital environments rose to prominence. Thus, ensuring that education is inclusive to as wide a demographic as possible, now encompasses both the physical and digital realms, as well as the learning materials and assessments which make up programmes of study.

Inclusion4EU: Co-Designing a Framework for Inclusive Software Design and Development

Dympna O'Sullivan^a, Emma Murphy^a, Andrea Curley^a, John Gilligan^a, Damian Gordon^a, Anna Becevel^a, Svetlana Hensman^a, Mariana Rocha^a, Claudia Rivera^a, Michael Collins^a, J Paul Gibson^b, Gordana Dodig-Crnkovic^c, Gearoid Kearney^d, Sarah Boland^e ^a Technological University Dublin, School of Computer Science, Ireland ^bINFormatique, Telecom SudParis, France

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Paper in IOS Proceedings

[Track D | Room 50 | Thu 08/31 | 08:30-10:30]

Abstract: Digital technology is now pervasive, however, not all groups have uniformly benefitted from technological changes and some groups have been left behind or digitally excluded. Comprehensive data from the 2017 Current Population Survey shows that older people and persons with disabilities still lag behind in computer and internet access. Furthermore unique ethical, privacy and safety implications exist for the use of technology for older persons and people with disabilities and careful reflection is required to incorporate these aspects, which are not always part of a traditional software lifecycle. In this paper we present the Inclusion4EU project that aims to co-design a new framework, guidelines and checklists for inclusive software design and development with endusers from excluded categories, academics with expertise in human-computer interaction and industry practitioners from software engineering.

Keywords: Inclusive Software Design and Development, Co-Design, Software Engineering, Older Adults, Persons with Disabilities

Universal Design in Education (UDE) Across the Life Course: Applying a Systems Framework to Create an Inclusive Experience for All

Gerald Craddock, Donal Fitzpatrick, James Hubbard, Ruth O'Reilly, Marion Wilkinson

National Disability Authority, Ireland

Paper in IOS Proceedings

[Track D | Room 50 | Thu 08/31 | 08:30-10:30]

Abstract: The UN Convention on the Rights of Persons with Disabilities (UNCRPD) promotes the realisation of the right of persons with disabilities to education through Article 24 - Education. Universal Design in Education (UDE) fosters a whole systems approach so that the physical and digital environments, the educational services, and the teaching and learning can be easily accessed, understood and used, by the widest range of learners and by all key stakeholders, in a more inclusive environment. The whole systems approach incorporates the entire educational environment, as well as the recognition of the capacity for all learners (including persons with disabilities) to learn, and environments which are fully accessible

and inclusive. This paper discusses methods whereby a systems approach can be applied to various aspects of education across the life continuum. It further advocates the inclusion of Universal Design as subject matter in curricula and assessment, to ensure a broader and more widespread adoption across the educational spectrum.

Keywords: Universal Design, Education, Universal Design in Education

Measuring Accessibility of Higher Educational Institution's Websites for Digital Inclusion

Mathew Martin Poothullil

Ministry of Social Justice & Empowerment, Govt. of India Read extended abstract page 241

 $[\mathsf{Track} \ \mathsf{D} \ | \ \mathsf{Room} \, \mathsf{50} \ | \ \mathsf{Thu} \ \mathsf{08}/\mathsf{31} \ | \ \mathsf{08}{:}\mathsf{30}{-}\mathsf{10}{:}\mathsf{30}]$

Abstract: Websites are today the face of an organization in the virtual space, with a global reach. The Universities are organizations (in India) offering higher education. They use their websites and social media platforms for education and the dissemination of information. Accessibility of these websites and social media platforms will be the test of their global reach to their students in terms of digital inclusion. This study is based on the Uses and Gratification theory (Blumer & Katz) that states viewers decide what they choose to see and hear. The Information and Technology (IT) Act 2000 of India and its amendment in 2022, is silent on the subject of accessibility for persons with disabilities. During the times of the Covid-19 pandemic, where human interaction has become, limited and is often not even a possibility, the failure of technology resulted in increasing isolation and marginalization, and in a few cases, even a breakdown of the system for persons with disabilities in terms of education. However, the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) guidelines, which have been ratified by the Govt. of India, in 2007 of which Article 9.2 (g) & (h) lay down that, states should facilitate access for persons with disabilities for education, for new information and communication technologies, especially the Internet. In fact the Rights of Persons with Disabilities (RPwD) Act 2016, did insist that accessibility compliance is mandatory and applicable to both the public as well as private sectors in India. One of the aims of the National Assessment and Accreditation Council (NAAC) is to assess and accredit institutions of higher education in the country and lay special emphasis on upholding the quality of higher education in India. The websites of 211 Central and State Universities with 3.01 Cumulative Grade Point Average (CGPA) and above grade for NAAC accreditation were used for the present study. The study was undertaken on 3rd December 2022 to analyze the quality of the websites designed by these Universities (in India), both of the central as well as the state government.

Keywords: Accessibility, Websites, Universities, Higher Education, Communication Technology, Digital Inclusion.

Analyzing Italian Inclusive Education Practices in Relation to Universal Design for Learning Principles Silvio Pagliara^a, Marta Sanchez Utge^b, Gianmarco Bonavolontà^a, Antonello Mura^a

- ^aUniversità degli Studi di Cagliari, Italy
- ^bUniversità degli Studi di Roma "Foro Italico", Italy Paper in IOS Proceedings

[Track D | Room 50 | Thu 08/31 | 08:30-10:30]

Abstract: This study aims to investigate how teaching practices in the Italian inclusive education system align with the principles of Universal Design for Learning (UDL), which is aimed at providing access to education for all students, including those with disabilities. In line with Article 2 of the Convention on the Rights of Persons with Disabilities (CRPD), which requires states to promote Universal Design (UD) in all aspects of life, including education, this research examines the extent to which the Italian education system meets this requirement. The study involved teachers who participated in a course on inclusive education. The research was conducted in three phases, including the introduction of UDL, identification of teachers' perceptions and initial reactions to UDL, compilation of a questionnaire related to UDL checkpoints, and a focus group discussion on teachers' attitudes towards UDL and the use of information and communication technologies (ICTs) in the classroom. The analysis focused on the first UDL principle, "Provide Multiple Means of Representation," which emphasizes the need to present information in an accessible way to learners with disabilities. The findings revealed that despite not having previous training on UDL, teachers in the Italian inclusive education system use ICTs in their daily teaching practices to make knowledge accessible, which is in line with the UDL principles. However, the study also highlighted a lack of awareness and reflection on the use of ICTs in teaching, suggesting the need for specific training to enhance inclusive practices. This study contributes to the ongoing dialogue on inclusive education in Italy and highlights the importance of promoting UD principles in education to ensure that all learners, regardless of their abilities, have equal access to education. Furthermore, it underscores the significance of providing adequate training and support to teachers to facilitate inclusive practices and improve learning outcomes for all students. Keywords: Higher education, universal design, inclusion,

Reywords: Higher education, universal design, inclusio Italian educational system

I'm in Tales MOOC on Tangible User Interfaces and the UDL Model: a Case Study

Silvio Pagliara^{a,b}, Katerina Mavrou^c, Chrystalla

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 $[\mathsf{Track}\ \mathsf{D}\ |\ \mathsf{Room}\, 50\ |\ \mathsf{Thu}\ 08/31\ |\ 08:30\text{-}10:30]$

Abstract: This paper presents the design and implementation of a Massive Open Online Course (MOOC) developed on Universal Design for Learning (UDL) principles within the I'm in Tales Erasmus Project, focused on Tangible User Interfaces (TUIs) and their potential in enhancing storytelling for inclusive education. The MOOC aims to equip educators with the knowledge and skills necessary to design and implement TUIs in educational settings, promoting their understanding of TUIs as tools for creating accessible and engaging storytelling experiences for all learners. The course follows a self-paced and independent learning approach, incorporating active, contextual, social, and reflective learning methods. Preliminary evaluation results are discussed, and further evaluation methods are planned to assess the MOOC's impact on educators' understanding of TUIs and their potential for inclusive education. The use case presented illustrates the practical application of TUIs in universally designed learning experiences. The study concludes that the MOOC provides a valuable resource for educators and learners interested in TUIs and their role in enhancing inclusive education.

Keywords: MOOC, tangible interfaces, UDL, inclusive education

Sensitize and Qualify Teachers for Digital Accessibility

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^aBielefeld University, Faculty of Educational Science, Germany

^bBielefeld University, ZAB - Accessibility Services, Germany Read extended abstract page 244

[Track D | Room 50 | Thu 08/31 | 11:00-12:30]

Abstract: University teachers face new challenges, particularly in the context of digital teaching and learning. However, teachers often encounter obstacles in implementing digital accessibility in their teaching. One of the challenges is disproportionate additional time effort as well as technical and didactic compatibility issues. The SHUFFLE project aims to support teachers with their needs in designing accessible digital teaching concepts through a material package based on the concept of Universal Design for Learning. The package includes checklists, guides, and a knowledge database, which covers various aspects related to digital teaching – accessible to everyone. The checklists offer advice and assistance on technical and didactic requirements, and the guidelines provide detailed instructions for implementation. The knowledge database provides additional information on other aspects of making digital teaching accessible. The materials will be available in German and English under the Creative Commons license CCBY.

Keywords: digital accessibility, material packages, higher education, inclusion, universal design for learning

Accessibility and Universal Design in Higher Education Curricula: the Athena Project

<u>Maria Mouka</u>, Irene Hermosa-Ramírez^a, Reinhard Koutny^b, Carmen Lepsch^b, Anna Matamala^a, Katerina Mavrou^c, Eleni Theodorou^c, <u>Maria Mouka</u>^c

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^cEuropean University Cyprus, Department of Education Sciences, Cyprus

Read extended abstract page 246

[Track D | Room 50 | Thu 08/31 | 11:00-12:30]

Abstract: This contribution aims to present a research study (work in progress) conducted under the ATHENA project, examining if and how issues of accessibility are integrated in Higher Education curricula in various European Countries across disciplines of studies. Data collection includes publicly available curricula of higher education programmes in disciplines defined by the ISCED fields of education and training 2013 (ISCED-F 2013). A fixed number of 21 bachelor's master's curricula and syllabi are sampled in each participating country. Two methodological approaches are applied for collection and analysis of the data: corpus linguistics and thematic analysis. The findings of the study are anticipated to inform the development of a set of recommendations on how to incorporate accessibility and universal design into higher education curricula through focus groups with experts from the main areas of knowledge.

Keywords: Universal design, accessibility, higher education, university curricula, syllabi

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Assistive Technology and Inclusive Early Childhood Education

Chairs: Lorenzo Desideri^a, Silvio Pagliara^b ^aAIAS Bologna onlus, Italy ^bAusilioteca Mediterranea Onlus - GLIC Associate Board Member, Italy

The imperative of inclusive education in early years is a basic principle in all declarations and initiatives for children's rights. Though there are progress towards this, there are still too many young children that are excluded from pre-school. According to the UNESCO (2021) "early childhood services aim to provide for all children equally, but when the most vulnerable children are excluded or ignored, universal participation is unattainable" (p. 2). Diverse groups of children are prevented for accessing and/or equally participating in early childhood education due to various barriers. This exclusion and inequalities have been exacerbated during the COVID-19 pandemic, where access to resources, to digital education environments, to assistive technology and appropriate learning processes became even more distant for a great number of children around the world. At the same time, digital and technology enhanced education is gaining ground. European (e.g. EU Digital Education Action Plan 2021-2027; European Agency, 2022) and global (UNICEF, 2021) initiatives shifted interest in inclusive digital and accessible education, and underline the importance of assistive technology. Albeit the emphasis on the importance of early intervention and access to inclusive, quality early childhood education actors in gearing innovative and assistive technologies for equal access and participation in early years.

Drivers and Barriers for Use of Assistive Technology Among Children with Autism And/Or Intellectual Disabilities: Parents Perspective

Kristin Skeide Fuglerud^{a,b}, Tobba Therkildsen

Sudmann^c, Undine Knarvik^{c,d}, Zada Pajalic^e, Tone Øderud^f

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Read extended abstract page 248

 $[\mathsf{Track}\ \mathsf{D}\ |\ \mathsf{Room}\ 50\ |\ \mathsf{Thu}\ 08/31\ |\ 11:00\text{--}12:30]$

Abstract: The aim of this study was to detect drivers and barriers for use of assistive technology (AT) among children with autism spectrum disorder and/or intellectual disabilities. An online workshop with researchers and two parents produced the material. The main drivers for using AT are knowledge about its existence, its inherent possibilities, access and funding. Barriers are related to lack of information, accessibility, knowledge in schools, funding, poor user interface, and poor retail and maintenance service. The workshop co-created an online form which subsequently will be sent to other parents to address these issues further. The study highlights perspectives and aspects that are important to parents and encourages researchers and AT-designers to systematically include end-users in design and implementation.

Keywords: Participatory design, inclusive design, assistive technology, autism spectrum disorder (ASD) and/or intellectual disabilities (ID), social inclusion

Development of an Educational System for Blind Children Using VR Haptic Device

<u>Naoki Asakawa</u>^a, Yuko Shimomura^a, Hiroki Wada^b ^aKanazawa University, Advanced Manufacturing Technology Institute, Japan

^bKinjo College, Department of Art, Japan

Read extended abstract page 251

 $[\mathsf{Track}\ \mathsf{D}\ |\ \mathsf{Room}\ 50\ |\ \mathsf{Thu}\ 08/31\ |\ 11:00\text{--}12:30]$

Abstract: In education for the visually impaired, tactile perception education, which uses tactile sensation to learn shapes, etc., has become an important means of education. In this research, we propose tactile perception education using VR as a solution to these problems. By using virtual objects on VR as teaching materials for tactile perception education, we can solve the problems caused by using real objects, and a more flexible and wide-ranging education is possible. The purpose of this research is to construct a VR system that can be used in education for the visually impaired by creating an interface that enables tactile perception education.

Keywords: Visually impaired children, VR, Tactile education

Development of Orientation and Mobility Training System for Visually Impaired Children Using VR

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Paper in IOS Proceedings

 $[\mathsf{Track}\ \mathsf{D}\ |\ \mathsf{Room}\, 50\ |\ \mathsf{Thu}\ 08/31\ |\ 11:00\text{--}12:30]$

Abstract: Visually impaired children do Orientation and Mobility(O&M) training to acquire the abilities to walk alone with white cane. The abilities to walk alone are to discriminate sound sources, localize sound sources, recognizer sound motion or echoes, and form a mental map. A mental map is a map formed in the brain, and visually impaired people create a map mainly from sound information. Walking without sight is dangerous, so many assistants are needed during O&M training. However, due to the shortage of O&M specialists, the time which visually impaired children do O&M training is becoming shorter. Therefore, we developed an O&M training system on a map created in a Virtual Reality (VR) space to eliminate the danger and alarm which visually impaired children feel during O&M training, and to enable safe and secure O&M training with fewer assistants.

Keywords: Orientation and Mobility training, VR, VI children

The Design and Implementation of Technology Based Inclusive Classroom Activities in Inclusive Early Childhood Education and Care: a Pilot Study in Four European Countries

<u>Jo Daems</u>^a, <u>Tessa Delien</u>^a, Bert Bonroy^a, Hilde Pitteljon^b, Xanthipi Aristidou^c, Marianna Efstathiadou^c, Katerina Mavrou^c, Arianna Gherardini^d, Ilaria Valoti^d, Gordana Blagojevska^e, Kristijan Lazarev^e, Dance Todorovska^e

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Innovation Center, Italy

^eOpen the Windows, North Macedonia

Paper in IOS Proceedings

 $[\mathsf{Track} \ \mathsf{D} \ | \ \mathsf{Room} \, 50 \ | \ \mathsf{Thu} \ 08/31 \ | \ 15:00\text{--}16:30]$

Abstract: Access to inclusive and qualitative education on an equal basis is a clear right of every child, even from the very beginning in Early Childhood Education and Care (ECEC). However, inclusive education is often not possible without access to appropriate (assistive) technologies. Notwithstanding the opportunities of technology to enhance inclusion of all children, it is still limitedly integrated by educators and teachers into their curriculum. Therefore, the SKATE project aims in gearing innovative technology as resource for inclusive education. This study describes and evaluates the preparation, the design, the implementation, and the effects of technologybased classroom activities in inclusive ECEC. The classroom activities are developed and implemented by school teams of 14 preschools spread over four European (EU) countries. A total of 50 school team members participated in a SKATE Learning Programme. This resulted in more than 20 technology-based inclusive class activities, created by school teams together with technology experts. Across the four countries, approximately 330 pre-schoolers, with and without special educational needs (SEN), participated. At this moment, 13 school team members from four EU countries and 45 parents from two EU countries evaluated the technology-based inclusive classroom activities. Nearly all teachers agreed that the activity promoted the inclusion of all children. Teachers reported that most of the children enjoyed the activity. This was confirmed in the evaluation by the parents. Most parents had the impression that the activity was meaningful, joyful and inclusive for all children.

Keywords: Inclusion, Early Childhood Education and Care, Assistive Technology, Information and Communication Technology, technology-based inclusive classroom activities

Designing an Augmented Tactile Book: Designing a Multisensory Page

Yassine Fadlaoui, Dominique Archambault

Université Paris 8-Vincennes-Saint-Denis, CHArt Laboratory, France

Paper in IOS Proceedings [Track D | Room 50 | Thu 08/31 | 15:00-16:30]

Abstract: In the framework of the LTA project, focusing on leisure reading for children with visual impairment, we present a prototype of multisensory illustration that will be used as a model for future accessible tactile interactive books. This multisensory illustration is based on two approaches to illustrate the storytelling. The first approach consists in embodying the character's legs with the index and middle fingers in order for the user to imitate actions such as walking. The second approach is to offer interactions feedback according to the readers actions. The main goal of this multisensory illustration prototype is to test and evaluate a selection of interactions and their associated sensors. These interactions help visually impaired readers to identify the environment of the story. They also help to understand actions behind the verbs. Readers are engaged to produce actions such as touching and imitating with their fingers. These interactions are developed according to hypotheses based on the literature. This multisensory illustration prototype was tested with a panel of children. The results comfort the idea that these interactions are useful for them.

Keywords: multisensory illustration, visually impaired children, tactile book

'Touching' Stories: Towards the Development of Tangible User Interfaces Story-Building Authoring Tool for Inclusive Education

<u>Lorenzo Desideri</u>^a, Katerina Mavrou^b, Eliana Brunetti^c, Raffaele Di Fuccio^c, Silvio Pagliara^{d,e}, Maria Mouka^b, Giulia Mignardi^a, Riccardo Magni^d, Chrystalla Papademetri^b, Marianna Efstathiadou^b, Inge Piedfort^f, Vilma Ferrari^g, Silvia Mazzoni^h

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Paper in IOS Proceedings

[Track D | Room 50 | Thu 08/31 | 15:00-16:30]

Abstract: Tangible User Interfaces (hereafter, TUIs) are novel forms of human-computer interactions based on the physical manipulation of any kind of object/artifact. A great potential of TUIs technologies is the possibility to personalize objects and interaction between the user and the system. The high level of platform flexibility allows, for example, a multisensory approach, that is crucial for children that have sensory limitations and disabilities. This contribution aims at presenting and discussing the development of an authoring tool for creating TUI-supported activities for inclusive digital storytelling. The authoring tool is a product of collaboration and consultation with researchers and teachers involved in the ERASMUS+ project I'M IN TALES. A preliminary usability validation study using a mixed-method approach has been conducted involving 50 educators and assistive technology professionals. The results indicate an overall acceptance of the system. The feedback provided by the participants involved will be used for the future refinement of the tool.

Keywords: tangible user interfaces, education, inclusion, storytelling

Textbook'S Accessibility for Children with Dyspraxia and Visual Disability

<u>Léa Pacini</u>^{a,b}, Jérôme Dupire^a, Isabelle Barbet^a, Olivier Pons^a, Camille Guinaudeau^{c,d}, Vincent Mousseau^e, Céline Hudelot^e, Caroline Huron^{b,f} ^aCNAM, Cedric, France ^bUniversity Paris-Cité, Inserm, System Engineering and Evolution Dynamics, France ^cNII, CNRS, Japanese French Laboratory for Informatics, Japan ^dUniversity Paris-Saclay, France

^eUniversity Paris-Saclay, Centrale-Supélec, MICS, France ^fLearning Planet Institute, France

Read extended abstract page 253

[Track D | Room 50 | Thu 08/31 | 15:00-16:30]

Abstract: This paper introduces the beginning of our work to design accessible textbook's for children with disabilities, first with the understanding of transcription processes then with tests with end-users.

Training Program for Children with Severe Speech and Motor Disabilities Using Eye Control

Evgeniya Hristova^{a,b}, Maurice Grinberg^{a,b}

^aASSIST – Assistive Technology Foundation, Bulgaria ^bNew Bulgarian University, Department of Cognitive Science and Psychology, Bulgaria

Read extended abstract page 255

 $[\mathsf{Track}\ \mathsf{D}\ |\ \mathsf{Room}\ 50\ |\ \mathsf{Thu}\ 08/31\ |\ 15{:}00{-}16{:}30]$

Abstract: We present a methodology and a training program with a large set of interactive activities that allow the implementation of adapted and effective individual programs for developing basic cognitive and communication competences typically partially or completely missing in children with severe speech and motor disabilities. This target group presents particular challenges to professionals due to the combination of functional disabilities that make communication and learning almost impossible without the use of high-tech AT for augmentative and alternative communication (AAC) and for alternative computer access. A very important factor for children with motor and speech impairments is the limited or missing interactions with peers and the environment, dramatically low involvement in communication, and sometimes (e.g., in less developed countries) life at a single place (sometimes an apartment). The training program aims to level up the general knowledge and respective passive and active vocabulary with the typical ones and thus provide a basis for further cognitive development. The program is in Bulgarian but is sufficiently general to be implemented in other languages.

Keywords: Eye control, AAC, Educational program for children with CCN

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AT and Children's Rights

Chairs: Pedro Encarnação^a, Albert Cook^b, Angharad Beckett^c ^aUniversidade Católica Portuguesa, Portugal ^bUniversity of Alberta, United States of America ^cUniversity of Leeds, Great-Britain

The United Nations Convention on the Rights of Persons with Disabilities (CRPD), adopted in 2006, established the rights and fundamental freedoms of persons with disabilities. The CRPD is a benchmark document recognizing that persons with disabilities are persons with rights, able to make decisions about their own lives (even if requiring support to do so) and are active members of the society. CPRD Article 7 obliges States Parties to take all necessary measures to ensure that children with disabilities can enjoy the same human rights as any other child. This means that all of the rights enshrined in the Convention on the Rights of the Child (CRC) also apply to children with disabilities.

For many children with disabilities, enjoying the rights and fundamental freedoms set forth in the CRPD and CRC is only possible through the use of Assistive Technology (AT). For example, enjoyment of the right to play (CRPD Article 30, CRC Article 31) may require using a wheelchair to move within an accessible playground, with adapted equipment and a modified sand tool that enables playing with the sand while using the wheelchair. In order to exercise the right to freedom of expression and opinion (CRPD Article 7, CRC Article 12), an augmentative and alternative communication device incorporating the necessary vocabulary may be needed. From this perspective, Assistive Technology is a rights enabler.

The CRPD recognizes the importance of AT. Indeed, it sets forth a general obligation of signatories to undertake research, development and promote the availability of Assistive Technologies (Article 4). It also refers to the Assistive Technologies that may be required to ensure/realise the enjoyment of the enshrined rights in several of its articles. It may thus be argued that the CRPD also establishes the right to AT.

Typically, the route by which these AT rights enablers are acquired by children who need them is through the AT service delivery system. This system must also respect children's rights. For example, when assessing children for AT, the best interests of the child should be a primary consideration (CRPD Article 7, CRC Article 3) and children should be given the opportunity (and the means) to express their views freely (CRPD Article 7, CRC Article 12). A child-centred AT service delivery process should thus be followed.

Assessing the Outcomes of AT for Disabled Children/Adolescents. Is It Time for a New Approach?

Angharad E. Beckett^a, Mallika Khathuria^b ^aUniversity of Leeds, School of Sociology and Social Policy and Centre for Disability Studies, UK. ^bUniversity of Leeds, School of Law, UK.

Read extended abstract page 257

[Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: How do we measure outcomes of assistive technology as used by disabled children and adolescents? What does user-satisfaction mean for this age-group? What outcomes do young disabled people consider to be most important? We [a] consider existing assessment tools and suggest that there is potential for their refinement for use with disabled people in this age-range and [b] propose avenues for the development of new approaches. **Keywords:** Assistive Technology; Outcome Assessment; Evaluation; Methodologies; User-Centred; Co-production

A Case Study That Provides an Example of AAC Enabling Children's Rights

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^a UNICEF, Armenia
^b Armav Continuous Education Center, Armenia
Read extended abstract page 259
[Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: The UN Convention on the Rights of Persons with Disabilities (CRPD) recognizes the importance of access to assistive technology in several articles and urges states to ensure its availability. Implementing AAC at an early age is vital for children's interaction with others, learning, education, and participation in everyday activities. The paper is presenting a case study on how the availability and affordability of AAC system is enabling the realization of the rights of children with disabilities becoming a path towards achieving functional communication and better inclusion.

Keywords: augmentative and alternative communication (AAC), social inclusion, meaningful participation in edu-

cation, assistive technology

Developing Possibility-Focused Practices to Support Technology Related Transitions for Young People with Learning Disabilities

Jane Seale

The Open University, Faculty of Wellbeing, Education and Language Studies, Great-Britain

Read extended abstract page 261 [Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: The focus of this presentation is the support that young people with learning disabilities receive to use assistive technologies when they leave compulsory education. I will argue that support during and after the transition from compulsory education is important because we know that adults with learning disabilities are digitally excluded and that levels of digital inclusion are lower for adults with learning disabilities compared to other disabled and non-disabled groups [1,2,3]. Lacking access to assistive technologies when transitioning from compulsory education can reduce life opportunities such as finding employment [4,5].

Keywords: Learning disabilities, transition, support

The Right to Assistive Technology and Acccessible Instructional Materials for U.S. Students Does Not Consistently Translate Into Predictable Access and Effective Use

<u>Beth A. Mineo</u>^a, Katrina K. Morrison^b, Tania C. Cordero^b, Ronald I. Sibert^a

^aUniversity of Delaware, Center for Disabilities Studies, United States of America

^bUniversity of Delaware, Center for Research in Education & Social Policy, United States of America

Paper in IOS Proceedings

[Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: Students in the United States have federallyestablished rights regarding access to assistive technology (AT) devices and services, yet those rights are not consistently upheld for a variety of reasons acknowledged in the literature. We conducted a interview-based study with 48 education professionals, family members and students to analyze the facilitators and barriers that influence AT access for students in the State of Delaware. Study results were consistent with the extant literature, and revealed numerous violations of student rights guaranteed under U.S. special education law. Some barriers were attitudinal, yet most arose from the inadequacy of infrastructures: professionals lacked training, funding was inadequate or difficult to access and, in most areas, there was no definitive guidance relative to the processes that should be followed and how decisions regarding AT-related decisions regarding devices and services should be documented. Elements revealed to facilitate AT access and use were the availability of resources — highly-qualified personnel, time, training, funds, and access to devices — and persistence among educators and family members in pursuing AT solutions for students.

Keywords: Assistive technology, students with disabilities, access, school, barriers, facilitators

Personalized Assistive Technologies for Motor Impaired Students: a Case of Learning Process Mining

Shubhra Mishra, Amin Jalali, <u>Thomas Westin</u>, Paul Johannesson

Stockholm University, Department of Computer and Systems Sciences, Sweden

Paper in IOS Proceedings

[Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: Motor disability includes the lack of sensation, movement, or coordination, and Assistive Technologies (AT) can help overcome these challenges. Motor-disabled students need different ATs and configurations depending on courses and individual needs, and some solutions can be expensive. Some affordable AT has roots in gaming but can also be used for other purposes. However, there is little research on how they can be combined to define a personalized setting. Therefore, we performed a literature review to identify challenges and solutions to support students with motor disabilities in using information systems. The result defines a framework for identifying personalized settings. The usability of the result was demonstrated by performing a self-experimentation study of the first author, who has a motor disability. The results show its utility while learning process mining using the Graphical User Interface (GUI) and code-based tools. We identified challenges in using different User Interface (UI) elements, which can be used as a guideline for designers of process mining tools as well as other information systems to support diversity.

Keywords: assistive technologies, motor disability, underrepresented groups, process mining

Accessibility of AR/VR/XR

Chair: Gottfried Zimmermann *Stuttgart Media University, Germany*

A Systematic Literature Review of Accessibility Evaluation Methods for Augmented Reality Applications

Deogratias Shidende^{a,b}, Thomas Kessel^a, Anna

Treydte^b, Sabine Moebs^a

^aBaden-Württemberg Cooperative State University (DHBW), Germany ^bUniversity of Hohenheim, Germany

Paper in IOS Proceedings [Track D | Room 50 | Fri 09/01 | 08:30-10:30]

Abstract: Augmented reality is increasingly becoming significant in people's everyday life in different sectors. Particularly to users with disabilities, augmented reality can be an instructional tool and assistive technology, making it worth a vital tool for users with disabilities. For such an important tool, it is essential to understand how these applications are evaluated in order to improve their throughput and extend their accessibility. In that regard, a systematic literature review for peer-reviewed articles published between 2012 and 2022 was conducted to discover which methods, metrics, and tools/techniques researchers use during the accessibility evaluation of augmented reality applications. The PRISMA methodology allowed us to identify, screen, and include 60 articles from three databases. The finding shows that most researchers use task scenarios as the method, qualitative feedback as the metric, and questionnaire as a tool to collect data for accessibility evaluation. The conclusion and future studies are also discussed.

Keywords: Accessibility, Augmented Reality, Evaluation Methods

Disabled People'S Needs in Virtual Reality

Noémie Kempa, Isabelle Barbet, Jérôme Dupire CNAM, Cedric, France

Read extended abstract page 263

 $[\mathsf{Track} \ \mathsf{D} \ | \ \mathsf{Room} \, 50 \ | \ \mathsf{Fri} \ 09/01 \ | \ 11:00\text{-}12:15]$

Abstract: We designed an online survey in order to question disabled people about their needs in virtual reality. The results of this study will be presented at the conference and discussed in light of the current state of research on this topic.

Keywords: virtual reality, human centered design, users needs, disabilities

Re-Conceptualizing Disability Simulations: a Guided Strategies-Based Approach

Patricia Piskorek, Kathy-Ann Heitmeier, Verena Kersken, Gottfried Zimmermann Stuttgart Media University, Germany Read extended abstract page 265 [Track D | Room 50 | Fri 09/01 | 11:00-12:15]

Abstract: This paper examines approaches to developing disability simulations for the higher education context, that can help improve the design of learning materials for persons with disabilities. This research focuses on the use of: (i) guided, (ii) strategies-based; and (iii) task-based approaches to conceptualise simulations for a proposed platform for higher education teachers to have virtual encounters with students with disabilities.

Keywords: Digital Accessibility, Higher Education, Simulations

Making 360-Degree Interactive Content Less Inaccessible – Authoring Guidelines and Lessons Learned

<u>Gottfried Zimmermann</u>^a, David Derichs^b, Taija Votkin^b, Tomi Kauppinen^b

^aStuttgart Media University, Germany ^bAalto University, Finland

Read extended abstract page 268

[Track D | Room 50 | Fri 09/01 | 11:00-12:15]

Abstract: 360-degree immersive environments are increasingly employed for learning content at schools and Higher Education institutions. However, there is a lack of specific guidance for content authors on how to make 360-degree content accessible. In a quick heuristic study, we applied the "functional performance" criteria of EN 301 549 to 360-degree learning content in ThingLink.

As a result, we found issues with keyboard access, missing alternative texts for images and audio descriptions for videos, missing captions for videos, and some contrast issues. We present these findings and a new set of guidelines for ThingLink authors that we derived from the study. We conclude with lessons learned.

Keywords: 360-degree, accessibility, learning environment, LMS, ThingLink

The Use of Extended Reality (XR) in Rehabilitation for Patients with Acquired Brain Injury: a Scoping Review

Loes Bulle-Smid^a, Wouter Keuning^a, Renée Van Den Heuvel^b, Gido Hakvoort^a, Fenne Verhoeven^a, Ramon Daniëls^b, Marike Hettinga^a ^aWindesheim University of Applied Sciences, Research Group IT Innovations in Healthcare, The Netherlands ^bZuyd University of Applied Sciences, Research Centre Assistive Technology in Care, The Netherlands Paper in IOS Proceedings

[Track D | Room 50 | Fri 09/01 | 11:00-12:15]

Abstract: *Background:* Extended reality (XR) seems promising for rehabilitation for people with acquired brain injury in terms of reducing professional supervision, faster recovery, shorter hospital stays, and reduced expenses. Since there is no overview this scoping review describes how XR can be utilized in rehabilitation, particularly for people with acquired brain injury (ABI). *Methods:* The Arksey and O'Malley framework and PRISMA-ScR reporting guideline were followed. Studies between 2010 and May 2022 screened from healthcare as well as tech-

nical databases were imported in RAYYAN. Three researchers selected relevant articles in three rounds based on title, abstract and full text. Results: 75 articles were included in this scoping review. Most studies used VR as technology with therapy objectives in three main categories: cognitive, physical and diagnostic. The outcomes of the studies show potential and promising results of the use of XR, and enthusiasm with as well patients as professionals. A selection of four domains of the NASSS framework: condition, technology, value proposition and adopters were reported. Important lessons learned by the included studies are development of XR software, improvement of the hardware, improving feeling of safety and giving support to the patient, and support healthcare professionals for acceptance of XR. Discussion: the use of XR for people with ABI has potential and is promising but not common practice yet. Future research should focus on implementation factors with a diverse and inclusive patient group using service modelling.

Keywords: Extended reality, virtual reality, augmented reality, rehabilitation, acquired brain injury, service model, implementation, scoping review

Inclusion forum

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Policy sessions

Al to help people with disabilities on the labour market: opportunities and challenges

A session promoted by GAATO and OECD Confirmed speakers and panellists:

- Chloé Touzet, Lead researcher for OECD on Al and labour market accessibility
- Christine Hemphill, Managing Director of Open Inclusion, UK
- Bill Curtis-Davidson, Co-Director of the Partnership on Employment & Accessible Technology (PEAT), USA
- Klaus Miesenberger, Institut Integriert Studieren, University of Linz, Austria
- Lampros Stergiouslas, UNESCO Chair / Professor in AI & Data Science for Society at The Hague University of Applied Sciences, the Netherlands
- Chair: Luc De Witte, President of GAATO

[Inclusion Forum F | Room 3.01 | Wed 08/30 | 11:00-12:30]

Abstract: The road to work remains fraught with difficulties for people with disabilities and, if left unchecked, Al could further hinder labour market accessibility (e.g. through non-accessible innovations or biased algorithms). However, AI could also remove some of the barriers to employment faced by people with disabilities, notably through AI-powered assistive devices or AI-backed solutions improving the accessibility of mainstream systems. This session will discuss the main findings from an OECD report on the opportunities and challenges of using AI to foster labour marker accessibility, based on insights from Al innovators, users with disabilities, accessibility experts and policymakers. Discussants from OECD, GAATO, and other organisations will comment on the report and present their thoughts about how to make the best of AI to help people with disabilities access the labour market, as well as the role that governments can play.

Our Current Approach to Policy/Regulation is Not Working Well Enough. Time for Alternate Approach?

A Raising the Floor International / University of Maryland event

[Inclusion Forum F | Room 3.01 | Wed 08/30 | 14:00-16:00]

Abstract: Part of the Future of Interface series of work. Check out https://futureofinterface.org (an RTF/UMD project).

Open discussion on a new proposition for accessibility regulation.

The funding landscape for Digital AT in Europe

A session promoted by DATEurope Announced speakers:

- Christoph Jo. Müller
- Emma Smith
- Sabine Lobnig
- Siobhán Long

 $[{\sf Inclusion} ~{\sf Forum} ~{\sf F} ~|~ {\sf Room} ~ 3.01 ~|~ {\sf Wed} ~ 08/30 ~|~ 16:30\text{--}18:00]$

Abstract: This session outlines a methodology to address the question of "How are digital assistive technologies funded by European states?" and "Which systems are proving most effective in ensuring that persons with disabilities have access to the digital assistive technology they require?"

In seeking to understand the breadth and depth required, we build upon research (Banes 2016, DFI/Enable Ireland 2017, Thompson 2018), which stressed the vital role that assistive and accessible consumer technologies play in the lives of those with a disability, including access to education and employment and improving the quality of daily life.

Such technologies are increasingly built upon consumer technologies such as mobile phones, tablets and smartspeakers and include communication tools, low vision aids including magnification, navigation and guidance tools and access to mEducation, mHealth and a wide range of social, cultural and leisure activities.

Banes et al. (2019) highlighted funding models as a significant barrier to access to such devices and related products and services. Many funding channels were limited to technologies designed specifically for people with a disability and precluded mainstream devices which could be customised and enhanced for people with a disability. Information regarding such products and features was incorporated into the GSMA MISTT toolkit to promote access to social media and devices' accessibility features.

More recently, the need for change in this area has been raised with UN agencies including WHO, UNICEF and UNESCO in consultancy work related to AT capacity in low- and medium-income countries, access to AAC solutions and analysis of the life stories of people with a disability from across the globe.

To address these issues the session will outline data related to funding streams for Digital Assistive Technologies across Europe with an analysis of those approaches that are most effective. This will include:

 How are digital devices used by persons with disabilities (including consumer technologies) funded by the target states?

- How are additional hardware peripherals designed for use by persons with a disability funded by the target states?
- How are assistive software and apps for mobile and portable devices funded by the target states?
- What variations in funding and provision can be identified due to the context of use, such as health, education, social welfare (independent living)?

This should include whether there is any variation in funding as a result of other funding mechanisms or systems such as a charitable or philanthropic model, NGO's or direct payments such as that of the NDIS in Australia, the proposed AT Passport in Ireland and other funding mechanisms that provide for both dedicated devices and capacity to fund a combination of the technology platform and necessary software or peripherals. This may lead to identifying an integrated model of provision.

Towards WHO Global guidelines on the provision of assistive technology – journeying together

A session promoted the WHO, GAATO and GDIHubAnnounced speakers:

- Kylie Shae (WHO)
- Natasha Layton (GAATO)
- Victoria Austin (GDIHub)
- David Constantine (ISPO)

[Inclusion Forum F | Room 3.01 | Thu 08/31 | 08:30-10:30]

Abstract: In 2024 the World Health Organization (WHO) will begin development of Global guidelines on the provision of assistive technology. WHO guidelines contain evidence based recommendations for clinical practice or public health policy. Recommendations are designed to help end-users including service users, service providers and policy makers make informed decisions on whether, when and how to undertake specific actions. During this session, speakers from the World Health Organization (WHO), Global Alliance of Assistive Technology Organizations (GAATO) and Global Disability Innovation (GDI) Hub will describe the guideline development process, the potential impact Global guidelines on the provision of assistive technology may have, and share findings from an initial scoping review and consultations. Join us to hear how stakeholders can contribute, and for an opportunity to share your perspectives and hopes for the future Guidelines.

Building AT and AAC capacity in Eastern Europe and Central Asia

A session organised by AAATE and UNICEF Speakers:

- Nora Shabani, UNICEF ECARO
- Evert-Jan Hoogerwerf, UNICEF Consultant
- Maurice Grinberg, Assistfoundation, Bulgaria
- Hanna Usatenko, DyvoGra, Ukraine
- Alvard Poghosyan, UNICEF, Armenia
- Tone Øderud, AAATE

NB: other country representatives are invited.

[Inclusion Forum F | Room 3.01 | Thu 08/31 | 11:00-12:30]

Abstract: Increasingly countries in Eastern Europe and Central Asia are adopting policies that move away from a medical approach to disability towards a more social or human rights based approach. This involves also services for children with disabilities and their families. Early childhood intervention and inclusive education are often priority areas of intervention. AAC and AT play an important role in the development pathway of children with disabilities and capacity in providing tools to children that might benefit from them and user strategies plays a central role in making interventions aiming at inclusion and participation a success. The UNICEF office for Eastern Europe and Central Asia has developed a specific attention for AT and AAC capacity building and a framework has been developed to assess the state of the art in a country and to support the development of programmes aiming at making access to appropriate AT and proficient use a reality.

In this session we will look at that core features of the framework and discuss with key stakeholders the challenges in the different countries and how these could be addressed.

Towards a European Policy on person-centred digital technologies in integrated care

A session promoted by the AAATE, the SHAPES and SEURO consortiums, in collaboration with AIAS Bologna onlus Speakers:

- Evert-Jan Hoogerwerf, AIAS Bologna, The Shapes of Care
- Malcolm MacLachlan, Maynooth University and SHAPES project leader
- Julie Doyle, Dundalk Institute of Technology and SEURO consortium

Followed by a discussion with:

- Helianthe Kort, International Society for Gerontechnology, ISG
- Silvio Pagliara, Association for the Advancement of Assistive Technology in Europe, AAATE
- Ana Hannotte, European Association of Service Providers for Persons with Disabilities, EASPD
- Priscille Geiser, SHAPES Project Consultant
- Marco Manso, Edgineering, PT
- Dympna O'Sullivan, TU Dublin

[Inclusion Forum F | Room 3.01 | Thu 08/31 | 15:00-16:30]

Abstract: Increasingly trust is placed in technology to solve European challenges. A major one is the delivery of high-quality care to an ageing population in a sustainable way. Many efforts so far have met resistance among stakeholders or have to deal with different national care systems and cultures, including expectations from care receivers.

Although the European Union is active since many years in fostering technology in care, more could and should be done at policymaking level.

During the policy session we will present "The Shapes of Care", a document with recommendations, which was prepared by a European Think Tank on integrated care coordinated by the SHAPES project. It acknowledges the potential of person-centred technology to boost integrated care, but it also lists recommendations for policymakers that have the responsibility, and opportunity, to change the care landscape in Europe over the next decennia. We will discuss the document and its recommendations with a selected group of stakeholders and reflect on strategies to raise its impact.

Scaling innovations in AT

A session organised by the ZeroProject and GAATO Chairs:

- Wilfried Kainz, ZeroProject
- Luc de Witte, GAATO

Innovators:

- Sara Comai, Politecnico Milano
- Elodie Draperie, GiveVision
- Ibrahim Cherradi, Keynoa

Senior AT experts:

- Renzo Andrich, EASTIN
- Gregg Vanderheiden, Raising the Floor International
- Chapal Khasnabis, Senior Assistive Technology Advisor, Asian Development Bank

[Inclusion Forum F | Room 3.01 | Fri 09/01 | 08:30-10:30]

Abstract: Scaling innovations has become a buzz word recently, but very few startups and innovators are able to master this important step. In this session, we want to highlight what necessary requirements need to be obeyed, and we will present other crucial factors for success. One common trap is certainly a single focus on technology which ignores the rule of market economics. Therefore, a sound business plan has become an indispensable requirement. Successful innovators will tell their story and elaborate on key factors to reach customers and be commercially effective.

Moreover, the Zero Project will share some of its findings from their past and present research on technologies which benefit persons with disabilities.

The session is supported by GAATO who collaborates with the ZeroProject in scaling up innovations. The session will be an opportunity as well to present the ZeroProject/GAATO Sector report on Assistive Technologies.

The role of women in fostering equitable access to AT: key considerations in the context of service development, creative problem-solving, research and innovation

A session promoted by AAATE

A diverse panel of speakers will contribute to this session, and active audience participation is welcome. Speakers:

- Annalu Waller, University of Dundee
- Hanna Usatenko, AAC in Ukraine
- Natasha Layton, Monash University
- Nora Shabani, UNICEF
- Chair: Tone Øderud, Sintef
- Moderator: Siobhán Long, Enable Ireland

[Inclusion Forum F | Room 3.01 | Fri 09/01 | 11:00-12:15]

Abstract: Assistive Technology services and supports are developing at a different pace across the globe, influenced by economic, sociopolitical and legacy issue. Women have and continue to play a key role in defining and delivering AT services, as well as in guiding and informing the research agenda and in the development of innovative solutions. This session will explore the role of women and gender across a diverse range of contexts, reflecting on both the challenges and opportunities which women are addressing now, as well as considering those which need to be addressed in the future.

Educational sessions

Involving Users in AT Design: Sharing Failures – Unconference-Style

Karin Slegers^a, Fenne Verhoeven^b, Loes Bulle-Smid^b

^aZuyd University of Applied Sciences, research group

Assistive Technology in Care, The Netherlands

^bWindesheim University of Applied Sciences, research group IT-innovation in Healthcare, The Netherlands

[Inclusion Forum H | Room 3.03 | Thu 08/31 | 11:00-12:30]

Description/Abstract:

Based on the principles of unconferences, this session provides an open, relaxed atmosphere for participants to share experiences with involving users (e.g., clients and care professionals) in designing AT. Steering clear of a traditional lecture format, the content in this session is generated by the participants, embracing failure as a way of learning.

In small groups (cf. a World Café), participants are invited to 'confess' things they have done to involve users in the design process of new AT, that did not go according to plan. In current scientific practice, there is little room for sharing such failures. This is a pity, as knowing what does not work helps to prevent failures in the future. Rather than hiding failures, either epic or insignificant, this session offers an informal, constructive space for sharing and learning.

After confession, participants will collaboratively identify commonalities in the failures that were shared. This allows to understand possible causes which, in turn, helps to prevent similar failures in the future. The outcome, therefore, is a set of recommendations for preventing failures when involving users in designing AT.

Learning outcomes:

- Individual participants have gained knowledge about preventing failed approaches when involving users in AT design.
- Individual participants are inspired to apply the principles underlying this session's format (i.e. creating a relaxed atmosphere and encouraging people to share failures) to enable mutual learning in a constructive way in their own work.
- 3. The AT design community has a better understanding of causes of failures when involving users in AT design and concrete recommendations for preventing such failures.

Applying Accessibility Maturity Models to Measure the Accessibility of Organizations

Gottfried Zimmermann, Nadine Auer, Verena Kersken

Stuttgart Media University, Germany

[Inclusion Forum G | Room 3.02 | Fri 09/01 | 11:00-12:15]

Description/Abstract:

There have been a number of attempts on measuring the level of accessibility for organizations, assessing their structure, processes and products. A tool, that is increasingly used to measure and optimize processes in organizations in the last years is called "maturity model". A maturity model comprises a series of stages and describes a desired development path for a specific object. Maturity models found their way also into the areas of accessibility. Since 2005, there have been 25 maturity models for accessibility published, 6 of them targeting specifically higher education institutions (HEI). These maturity models not only differ in their target group, but also in their structure, the number of levels that can be achieved, and the indicators (also called "metrics"), which measure the accessibility of an organization. This Educational Session will focus on both: (1) sample accessibility maturity models that form systems of metrics, and (2) individual metrics and their relevance to accessibility of organizations. Session participants will get an introduction on existing maturity models in the field and will apply a first version of a sample accessibility maturity model for HEI hands-on. In a discussion, we will talk about our experiences with the sample maturity model as well as discuss the metrics used to measure accessibility.

Learning outcomes:

- 1. Describe structures and functions of maturity models
- 2. Identify existing accessibility maturity models
- 3. Identify candidate metrics for an accessibility maturity model for HEI
- 4. Apply a sample maturity model on the own organization
- 5. Discuss experiences of the application

Assistive Technologies for Older Adults to Age-in-Place; Gaining Knowledge About the Criteria

<u>Helianthe Kort</u>^a, Taiuani Raymundo^b, Mei Lan Fang^c, Kylie Shae^d

^aISG, The Netherlands

^bUniversidade Federal do Paraná, Brazil

^cUniversity of Dundee, Great-Britain

^dWorld Health Organization, Switzerland

[Inclusion Forum H | Room 3.03 | Fri 09/01 | 11:00-12:15]

Description/Abstract:

The utilization of various assistive technologies (AT) by older adults has become increasingly prevalent in facilitating the concept of ageing in place (AiP). These ATs can be employed to support both instrumental and digital daily activities, as well as social connectedness, within the constructs of "my home, my castle" or "comfortable living as long as possible". This workshop aims to delve into these two proposed constructs of AiP, allowing participants to identify and describe criteria that can be used to assess the safety and effectiveness of technology for active assisted living and aging in place. Such criteria may include acceptability, accessibility, integration, and appropriate use of the technology. The workshop is an integral activity within the WHO-ISG project on AT for ageing adults.

Learning outcomes:

1. Identify and describe the assistive technologies commonly used by older adults to support AiP.

- Define the criteria used to evaluate the safety and effectiveness of assistive technology products and devices for AiP, including factors such as usability, accessibility, and appropriateness.
- 3. Develop three recommendations for the assessment and selection of assistive technology for AiP, based on identified criteria and individual needs and preferences.
- Develop increased knowledge of the various AT available to support AiP, specifically for instrumental and digital daily activities, and social connectedness.
- Establish opportunities for networking and collaboration with other professionals and researchers interested in AT for aging adults, to share ideas and explore potential future collaborations.

The Wheelchair Skills Program: a 'Gold-Standard' for Assessment and Training

François Routhier, Krista Best

Université Laval, Department of rehabilitation, Center for interdisciplinary research in rehabilitation and social integration, Canada

[Inclusion Forum G | Room 3.02 | Wed 08/30 | 11:00-12:30]

Description/Abstract:

Provision of a wheelchair can facilitate mobility and social participation for individuals with mobility limitations. However, acquisition alone does not ensure safe and effective use. The Wheelchair Skills Program (WSP), an evidence-based program, comprises validated assessment tools (Wheelchair Skills Test (WST)) and an effective training program (Wheelchair Skills Training Program (WSTP)). Testing and training materials are available for manual and power wheelchair use and scooter use for people of all ages. The WSP resources can be used by anyone who has an interest in providing or learning about wheelchair or scooter use. The WSP resources (a training manual, objective and subjective tests) are freely accessible online at www.wheelchairskillsprogram.ca. The purpose of this workshop is to provide attendees with an overview of the WSP and foundational training in the standardized administration of the WST and WSTP.

Learning outcomes:

- 1. Describe the importance of the wheelchair in general and its use.
- 2. Describe a structured method of assessment and training to improve the skills of wheelchair users.
- 3. Select and retrieve the appropriate testing and training tools for a given wheelchair user.

Communication Aids: Beyond Face to Face Communication!

May Agius, Sharon Borg Schembri

ACTU, Agenzija Sapport, Malta

[Inclusion Forum G | Room 3.02 | Wed 08/30 | 14:00-16:00]

Description/Abstract:

High tech communication aids, in particular dedicated aids, have evolved to become more and more multifunctional offering the possibility of participation in society which goes beyond face to face expression. Such communication aids can play an important role in enabling users of augmentative and alternative communication (AAC) to participate in communication activities which may not be face to face, for example, through written emails, online communication using video, as well as social media apps which allow community with others through pictures and text. Furthermore, communication aids may also be utilised to support leisure activities including play and other computer activities, employment and education such that one device is used to meet the needs of a variety of activities which support participation in society. This session will explore how AAC assessment and intervention should consider prospective use of the communication aid for more than face to face communication from the outset using a Participation Model framework. Implications for both assessment and intervention will be discussed focusing on the client's present and prospective needs. Resources to support assessment and intervention will be presented.

Learning outcomes:

- Learn how communication aids can be used for other activities beyond face to face communication.
- 2. Learn how to consider other functions of communication aids in the assessment process.
- 3. Learn how to plan AAC service delivery for AAC users which focuses on more than face to face communication needs both at the current time and for future needs.

Digital Readiness for the Vocational Training of Persons with Intellectual Disabilities: a Story of Fortunate Consequences and Deliberations

Maria Mouka^{a,b}, Katerina Mavrou^a, Eleni Theodorou^a

^aEuropean University Cyprus, Cyprus

^bVocational Training Center MARGARITA, Greece

[Inclusion Forum H | Room 3.03 | Wed 08/30 | 14:00-16:00]

Description/Abstract:

Mobile technology is an integral part of the lifestyle and culture of contemporary life, with lifelong vocational training being a fundamental part of this evolution. Persons with intellectual disabilities are a key group of users whose needs are often overlooked in exploring the facets of this area.

In this workshop, we will explore the importance of communication soft skills for persons with intellectual disabilities when using mobile technology, in addition to the ability that these persons need to have, in order to make use of digital training materials. The above apply interestingly during the first stages of working at a recently acquired job placement. A case study will be presented, regarding a woman with intellectual disability. The case study will emphasise the vocational path that the person themselves has followed during the previous years, as well as some enabled changes in her behavior, both affected also by digital readiness developments. It will also emphasise relevant changes yielded in the supporting organisations and workers.

Learning outcomes:

- Have a deeper insight in current vocational training needs of persons with mild or medium intellectual disabilities, and how these can relate to their digital readiness (soft and hard skills of the persons);
- 2. Have increased their knowledge regarding approaches of services delivery in an NGO engaged in the vocational training of persons with intellectual disabilities, and the way that the organisation's digital readiness fundamentally influences these processes; and
- Appreciate the power of inevitable changes when enabling learning and digital readiness in involved contributors, regarding vocational training of persons with intellectual disabilities.

When Mainstream Technology Doesn't Meet the User's Needs!

Sharon Borg Schembri, May Agius ACTU, Agenzija Sapport, Malta [Inclusion Forum G | Room 3.02 | Wed 08/30 | 14:00-16:00]

Description/Abstract:

Due to advancements in the technological sector, there is an increased possibility that mainstream technology will meet the users of persons with disabilities. This session, however, is designed as a workshop to explore scenarios in which mainstream technology does not meet user needs. Case stories reflecting real life challenges will be presented which focus on 3 mains areas:

- Access to mainstream technology which for users with physical disabilities who require access methods which do not rely on touch or mouse e.g. switches and eye gaze
- Access to mainstream technology for users with intellectual disabilities
- Access to mainstream technology for users of minority langages

This presentation aims to focus on fostering awareness of the need for technology design to consider assistive technology principles from the outset.

Learning outcomes:

- 1. Be able to recognise the limitations of mainstream technology for person's with disability.
- 2. Learn about how mainstream technology can co-exist with AT to help a person with disability to participate independently in the activities they want.
- 3. Identify future avenues for research to address the limitations of current mainstream technology for persons with disability.

Training in Assistive Products: Introducing the World Health Organization's Innovative Online Open Access Training Resource to Grow the Global AT Workforce.

Emma Tebbutt, Kylie Shae, Irene Calvo

World Health Organization, Switzerland

[Inclusion Forum G | Room 3.02 | Wed 08/30 | 16:30-18:00]

Description/Abstract:

The World Health Organization (WHO) and UNICEF copublished the Global Report on Assistive Technology (Global Report) in 2022 which showed that there is a large, unmet need for assistive technology worldwide. Recommendation three of the Global Report is to: Enlarge, diversify, and improve human resource capacity. The Global Report suggests that reaching adequate personnel capacity at all levels (community/primary, secondary and tertiary) will demand a combination of AT specialists and generalists, as well as shifting roles of other professionals in task-shifting and task-sharing models.

In this interactive instructional course, WHO will introduce participants to Training in Assistive Products, a new WHO open access resource to support growing the global assistive technology workforce through increasing access to fitfor-purpose training.

Training in Assistive Products (TAP) aims to build capacity at community and primary health care level, to enable the workforce to recognise those who may benefit from assistive products, and to provide simple, priority assistive products safely and effectively. TAP is free and accessible to all.

TAP can also be used to deliver AT curriculum within pre-service education, such as nursing or occupational therapy degrees, or as continuing professional development for many health professionals who wish to add simple AT provision to their skillset. Participants will learn about TAP, it's features, functions and uses and will hear from people with experience of implementing TAP. Following this, participants will have the opportunity to interact with TAP, explore the suite of TAP resources, and ask questions.

Learning outcomes:

- Understand TAP: it's structure, content, blended learning approach, resources for country implemention, and different use cases
- 2. Have a TAP account and be familiar with how to navigate around the TAP website

Digital Skills Development to Support Independent Living - the Hands on Shafe Experience

Damon Berry, Fatima Badmos, Dympna O'Sullivan TU Dublin, ADAPT Research Centre, Ireland

[Inclusion Forum H | Room 3.03 | Wed 08/30 | 16:30-18:00]

Description/Abstract:

20 years ago the European Computer Driving Licence (ECDL) raised digital literacy related to desktop computing in many participating countries. ECDL focused on ICT skills needed for work. Today, digital literacy is not just important for work. It is an increasingly important life skill. The lack of digital skills can contribute to the digital divide. In the ERASMUS+ funded Hands-on SHAFE project, we have developed a set of learning resources for living independently in six European languages.

This one hour education session will outline the experience of researchers from TU Dublin who developed the Hands-on SHAFE web-based learning resource for raising digital literacy to support independent living. Our content has a particular focus on mobile technology, wearables and smart home technology. The presenter will provide an overview of the developed resources. In the second half of the session, the participants will be enabled to suggest topics that should be included. The workshop output will contribute towards development of an outline syllabus for digital literacy learning content for independent living.

Session outline

- PART 1 : Hands-on SHAFE (30 min), Dr. Damon Berry
 - □ Background: Digital Skills and the digital divide in ageing populations.
 - □ Introduction to the Hands-on SHAFE project
 - Reflection on Hands-on SHAFE "SMART" online digital skills content
 - National, regional and local contexts for digital skills training
- PART 2 : Brainstorming a broad syllabus for digital skills (30 min), Fatima Badmos

In this part of the session, the participants will be given an opportunity to suggest and prioritise topics that should be included in a digital skills training syllabus to support independent living.

Requirements and Design Principles for Co-Design Workshops Involving People with a Visual Impairment

<u>Bard Wartena</u>^{a,b}, Job Van t' Veer^a, Christiaan Pinkster^c ^aNHL-Stenden University of applied sciences, The Netherlands

^bUniversity of Technology Delft, The Netherlands ^cKoninklijke Visio, The Netherlands

[Inclusion Forum G | Room 3.02 | Thu 08/31 | 08:30-10:30]

Description/Abstract:

Co-design workshops can be used to involve people with visual impairments in the design process of assistive technology. These workshops bring together designers, researchers, and people with visual disabilities to develop and refine design concepts collaboratively. However, when designing with people with visual disabilities, it is important to use methods that take into account their specific needs and capabilities. Most design methods rely heavily on creative cooperation through visual affordances; this makes using them in co-design with people with visual disabilities a challenge. The project "Inclusive Innovation" focuses on finding requirements and design principles necessary to facilitate inclusive co-design through design methods.

The educational session will focus on sharing and distributing the knowledge gained during the project. Through a multitude of practices with different formats of co-design methods and workshops, design requirements and principles where found. With these project managers, educators and other professionals that work with people with visual impairments, can prepare and develop their own workshops project. During the session the first part will be a presentation on the requirements and design principles and how they were gathered. The second part will be on how to apply them in their own practices through a short workshop-format supported by a Canvas.

Learning outcomes:

- 1. Requirements and Design Principles for co-design workshops involving blind people with visual disabilities.
- The importance of individual needs and universal design principles in the design process of Assistive Technology for people with visual impairments.
- 3. How to ensure design methods and workshop materials are accessible for individuals with visual impairments.
- How to facilitate a shared mental model between participants through sensitizers and reflexivity by the facilitator.

How to Train People with Disabilities Across Europe to Provide Feedback on Web Accessibility Issues

Susanne Dirks^a, Lukas Baumann^a, Sergio Marin Zapata^b

^aTU Dortmund University, Germany

^bEuropean Blind Union, Belgium

[Inclusion Forum G | Room 3.02 | Thu 08/31 | 08:30-10:30]

Description/Abstract:

The Web Accessibility Directive (WAD) requires public sector bodies' websites and mobile apps to be accessible to all users and to document and monitor their accessibility. This includes a feedback mechanism to report barriers and request accessible information on content that has been published in a nonaccessible format. Reports from EU member states show that there is almost no feedback on still existing barriers. The UPowerWAD project funded by the Erasmus+ Programme aims to bridge that gap by raising awareness for accessibility issues and empowering and training people with disabilities to take active participation in the implementation of the WAD.

In this workshop, we will discuss and adopt a model curriculum on how to train people with disabilities to provide relevant and actionable feedback on web accessibility issues across Europe. This session is particularly focused on integrating national requirements and resources into the developed model curriculum.

The session will give an overview of goals of the UPower-WAD project, focusing on the presentation of the developed model curriculum. From there, we will discuss the adaptation of the curriculum to the needs of the different member states, and develop an idea on how to successfully implement a scaling up process.

The session will use a methodological combination of short presentations, round table talks and group discussions.

Learning outcomes:

- 1. Understand the feedback mechanism of the WAD
- 2. Understand the importance of the adaption of the model curriculum to the national requirements of the different

member states

3. Know strategies on how to scale up the model curriculum to their respective national requirements

How to Make Content Usable for People with Learning and Cognitive Disabilities

David Fazio

Helix Opportunity, United States of America

[Inclusion Forum G | Room 3.02 | Thu 08/31 | 11:00-12:30]

Description/Abstract:

W3C Invited Expert, David Fazio, will present the W3C Cognitive Accessibility and Learning Disabilities Task Force, Guide on How to Make Content Usable for People with Cognitive and Learning Disabilities.

More than 200 million people around the world, approximately 3% of the global population, have an intellectual disability, according to conservative estimates. That number is projected to increase to around 300 million by 2050. It is essential to the economy and to society that people with intellectual, and cognitive, disabilities stay as active as possible, and participate in society for as long as possible.

The current standards of web-based applications and other digital interfaces make ICT virtually impossible to use for many people with only a mild cognitive decline, let alone more severe cases of cognitive disability. That means more and more people are dependent on caregivers for things that they should be able to do themselves. That increases the crippling cost of care and reduces human dignity. People who cannot use these interfaces will have an increased feeling of disability and isolation, as they are alienated from society.

Given the extraordinary amount of time human beings spend interacting with the web, and ICT, in this day and age, design is having major, potentially catastrophic, consequences on the wellbeing of all users in society. This session serves as a crash course in cognitive accessibility, and how these newly proposed success criteria provide accessibility to these user groups.

The W3C COGA Task Force Guide on How To Make Content Usable for People with Cognitive and Learning Disabilities was developed to address many of these issues.

Cognitive Accessibility Design Workshop

David Fazio

Helix Opportunity, United States of America

[Inclusion Forum G | Room 3.02 | Thu 08/31 | 15:00-16:30]

Description/Abstract:

The W3C COGA Task Force Invited Expert, David Fazio will co-create website wireframes that comply with the Task Force's How To Make Content Usable For People With Cognitive and Learning Disabilities Guide. We will demonstrate these principles, in practice, together.

Service Modelling for AT: Principles, Tools, and Practical Value

Fenne Verhoeven^a, Karin Slegers^b, Loes Bulle-Smid^a

^aWindesheim University of Applied Sciences, research group IT-innovation in Healthcare, The Netherlands

^bZuyd University of Applied Sciences, research group

Assistive Technology in Care, The Netherlands

[Inclusion Forum H | Room 3.03 | Thu 08/31 | 15:00-16:30]

Description/Abstract:

AT can play a significant role in transferring healthcare (e.g., physical and occupational therapy) from rehabilitation clinic

to home. Despite the large number of scientific publications and commercial AT-applications, uptake in daily practice lags behind. This might be caused by a focus on technological development processes, not (enough) considering insights in how both professionals and patients will experience AT in daily work practice/ life.

Service model design might contribute to creating durable AT-implementation strategies. A service model, often presented graphically, shows the interplay between service model design, technical development and business modelling. In this session, we will:

- 1. Show the principles of service modelling illustrated by our own XR-for-rehabilitation-cases;
- Facilitate participants in small groups to work with one service modelling-tool (e.g., fill in a service blue print based on pre-formulated personas) regarding rehabilitation care in the home situation by XR;
- 3. Plenary reflect on (a) the practical application of service modelling and (b) barriers and facilitators for AT for rehabilitation.

Learning outcomes:

- 1. Individual participants will know what the service modelling-approach and accompanying tools imply and can determine their value for their own daily work practice;
- Participants know which barriers and facilitators prevail (on top of mind) among the AT community towards structural implementation of AT for rehabilitation (from clinic to home).

Challenges for Assistive Technologies That Target Older Adults: Using Examples From AAL Funded Projects.

Andreea Stamate, Cosmina Paul

Ana Aslan International Foundation, Romania

[Inclusion Forum G | Room 3.02 | Fri 09/01 | 08:30-10:30]

Description/Abstract:

The World Health Organisation predicts that 1 in 6 people will be aged 60 years or over by 2030 (World Health Organisation, 2022). Many older adults have, or may face as they advance in age, complex health needs. Needs which require that they, or various medical staff, routinely travel to access, or deliver health services. The public sectors' financial constraints, together with the current economic downturn are leading to increasing financial pressures which require that healthcare and social-care service providers identify alternative, more efficient, delivery models (Currie et al., 2015). Assistive Technology (AT) can be an effective tool to tackle some of these issues. AT has many advantages, in terms of accessibility, richness of measurement, and cost (Germine et al., 2018), still this technology is at an early stage and faces several challenges. In this lecture we will focus on AT that use digital assessment to monitor users from a cognitive and physical perspective. Tools that use digital assessment should have several important characteristics, including, but not limited to: leaving the construct of the measurement unchanged; uncover and measure behaviour not otherwise obtainable; the behaviour/s they uncover should be used to operationally define neurocognitive constructs (Libon et al., 2021). Proper piloting and research of digital assessments tools is also extremely important, however, this is at times treated lightly. This session will address the opportunities and barriers of this type of technology and share some of our experiences relating to their development and field testing, using examples from AAL projects that we have implemented and the literature. Participants will engage in discussion on how to assess the value of existing solutions and on how develop proposals, and improve methodology, for

new solutions that aim to monitor older adults remotely using digital devices.

Learning outcomes:

- 1. Think critically about the advantages and disadvantages of using AT to monitor older adults remotely;
- Understand the importance of utilising sound methodology within the assessment process to measure AT effectiveness;
- 3. Identify strategies for successful implementation and adoption of AT targeting older adults.

Advancing Social Inclusion through Technology and Empowerment (A-Step) Cost Action Ca19104

<u>Geraldine Leader</u>^a, Zeynep Şahin Timar^b, Özge Mısırlı^c, Merita Hoxha^d, Carla Sousa^e, Silvio Pagliara^f, Branislav Gerazov^g, Cecília Sik Lanyi^h, Şebnem Çakır^a

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^dAleksandër Xhuvani University, Albania

^eLusófona University, Portugal

^fGLIC, Italy

^gSt Cyril and Methodius University of Skopje, North Macedonia

^hUniversity of Pannonia, Hungary

[Inclusion Forum H | Room 3.03 | Fri 09/01 | 08:30-10:30]

Description/Abstract:

Social inclusion is an important element of well-being for people with Autism Spectrum Disorder (ASD) and/or Intellectual Disability (ID). Research has highlighted that social inclusion is facilitated through access to education and employment. Despite this, people with ASD and/or ID have low rates of participation in these domains. Research has demonstrated that Assistive Technology (AT) shows great promise in increasing participation in education and employment. Notwithstanding recent technological advances, there are low rates of adoption of AT throughout Europe by service providers, educators, employers and policymakers. There are several areas of unmet need including: high abandonment rates of AT, lack of inclusion of people with ASD and/or ID in the research process, lack of interdisciplinary and intersectoral collaboration and poor match between technology and the individual with ASD and/or ID. a-STEP has built an interdisciplinary, intersectoral pan EU and beyond consortium which will enhance social inclusion of individuals with ASD and/or ID. a-STEP is Evaluating the development of novel AT by providing an interdisciplinary and intersectoral collaboration between all stakeholders using a translational approach to establish standardised practice guidelines for design, development and deployment of AT. a-STEP is also Creating knowledge, by providing a database of current AT technologies and their match to employment and educational contexts for users with ASD and/or ID. Finally, a-STEP is Promoting the adoption of evidence-based guidelines in relation to use of AT across settings and populations and propagating the use of inclusive design and rigorous research approaches. During this session a-STEP Workgroup leaders will present their findings.

Learning outcomes: Learn about the a-STEP COST action, it's aims, activities, working groups, deliverables and grants.

Seuro Tools Workshop: Co-Creating Digital Organisational Assessment Tool to Support the Transferability of Digital Health Innovations in Practice.

<u>Cristian Leorin</u>^a, Filipa Teixeira^b, John Dinsmore^b ^aAIAS Bologna, Italy

^bTrinity College Dublin, Ireland

[Inclusion Forum G | Room 3.02 | Fri 09/01 | 08:30-10:30]

Description/Abstract:

The SEURO (Scaling EUROpean citizen driven transferable and transformative digital integrated health and social care) project is exploring the optimisation and transferability of digital health solutions across the European Union by developing two different digital self-assessment tools: the ProTransfer (to evaluate the readiness of local/regional organisations to transfer or adopt a digital health solution in their specific organisational context) and the ProBCF-C (a digital checklist of key actions to consider in the design, development, evaluation and commercialisation of any digital health behaviour change intervention [DHBCI]). By recognising that designing innovations for real-world applications requires considering the variability of organisational contexts in terms of structure, culture and stakeholder make-up, this workshop intends to collect feedback from participants, in a role game activity, co-creating and informing the next phase of the development of these two tools.

Learning outcomes:

- 1. Recognise and explain the importance of implementing self-assessment tools within an organisation dealing with digital health solutions, especially targeting older people with multiple chronic conditions.
- 2. Participate in a co-design approach of a self-assessment tool.
- Discuss the importance of building a sustainability plan for digital health interventions for chronic disease (including multimorbidity outside in real world practice.
- 4. Understand requirements for delivering sustainable, scalable and transferable digital health solutions in practice.

Innovation Area sessions

Wheelchair Convex Seat

Daniel S. U. Tamashiro University of Sao Paulo Medical School General Hospital, IMREA-HCFMUSP, Brazil

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 11:00-12:30]

Description:

Maintaining a proper sitting posture in a wheelchair is essential for the user's overall health and well-being. A good sitting posture provides stability for tasks involving motor and visual control, reduces the pressure on the joints of the lower limbs, and minimizes hydrostatic pressure in the circulation of the lower limbs. On the other hand, a bad posture while sitting in a wheelchair can cause discomfort, pain, pressure ulcers, breathing difficulties, postural deformities, swelling in the legs, and may even lead to device abandonment. Therefore, it is crucial to ensure that the user maintains a good posture while sitting in a wheelchair.

We have developed a lightweight and cost-effective convex seat for wheelchairs to help maintain a healthy seated posture. The unique design of the seat ensures an even surface by eliminating the bowing or hammocking effect of the cushion, providing a flat and stable seating area. This seat insert allows for proper weight distribution, which helps to improve the overall positioning of the user in the wheelchair. Traditional sling seating often leads to poor positioning, causing discomfort and longterm issues such as internal rotation of lower extremities, sacral sitting, posterior pelvic tilt, and obliquity of the pelvis.

Assistive Technology on Demand Extension to Morphic, a Free and Open-Source Utility

Gregg Vanderheiden

Raising the Floor-International, Switzerland

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 11:00-12:30]

Description:

Morphic is an open-source utility that was released last year and is now in distribution and installed on over 7000 computers in major universities and library systems in the US.

AT-on-Demand was released in January and is in test deployments at universities in the US. AT-on-Demand is a small, free, open-source utility installed on computers, coupled with a set of AT installation packages on a nearby server. It was developed by nonprofit organization Raising the Floor, in collaboration with partners internationally. When a user logs into a computer Morphic with AT-on-Demand retrieves their AT requirements and settings from a secure, encrypted vault. Morphic w/AToD installs their AT (if it is not already on the computer) and then applies all of the user's personal and accessibility settings. When the user is done using the computer, the AT is automatically removed. With AT-on-Demand, AT users can, for the first time, have the ability to use all of the same computers, in all of the same locations as their peers – providing a new level of digital equity not possible before – and allowing them to better compete and succeed in education, work, and daily living situations. And it is free to individuals and institutions, and in deployment in the US now.

Remotely Operated Portable, Telescopic, Cantilevered Hoist for Patient on Powerchair

Hervé Pierre Dutrenit

Curtin University, Australia

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 14:00-16:00]

Description:

FIELD OF THE RESEARCH

This invention is a portable, telescopic patient hoist fitted onto the powerchair of a quadriplegic or elderly patient. The presentation is about the patent AU2016206312 and the possibility of remote control from mobile phone, tablets or computer.

BACKGROUND OF THE INVENTION:

Currently medical hoists are used with cumbersome long legs. The long, bulky legs prevent patients from carrying the hoist anywhere they go. Moreover, with the latter invention, clearance is compulsory between the ground and the object where the patient is to be set down. This restricts patients' possibility of where and when to be hoisted off the chair. This implies that in case of commuting or travel with the chair hoisting is not possible. The other limitation is when a person wants to be hoisted into a pool or into a boat. This problem happens with the current hoists available on the market. It is impossible to be hoisted if there is no ground under where the patient needs to be lifted or set down.

Methods:

The design is made of aluminium 6061-T6, 6083 to offer yield strength of 241 MPa for a density of 2.7 . This allows a low weight design, facilitating retrofit to existing chairs without requiring upgrade to Powerchair motors. By comparison, 316 Stainless steel has a Yield strength of 310 MPa for a density of 7.9. The telescopic poles are made of Acme Lead screws that enable a 9,000 N Load.

The whole hoist and power chair compound is rated for a patient weighing up to 200 kg. With the telescopic hoist, the patient can be hoisted anywhere, anytime. This Telescopic hoist is retrofitted directly onto the chair of the patient and is very compact when it is folded. This enables him/her to travel normally on planes, public transport or cars which have already been fitted with a powerchair docking station. The patient may also utilise public restrooms whenever required, regardless of the location.

Before a patient needs to be lifted, she/he presses the controls from his/her adapted HMI and the telescopic hoist deploys itself. (Video of the telescopic hoist will be presented at the conference). https://youtu.be/kClTfJE-EVO In operation, the remote technology can be used. It consists of a cloud web application hosted in a NodeJS runtime environment. This technology does not require any download of proprietary application. Connection to the hoist happens via Chrome, Safari or any other browser. This provides compatibility and versatility across platforms and devices such as mobile phones, tablets, desktop workstations, notebook or laptop, etc.

The family or carer who wants to control the hoist remotely just needs to have credentials to log in and get control of the hoist and talk to the patient via Video Chat using Web RTC protocol. Hoist Control buttons are also embedded in the Video chat and enable Left, Right, Up and Down movements of the patient on the hoist. For extra safety the hoist possesses an embedded camera and a 5 G access point that enables control from the device of a third Party. This ensures that family or Carer can monitor that all operations are going safely. To further improve safety, Computer Vision with an AI algorithm could be utilised to detect anomalies and provide automatic protection to the patient. This is currently being investigated for potential improvement of the hoist.

FINDINGS SUMMARY:

- The telescopic hoist broadens the possibilities of the patient to travel independently.
- With the remote control, the carer of family can assist the patient anywhere at any time.
- This increases human interactions for the patient with the community through an extended scope of activities.

CONCLUSION:

The telescopic patient hoist is a breakthrough in the extra possibilities that the patient has for getting hoisted anywhere. At the moment a carer is still required in case something is not working. Future developments with addition of computer vision with AI will enable increased independence without compromising patient safety.

Standardising Hardware Accessibility: the Proteus Controller

Brandon Blacoe

ByoWave, Ireland

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 14:00-16:00]

Description:

ByoWave is a company which is dedicated to developing solutions that give everyone bespoke access to the digital world, and the first step on that mission is the Proteus

Controller, a mass-manufactured, modular adaptive video game controller kit, designed using universal design principles, with an accessibility-first approach. The Proteus Controller allows users to easily build their controllers in a way that best suits their needs. With our technology, the user can use a single kit to build over 100M controller combinations. Each kit comes with everything you need to play straight out of the box. The kit consists of body modules which lock together and make up the shape of your controller, and peripheral buttons, handles and plugs which snap on magnetically allowing you to snap and play. The Proteus Controller can be taken apart and reconfigured over and over, so you can try different combos, or have configurations for different games. By open-sourcing the connection mechanism of the device, users can also 3D print custom parts for their configurations. Given its modularity, the Proteus Controller can also be used as a tool to define the minimum standards that hardware must meet. Input devices are the gateway to accessing the digital world, but the lack of a hardware accessibility standard is a major issue in the hardware development space. Technology is advancing in a way that allows the mass manufacturing of customised solutions which can lead the way to help define a minimum standard in hardware accessibility.

Immersive & Inclusive Online Learning Management System

David Fazio

Helix Opportunity, United States of America

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 14:00-16:00]

Description:

The Helix Opportunity Institute is an Angular Java Script application with a Moodle backend. It was designed to provide a rich, and robust, immersive, online, digital, education experience. It is fully inclusive, and accessible both from a user experience and online learning perspective, and in administrative functionality. Our unique design provides the option to incorporate embedded audio to provide contextual information, synchronized with text, for every screen, and interactive element, throughout the application. Our application has been carefully crafted to resemble an actual university experience. The home, landing, page is laid out as an actual campus, with the learning content compartmentalized into subject matter by school buildings.

The versatility and affordable scalability provided by Helix Opportunity Institute's Moodle integrated platform is matched, given the flexibility of our core architecture. We have chosen a custom Moodle integration because of its world-renowned acclaim of ease of use. Trainees, admins, and instructors all find it a straightforward system to work with, with intuitive features such as dragand-drop organization tools. This platform employs neuropsychological design, and cognitive accessibility best practices.

Assistive Technologies for Kids with Special Needs

Valerio Sperati^a, Lisa Jacquey^b

^aCNR, Institute of Cognitive Sciences and Technologies, Italy ^bLearning Planet Institute, France [Inclusion Forum E | Room 3.08 | Wed 08/30 | 16:30-18:00]

Description:

The researchers will present the 3 technological tools developed, as experimental prototypes, in the European project "IM-TWIN: "from Intrinsic Motivations to Transitional Wearable INtelligent companions for autism spectrum disorder" (https://im-twin.eu/):

- Transitional Wearable Companions: soft, interactive, "smart toys", to stimulate the social interaction in kids with special needs, aged in 36-60 months; the prototypes of Panda PlusMe and Octopus X-8 will be shown.
- Camera glasses: sensorised glasses for therapists, to detect and measure – through AI algorithms – the eye contact between child and caregiver;
- Sensorised T-shirt: a t-shirt for kids aged in 36-60 months, to measure the heart rate and the electrodermal activity.

Multi-Intensity Lower Limb Training with Optimized Neurorehabilitation Using Functional Electrical Stimulation (Milton - Fes)

Daniel S. U. Tamashiro

University of Sao Paulo Medical School General Hospital, IMREA-HCFMUSP, Brazil

[Inclusion Forum E | Room 3.08 | Wed 08/30 | 16:30-18:00]

Description:

The MILTON system is a highly effective solution for individuals with neurological impairments looking to achieve their therapeutic goals through multi-intensity lower limb training with functional electrical stimulation. Specifically designed for patients with a complete spinal cord injury at the cervical or high thoracic level, MILTON incorporates an exercise bike (ergometer) that integrates functional electrical stimulation (FES) with task-specific or motor assistance/resistance activities to optimize therapeutic outcomes. The acronym MILTON stands for "Multi-Intensity Lower Limb Training with Optimized Neurorehabilitation using Functional Electrical Stimulation on an Ergometer."

By utilizing functional electrical stimulation in the cycle ergometer, MILTON produces sequential contractions of the lower limb muscles, reproducing the pedaling motion of the bike. This coordinated stimulation method enables patients to experience an adaptive response with training, allowing them to gradually increase their resistance to the pedaling motion and improve their cardiovascular conditioning. One of the primary benefits of the MILTON system is its ability to combat physical inactivity and muscle atrophy in individuals with spinal cord injury, leading to better cardiovascular health. The system's proprietary software provides real-time biofeedback and data tracking, optimizing training and helping patients achieve their therapeutic goals. Its sophisticated control algorithms are designed specifically for a wide range of neurological impairments, providing customized training that can adapt to each patient's unique needs. The MIL-TON system also features a motivational extended reality graphical interface tablet, designed to keep patients engaged and motivated throughout their training.

Additionally, the MILTON system can be attached to a multiparameter monitor to collect vital health information during the exercise, including heart rate, oxygen saturation levels, arterial pressure, and temperature. By collecting this data during training sessions, healthcare professionals can gain valuable insights into how the patient's body is responding to the therapy and adjust training plans accordingly. Monitoring vital signs during training sessions is particularly important for individuals with neurological impairments, as they may be at a higher risk for complications such as autonomic dysreflexia. With the ability to monitor vital signs in real-time, healthcare professionals can quickly identify any potential issues and take appropriate action to prevent complications.

Finally, the MILTON system includes a web platform that enables healthcare professionals to monitor and record patient activities and exercises remotely. This feature provides important insights into patient progress, allowing clinicians to adjust training plans and optimize outcomes. Overall, the MILTON system is a comprehensive and sophisticated solution for multi-intensity lower limb training with functional electrical stimulation, designed to help individuals with neurological impairments achieve their therapeutic goals and improve their quality of life. With its innovative approach, proprietary software, and vital sign monitoring capabilities, the MILTON system provides safe and effective therapy that is customized to each patient's unique needs.

Steering-by-Leaning: a Novel Principle for Motion Control in Manual Wheelchairs

Reto Togni, Stefan Villiger

ETH Zürich, Laboratory for Movement Biomechanics, Switzerland

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 08:30-10:30]

Description:

In manual wheelchairs, every change or adjustment of direction is associated with one-handed braking which results in energy loss and the need for re-acceleration. Directional control therefore significantly contributes to the physiological energy cost of wheelchair propulsion, is hazardous to users' health and has been described as frustrating. With "steering-by-leaning", we aim to remove these adverse conditions. With such a system engaged, the orientation of the front wheels and hence of the direction of travel is controlled by a laterally tilting backrest and users are allowed to steer wheelchair movement by leaning into curves. Equally, straightforward movement is maintained by sitting upright, also when moving along tilted surfaces such as pavements where conventional wheelchairs tend to veer off. The results are improved energy efficiency and easy one-handed propulsion, all while offering intuitive motion control to wheelchair users across a surprisingly broad functional spectrum.

Keynoa Assistive Technologies - Seeing with the Fingers

Ibrahim Cherradi

Keynoa, Austria

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 08:30-10:30]

Description:

Keynoa is a new Assistive Technologies Platform designed specifically for blind and visually impaired individuals, empowering them by offering effective solutions that support their education, inclusion, and accessibility. Keynoa introduces the innovative concept of "Seeing With The Fingers". By producing gentle vibrations on the fingers it allows the users to:

- read digital text in any language,
- feel objects and evaluate their distance,
- read maps and other pedagogic graphic images,
- sense colors, etc.

With Keynoa, the users can also write digital text in any language by producing finger taps simply and naturally. Keynoa consists of hardware and software tools based on the following elements:

1. Keynoa Method

Based on the Cherradi method, Keynoa assigns simple finger combinations to digital information, like language characters, RGB colours, distance ranges, and more.

2. Keynoa Rings

Keynoa Rings is hand wearable device that consist of five finger rings and an arm-watch-controller, which communicate with a smartphone via Bluetooth. Keynoa Rings uses Keynoa Method to:

- convert digital information into vibrations on the fingers, and
- convert finger-taps to digital characters
- 3. Keynoa App

Keynoa App is a mobile application that works in tandem with Keynoa Rings via Bluetooth connection, enabling users to perform various "Seeing With The Fingers" functions such as:

- write text in any language by finger taps,
- select and transmit digital text for reading with vibrations on the fingers,
- select maps and scientific graphics to "see" their content elements,
- feel the colours of the smartphone screen,
- feel objects at distance ranging from centimetres to meters.

The development of Keynoa is complete but necessary commercial certifications are pending before its release to the market.

Tech Innovation for Arm Mobility

Dorothée Petroff, <u>Mona Jamois</u> ORTHOPUS, France

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 08:30-10:30]

Description:

ORTHOPUS is the first hardware company in the healthcare sector that combines a strong social objective with high tech expertise. Promoting fair and open healthcare, ORTHOPUS defends access to innovative technologies at the service of the human gesture. The company wishes indeed to participate in improving access to assistive technology globally through:

- co-design with users, their families and caregivers
- transparency and fair pricing

- healthcare professionals' training (webinars, tutorials, etc)
- sensitization and documentation to help users in procedures and fitting process
- communication of knowledge about technology to support devices' acceptance

Based in Nantes (France), the startup was founded in 2019 by David Gouaillier, PhD in robotics and expert in motion engineering.

FIRST PRODUCT: AN ASSISTIVE DEVICE FOR ARM MOBILITY

The ORTHOPUS Supporter is the first product part of the ORTHOPUS' range of robotic assistive devices adaptable to all types of upper limb disabilities. This new innovative robotic arm device lightens the arm to support motions, including 2 modes: a STATIONARY mode locking at the chosen height, and a FREE mode accompanying the movements. To facilitate the acceptance of the device for users, the ORTHOPUS Supporter comprises customizable elements.

Key features:

- for children from 7 years old and adults
- compensation strength adjustable from 0 to 4 kg
- 4 different sizes of arm brace
- installed on an electric wheelchair or on a table

This ORTHOPUS Supporter is suitable for people living with limited arm mobility: muscular dystrophy, spinal amyotrophy, spinal cord trauma, arms / shoulders pain, etc. The ORTHOPUS Supporter meets a lack of solutions between mechanicals devices and more sophisticated electrical devices for arm mobility. Developed in 2021-22, the ORTHOPUS Supporter is already available in France and soon in the Netherlands. This is a Class I medical device and a CE certified product since 02/09/2022.

Flex Picture eBook: Inclusive Children's Literature Made Easy.

Valentín Salinas-López

Johannes Kepler University, Linz, Austria

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 08:30-10:30]

Description:

Flex Picture eBook project aims to promote literacy and inclusivity in teaching by creating a concept of accessible and highly customisable illustrated eBooks, suitable for all children, including those with visual, cognitive, and learning disabilities. This project offers a concept and guidelines for the creation of eBooks that allow teachers to easily customise to suit the individual needs of each child. The functionalities have been improved based on feedback from teachers and social inclusion organisations from Austria, France, Italy, and Lithuania. It has also been tested in inclusive classrooms with children of different abilities. This project is designed to increase inclusion in literacy by making it easier to publish multi-modal literature for children that can be used at home and in inclusive classrooms. The development of the project has been supported by the Erasmus+ program of the European Union and has the potential to be adopted by all publishers of children's literature.

Wheelchair Controlled by Head Motion Interaction

<u>Mario Covarrubias</u>

Politecnico di Milano, Italy

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 11:00-12:30]

Description:

Electric wheelchairs are designed to aid paraplegics. Unfortunately, these cannot be used by persons with higher degree of impairment, such as quadriplegics, i.e. persons that, due to age or illness, cannot move any of the body parts, except of the head. Target of this project is to develop a solution able to move the wheelchair by the movement of the head. With an accelerometer which is placed on a cap, which is worn by the patient, it's possible to obtain the head motion recognition. By means of the accelerometer data processing, stepper motors are controlled in order to move the joystick of an electric wheelchairs.

Bridge: Non-Intrusive Indoor Monitoring System for Frail Persons

<u>Sara Comai</u>

Politecnico di Milano, Italy

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 11:00-12:30]

Description:

The advancing ageing of the population has long been a known issue. Maintaining a state of mutual tranquility between family/caregivers and person, and preventing cognitive deterioration through active and independent ageing, are some of the objectives related to keeping the elderly population at home. Technology is the compensatory tool to achieve these goals. The BRIDGe system implements the paradigms of behavioural monitoring and mutual tranquility through the identification, without using either wearable devices or cameras and in real time, of the status of the person, his/her movements in the apartment, the occupancy of rooms and, through a set of spatio-temporal rules, of critical situations (alerts and alarms). Furthermore, through the transformation of information into knowledge, some of the ADLs (e.g. breakfast, personal hygiene, meals, etc.) are inferred. Furthermore, through a set of proprietary machine learning algorithms, BRIDGe identifies one or more behavioral drifts with respect to a base line; the algorithms are unsupervised.

Bridge uses wireless sensors to allow easy installation in any environment. BRIDGe is modular and can be integrated with telemedicine solutions. The BRIDGe system also includes a contactless sensor for the bed (detecting the presence and estimating the heartbeat and respiratory rhythm, essential for night-time tranquility) and one or more buttons for requesting attention from the person. The BRIDGe interface is an APP (Android) that allows one or more caregivers to have an immediate view of all the useful information and receive notifications.

BRIDGe is TRL-9. BRIDGe is the result of a research born in 2007 in the context of the relations between the Politecnico di Milano – Como campus – and the social cooperatives of the area. BRIDGe is marketed by the innovative start-up Lyotech (2021), a spin-off of the Politecnico di Milano. BRIDGe is available for both B2B and B2C market.

Developing an Affordable and Lightweight Vibro-Tactile Stimulation Device for Prosthetic Use

Daniel S. U. Tamashiro

University of Sao Paulo Medical School General Hospital, IMREA-HCFMUSP, Brazil

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 11:00-12:30]

Description:

Amputation involves the removal of a limb, whether partially or completely, due to a range of causes such as illness or injury. In Brazil, amputation rates have been steadily increasing, with over 50,000 cases recorded in 2011, and lower limb amputations accounting for more than 80 % of them.

Individuals with lower limb amputations face difficulties in maintaining balance and stability while walking, and depending on the extent and type of amputation, may experience functional impairments like an altered gait pattern or an increased risk of falls. To tackle these issues, we have developed an affordable and lightweight vibrotactile stimulation device that can aid in the rehabilitation of lower limb amputees. This device provides sensory support for prosthetic use, boosting patients' confidence and security while walking.

By incorporating biofeedback techniques in gait training rehabilitation, we aim to enhance the quality of life of individuals with lower limb amputations. Research has shown that biofeedback, which provides sensory feedback to the brain during movement, can help improve walking patterns and reduce the likelihood of falls. The use of vibrotactile sensory biofeedback is anticipated to result in substantial enhancements in gait performance.

Development of a Functional and Durable Prosthetic Foot for Low Income Countries

Justin Z. Laferrier

Johnson and Wales University, Physical Therapy Department, United States of America

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 15:00-16:30]

Description:

Major advances in research and development as it pertains prosthetic feet have increased the quality of life for many individuals with amputations in the last decade. However, a negative aspect of these advancements is that the majority of end users are not able to benefit from these advances in technology. While these prosthetics are technologically impressive and work well for the small number of individuals, they fail to meet the needs of the majority of amputees worldwide. More than 80% of the world's amputee population reside in low resource countries. Approximately 95% of these individuals do not have access to prosthetics. Research is needed in this area to promote the design and development of a cost-effective prosthetic foot that meets economic, environmental, cultural, and physical standards including durability, local availability, simple repair, local production, lightweight, biomechanically appropriate, and structural integrity in adverse climates and working conditions.

We have developed and preliminarily tested four prosthetic foot designs and have determined an optimal design of a prosthetic foot that fits our design criteria. The design criteria include low-cost (about \$9 USD), load variable (able to support and function at +/-100 pounds from the designed weight), durable (able to withstand environmental stresses found in developing countries) and the ability to store and return energy throughout variable loads (200 % energy return). The prosthetic is made from Delrin, which is a low-cost thermoplastic that can be used in injection molding, which is an inexpensive manufacturing method. The prosthetic also includes a natural rubber insert, which will allow the foot to be load variable and able to store and return energy. This foot will imitate the natural gait cycle and provide enough energy storage and return to make walking more biomechanically acceptable. The optimal design of this prosthetic foot will allow amputees from low resource countries to continue to work, which will include walking considerable distances over rough terrains and carrying varying degrees of heavy loads. The materials (Delrin and natural rubber) and manufacturing method (injection molding) are both available in developing countries, so the prosthetic can be made on site, which will also reduce cost by eliminating shipping fees.

Social and Job Inclusion Platform for Young Students with Disabilities through VR and Ar Technologies.

Mario Covarrubias

Politecnico di Milano, Italy

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 15:00-16:30]

Description:

Social Inclusion is an important element of well-being for young students with ASD and/or Intellectual Disability (ID). Previous studies have highlighted that social inclusion is facilitated through access to education and employment. Despite this, young students with ASD and/or ID have low rates of participation in these domains, after the high school. Research has also shown that Assistive Technology (VR/AR) shows great promise in increasing participation in education and employment. The main aim of The Haptic Eye project is to create an interdisciplinary, international network which will enhance social inclusion and empowerment of young students (19 to 24 years old) with Autism Spectrum Disorder (ASD) and/or Intellectual Disability (ID) using the Assistive Technology approach through the use of VR/AR applications the students receive training session regarding the use of specific devices (e.g. 3D printers, manual and CNC mills, manual and CNC lathes, etc.) in order to increase their manual skills.

Low Vision Headset for Watching Sports & Cultural Events

Elodie Draperi

GiveVision, France

[Inclusion Forum E | Room 3.08 | Thu 08/31 | 15:00-16:30]

Description:

GiveVision has built a solution called GiveVision Live on their existing IP portfolio in wearable vision aid systems.

Last year, they adapted their technology for watching sports and cultural events. It allows partially sighted spectators to actually follow live events in real-time and significantly improves their experience on site.

2 million people in the UK are visually impaired (VI), that's about 1 out of 30. However, according to the Football Association only 1 in 3000 stadium tickets are purchased by people with sight loss. The disparity is unsurprising, considering that the only accessibility provision for the VI at stadiums is audio commentary narrated via a set of radio headphones. Since there is no ability to see the game, very few partially sighted sports fans actually come to live games. This is why GiveVision has adjusted its wearable low vision aid to be optimised for this use case: watching live events. GiveVision aims to set a new "accessibility standard" for sports and cultural venues. The team is working with different partners in the UK and France to install its equipment permanently or temporarily. The tests organised have shown promising results regarding performance and user satisfaction. Their ambition is to provide this solution during the Olympics and Paralympics.

A Tool for Physical Exercise and Orofacial Rehabilitation at Home for Older Adults

María José Santofimia Romero, Xavier Del Toro García University of Castilla-La Mancha, Spain

[Inclusion Forum E | Room 3.08 | Fri 09/01 | 08:30-10:30]

Description:

Performing physical rehabilitation exercises is very commonly prescribed to a wide variety of individuals to recover from an injury or just to address the degenerative effects of time that lead to conditions such as frailty. Furthermore, physical inactivity is pointed out as one of the main risk factors underlying the most prevalent chronic conditions. Nonetheless, attending supervised rehabilitation sessions is unfeasible to many patients due to the economic cost it entails, time constraints, or just the lack of health centres nearby providing such services. The alternative is to perform such exercises at home, in an unsupervised manner. These exercises are normally prescribed on a paper sheet or leaflet or, in the best case, with a list of videos. Still, this approach presents a very low rate of adherence, and it provides no information to the specialist supervising the rehabilitation process. The Phyx.io software presented here is a system that supports at-home physical rehabilitation, enhanced with real-time monitoring. Exercises for orofacial rehabilitation and improvement of joint range of motion are provided. The system is described here is experimentally validated under the work carried out in SHAPES Pilot Theme 6.

Smart Blankets

Federico Pacini

University of Pisa, Italy

[Inclusion Forum E | Room 3.08 | Fri 09/01 | 08:30-10:30]

Description:

Nowadays, a consistently large number of people suffer from impairments, such as people with Cerebral Palsy,

Muscular Dystrophy, etc., and this number is continuously growing due to the aging of the population. For some disorders, freedom of movement gets worse and worse. Daily actions taken for granted by most people can be difficult for others. One of them is lifting blankets on the bed. Thinking about people not able to move their upper limbs, it is impossible for them to perform such action. The possibility of performing such actions in an autonomous way gives individuals a remarkable physical and psychological sense of well-being and a relief also for caregivers. Assuming the user is still able to produce utterances, the idea is to realize a kit which allows the blankets to follow the willingness of the user. The system is enabled after an utterance is mapped to a valid command. A moving system brings the blanket to the desired position and adjusts its proximity to the user.

Walking Simulator Used Swivel Chair for Blind Children

Yuko Shimomura

Kanazawa University, Advanced Manufacturing Technology Institute, Japan

[Inclusion Forum E | Room 3.08 | Fri 09/01 | 08:30-10:30]

Description:

We are building a walking practice system for blind children. In order for blind children to walk alone, they need to be able to create a mental map in their mind. То develop this ability, we constructed a system in which a blind child walks on a road in VR. In reality, the blind child sits on a swivel chair and only moves his/her legs. However, since the blind child walks on various roads in VR, the blind child's ability to create a mental map improves. This way, the blind child is safe and only one support person is needed. The system configuration is as follows. As input/output devices, MetaQuest2 and a microswitch for judging footsteps were used. The simulation system was built with the game engine Unity. Environmental sounds were output using the stereophonic SDK. White canes and Braille blocks were also used in VR to inform the user of the surrounding environment through sound and vibration. We believe it is also important for children to practice walking while having fun.

Digiacademy: an Accessible Digital Education Platform

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[Inclusion Forum E | Room 3.08 | Fri 09/01 | 08:30-10:30]

Description:

DigiAcademy is an accessible digital skills e-learning video platform co created with and for people with accessibility needs to address the challenge of digital literacy and access to ensure better health, well-being and inclusion outcomes: Digi-Academy.

The programme was designed to push the co-creation process to an optimum level, through support and coaching to enable our Citizen Advisory Panel (CAP) members with intellectual disability to become DigiAcademy teachers. This demonstrates the power and potential of people with intellectual disability to be the 'face' and 'voice' of our accessible education programme. DigiAcademy accessible digital skills education programme is comprised of short video tutorials on priority topics identified during the focus groups, delivered by our CAP members. Also inviting audience to give it a go with us and test together the new supporter side.

Smart Mirrors as a Tool for Social Inclusion of Older Adults

<u>María José Santofimia Romero</u>, Oscar Aceña, Javier Dorado Chaparro, Cristina Bolaños Peño, Henry Llumiguano Solano, Jesús Fernández-Bermejo Ruiz *University of Castilla-La Mancha, Spain*

[Inclusion Forum E | Room 3.08 | Fri 09/01 | 11:00-12:15]

Description:

Loneliness and isolation, either real or perceived, are among the most leading factors to mental health problems, such as depression. The COVID-19 outbreak brought about a mandatory social distancing and isolation that had lead to severe psychosocial consequences, such as late-life depression [1]. Online communication stood up as a valuable mechanism for preserving mental health, specially among older adults [2]. Nevertheless, access to online communication was not an option for an important part of the population with low technology literacy. It is a fact that, despite the potential benefits that technology has for older adults, they are very reluctant to embrace new technologies [3].

Video calls are one of these technologies that could help mitigating loneliness and isolation, especially for those older adults living alone. Moreover, this is also an important resource for accessing health care services remotely. This has many benefits, especially for those living in rural areas where such services are not provided or those that have limited mobility and depend on other people for accessing such services. Nonetheless, the access to such services is not a trivial or simple procedure for an important part of the older adult population due to aspects such as: limited digital skills, low confidence, and scarce experience in the use of technology [4].

There are currently different platforms for video call or remote communication. Most of these platforms can be run on different type of devices such as telephones, tablets, or PCs. This means that different interaction mechanisms are supported, such as touch screens, mouses, keyboards, or even voice commands. Furthermore, different operating systems, therefore, different interaction mechanisms are also considered. These platforms also introduce, very often, new developments and functions which make it more complex for older adults to efficiently use such tools.

There is therefore a compelling need to identify the main drawback or challenges that older adults have to face in order to make an effective use of video calls so that the can benefits from all the advantages that new technologies bring when it comes to ease and enable remote communication.

This analysis should start from the factors already identified as determinant for the use and adoption of new

technologies, as the ones identified by Lee and Coughlin [5] from there, the focus will be addressed to identify the barriers and enablers found in the literature for the specific application of video calls [4][6][7]. Based on this analysis, the videocall solution presented here will be compared with the identified barriers and enablers.

The video call solution presented here has been specifically designed for an older adult audience. The interaction mechanisms have been minimized and touchscreen or navigation through user interfaces are avoided, although available. Furthermore, this solution is implemented over the Telegram network so, on the other end of the communication, only the Telegram application is required. This solution is deployed on a smart mirror platform that include an RFID reader as a basic element for the communication. In this sense, RFID cards, bands or keyrings are used to hold the required information to launch a call. The only interaction mechanism required by the user is that of approach the RFID tag to the reader, embedded in the mirror.

This article presents the overall architecture designed under the SHAPES project[1] (Smart and Healthy Ageing through People Engaging in Supportive Systems), intended to simplify the process for older adults to use video call services both, as a meant to tackle loneliness and isolation and as a way to contact with health care services. In this case, the video call service has been embedded in a tool for at-home physical rehabilitation. This tool includes the functionality for contact the physiotherapist. This work describes the architecture of the calling service and its integration into a smart mirror platform.

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Smart Mirrors: the Definitive Enabler for Active and Healthy Ageing

María José Santofimia Romero

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[Inclusion Forum E | Room 3.08 | Fri 09/01 | 11:00-12:15]

Description:

The smart mirror we will presenting is a hardware device equipped with different interacting interfaces such as touch screen, RFID reader, communications, speakers, or video and voice input devices. This platform is equipped with a set of services which, among the most relevant ones include: video call service, physical and cognitive exercises, reminders, data collector without requiring user intervention from smart bands, digital scales, fall detectors, smart home appliances, etc.

Appendix

Extended Abstracts

Oral Only Contributions
Design and development of assistive technologies for the ageing population: a systematic literature review

Jing Forrest^a*, Alexandre De Masi^a, Katarzyna Wac^a, Mirana Randriambelonoro^b

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Abstract

Systematic literature review of papers published between 2012 and early 2022, to explore the potential of assistive technologies for supporting the ageing population, to understand the context and the ecosystem in which these technologies have been designed and developed, and to identify the challenges that need to be addressed in hope to promote the widespread Assistive Technologies (AT) usages.

Keywords

assistive technologies, AT, ageing population, seniors, older adults, design and development, challenges, guidelines

Context

The world's population is ageing rapidly. It is estimated that people over the age of 65 will account for 16% of the world's population by 2050[1].

Ageing is often associated with a decline in physical and cognitive abilities, leading to increased dependency and reduced quality of life. As the number of older adults increases, there will be an increasing societal and economic need to provide support systems to help older adults maintain their independence and quality of life.

In recent years, technology has become an increasingly important tool in addressing the challenges of ageing.

Assistive Technologies (AT), in particular, have the potential to help older adults live more independently and comfortably by providing them with a range of services and support. From wearable devices to smart homes and robotic assistants, the potential of AT to improve the quality of life of older adults is vast [2, 3].

However, the widespread adoption of AT among older adults remains a challenge. Cost, complexity, accessibility, acceptance, adoption, and digital literacy are some of the main challenges that must be addressed to order to facilitate the uptake and use of these technologies [4].

There is also gaps and limitations in understanding how to design and develop AT tailored specifically for the ageing population [5].

Methodology

We conducted a systematic literature review of papers published between 2012 and early 2022 which explore the potential for AT to support the ageing population. The aim of this literature review is to understand the context and the ecosystem in which these technologies have been designed and developed, and to identify the challenges that need to be addressed in order to promote widespread use of AT for the ageing population.

From an initial selection of 2274 publications, 113 have been included in this review. We provide an overview of the current landscape of assistive technologies and examine the different stages of AT design and implementation.

Based on the WHO's Assistive Products grouping and Quality of Life (QoL) Assessment, we organized the literature review into six basic Human Functioning areas and four QoL Domains. Furthermore, we provided a summary of our review focusing on three categories of assistive technology (AT) products

By organizing the literature review based on these comprehensive frameworks and categories, we aimed to provide a holistic understanding of how assistive technologies and interventions can enhance human functioning, improve quality of life, and support individuals in their daily activities and overall well-being.

Results and Discussion

Our review provided a comprehensive examination of the impact of assistive technologies on diverse user groups, while also delving into the attitudes and perspectives of the ageing population. This holistic approach aimed to contribute to the development of assistive technologies that are more inclusive, user-friendly, and tailored to the unique needs of different user groups.

Based on our analysis of the literature, we have formulated evidence-based recommendations which should be fo-

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cused on improving the usability, accessibility, and effectiveness of assistive technologies to better meet the unique needs of older adults. By incorporating these recommendations into the design and development processes of any AT, the overall quality of life for seniors who rely on these technologies can be enhanced.

Some key recommendations:

- (a) User-Centered Design Approach: Actively engaging seniors in the design process. This ensures that their perspectives, preferences, and needs are taken into account throughout the development stages.
- (b) Simplicity and Ease of Use: Design AT with simplicity and ease of use in mind. Seniors often have varying levels of technological familiarity, so it is important to create intuitive interfaces, clear instructions, and minimize complexity to facilitate easy adoption and utilization.
- (c) Accessibility Considerations: Ensure that assistive technologies are accessible to seniors with different abilities. Incorporate features such as voice recognition software with more sensitive to different voices, speech patterns, or accents.
- (d) Personalization: Seniors have diverse preferences and needs, so offering adjustable settings and adaptable features allows them to tailor the technology to their specific requirements.
- (e) Training and Support: seniors often require ongoing training and support for using assistive technologies. They would need easily accessible help resources in understanding and effectively utilizing the technology.
- (f) Social and Emotional Considerations: Address social and emotional aspects in the design of assistive technologies. Foster social connections and reduce feelings of isolation by incorporating features that facilitate communication, social networking, and access to support networks.
- (g) Continuous Iterative Improvement: Regularly gather feedback from seniors and iterate on the design based on their experiences and suggestions. This iterative process helps to identify and address usability issues and further refine the technology to better suit the needs of seniors.

By incorporating these evidence-based recommendations into the design and development of assistive technologies for

seniors, we can ensure that assistive technologies meet the unique needs of seniors and enhance their quality of life.

Conclusion

This review offers valuable knowledge for various stakeholders involved in the field of assistive technologies for seniors. It provides insights that can benefit researchers and academics interested in the design, development, and evaluation of such technologies.

Healthcare professionals and caregivers who work with seniors will also find valuable information to enhance their care and support.

Policymakers and funding agencies responsible for shaping healthcare and social policies can utilize the findings to inform their decision-making processes.

Technology companies and startups in the assistive technology industry can gain valuable insights to guide their product development strategies.

Lastly, seniors and their families, as the primary users and beneficiaries of assistive technologies, will find this review helpful in making informed decisions regarding adoption and utilization.

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Assistive Technology in the assessment of loneliness in the elderly

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Abstract

The analysis of loneliness and social isolation is a relevant topic in public health policies. In recent years, an increasing number of studies have been carried out addressing the nature and extent of this phenomenon in different social groups. This paper describes an interdisciplinary project being carried out with the participation of anthropologists and computer engineers in a rural locality in Extremadura, Spain. In this context, the research began with ethnographic fieldwork to understand the meanings, experiences and social representations of loneliness.

Keywords

loneliness, assistive technology, ageing people

Assistive technology in the assessment of loneliness

The analysis of loneliness and social isolation is an increasingly relevant topic in public health policies and health management. In recent years, an increasing number of studies have been carried out addressing the nature and extent of this phenomenon in different social groups. Most of these studies are based on quantitative approaches, using questionnaires and standardized scales, which offer a description of this reality limited to mere arithmetic. However, the social sciences have begun to highlight criticisms of the limitations of these approaches, which are incapable of describing a complex and diverse experience for different population groups. Others have focused on the review and adaptation of the measurement instruments used [1, 2]. However, this kind of approach fails to grasp the nature of the experience of loneliness in its entirety-since this is grounded on social, political, emotional, and cultural underpinnings that can prove elusive and difficult to quantify [3, 4, 5].

This paper describes the interdisciplinary project being carried out with the participation of anthropologists and computer engineers in a rural locality in Extremadura, Spain. The rural demography of these localities is marked by aging, depopulation and progressive social isolation of the population. The location has been selected on the basis of a number of socio-demographic indicators: that is, a total population under 300; more than 40% of its population being 65 years or over; a 10% decrease in population size over the last decade; a birth rate lower than 5%; or a population density around 10 inhabitants per square kilometer.

In this context, the research began with ethnographic fieldwork to understand the meanings, experiences and social representations of loneliness, working on a more complex and comprehensive definition of loneliness in cultural terms. Based on the results, a two-fold technologyassisted objective has been defined: 1) Diagnosis of isolation and collection of data from social surveys; 2) Development of technological solutions in the home environment to combat loneliness. For the first objective, the study examines data collected through technological devices on a number of variables related to loneliness and social isolation-that is, mobility and social interaction. This technology-based methodology provides an interesting, pioneering approach to research on the issue of loneliness, as well as on the different ways in which data can be acquired and presented. We use smart bands, smartphone app and Bluetooth sensors placed in the spaces of socialization defined by the social researchers

This approach provide information on the presence of people in different spaces-the ways in which people move around, where they spend their days, and how long they spend with other people on a daily basis. Technological devices also allow us to create displays tracing "maps of loneliness" numerical compilations of meetings and the locations where they take place-a "cartography of loneliness." To track social interactions in public spaces, Bluetooth sensors are used. When paired with smartbands, Bluetooth sensors will be able to detect study participants as they pass by. This will allow us to create maps of people's movements, providing a better understanding of social interactions in public spaces, as well as each individual's social participation. Bluetooth sensors could be installed in public spaces such as the village square, bars, shops, hair salons, or health centres.

This type of data will serve to compare those produced in the ethnographic research, which delimits loneliness in social, cultural, class or gender terms, as well as the

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social practices that are distinctive in the creation of the feeling of loneliness.

Second, this paper describes the possibilities that interdisciplinary research offers in delineating solutions or strategies for coping with loneliness. From the analysis of the discourses of people who feel lonely -the causes they describe, their coping strategies- a person-centered approach to technological assistance in relation to their sociocultural context is offered. Technology is seen here as the tool that serves to connect in daily routines: eating processes, leisure practices, or interaction contexts. A preview of the design of technologically assisted households to deal with loneliness from a cultural perspective in these rural areas is offered in this communication.

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Aging Positively: Enhancing Positive Emotions in Older Adults through Natural and Social Experiences in Immersive Virtual Reality

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Abstract

Recently, immersive technologies such as Virtual Reality (VR) have become believable candidates for enhancing individuals' well-being. However, there are several barriers to using VR to improve well-being, including design, and the availability of diverse video content. Thus, our study aimed to investigate the impact of immersion and virtual environment content (natural vs. social) on different age groups, as there is limited research on this aspect. 38 undergraduates and 25 older adults were recruited for the present study. They watched and rated 360° videos of natural and social contents under a highly immersive Head-mounted display (HMD) and a less immersive screen, while their skin conductance and heart rate were collected. Overall, preliminary findings suggest that while video content matters and leads to specific emotional responses in younger adults, older users reported high levels of positive emotions and arousal throughout most immersive experiences. As these are encouraging results VR for fostering positive emotions in elderly users, potential applications for a "successful aging" or vulnerable users will be discussed.

Keywords

Aging, Virtual Reality, Positive Emotions, Physiological responses

Context

Positive emotions are known to have long-term benefits on people's health, quality of life, and overall well-being [1]. Therefore, there are clear benefits to promoting positive experiences and emotions, especially among vulnerable and/or isolated adults. Recently, technologies have become believable candidates for enhancing individuals' health and well-being, leading to the emergence of the "positive technology" framework [2]. This framework suggests that technologies may improve user emotions, well-being, and interactions. Within the positive technologies framework, virtual reality (VR) enables users to have experiences in safe and controlled environments [3] and can trigger changes in their emotions [4]. As such, VR has great potential in improving users' emotions and well-being.

However, there are several barriers to using VR to improve well-being, including cost, design, and the availability of diverse video content [5]. Therefore, it is necessary to investigate which characteristics of the VR experience are essential to efficiently elicit positive emotions. Furthermore, it is crucial to investigate the VR features that influence users' emotional responses across different age groups. In this context, our study aimed to investigate the impact of immersion and virtual environment content (natural vs. social) on different age groups, as there is limited research on this aspect.

Methodology

For the present study, 38 undergraduates (19 women, 19 men, 22.4 \pm 2.5 years old) and 25 older adults (17 women, 8 men, 70.3 \pm 5.8 years old) were recruited. None of the participants had a history of neurological or psychiatric disorders.

The material consisted of two technologies with variable levels of immersion: a highly immersive Head-Mounted Display (HMD) (110° Field of View 1440 x 1600 pixels resolution) and a less immersive computer screen (25-inch screen, 1920×1080 pixels resolution). The stimuli consisted of 360degree videos, with natural, social, or neutral (control) content. To assess participants emotional responses, we employed both self-report and physiological measures. Self-reports consisted of valence and arousal ratings on the Self-Assessed Manikin Scale (SAM). Physiological emotional measures were acquired using the Empatica E4 wristband, which collects Electrodermal Activity (EDA) and Heart Rate (HR) data. Additionally, sense of presence was assessed using the Spatial Presence Experience Scale (SPES), and the Social Richness subscale from the Temple Presence Inventory (TPI-SR).

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Each participant was exposed to 360-degree videos on both a screen and an HMD in a counterbalanced order. For both levels of immersion, participants followed the same procedure. Participants were first asked to watch a control video (an empty waiting room with shapes on the walls) twice for two minutes. The first viewing session served as a training phase so that the users could get comfortable with controlling the exploration in the 360° virtual world. During the second viewing, participants were asked to relax to record physiological data. Next, they watched two natural and then two social videos (or in reverse order). After each video, participants filled out questionnaires to report their emotions and sense of presence. Physiological data were acquired while viewing each video. This procedure was repeated for both technologies (HDM and screen).

Results and Discussion

As expected, the highly immersive HMD proved to be more efficient than the less immersive screen presentation for inducing positive emotions in both younger and older users. This finding was further supported by higher levels of sense of presence reported by both age-groups for the HMD compared to the less immersive screen presentation.

Interestingly, elderly users reported high levels of arousal for all videos, whereas younger adults reported variable arousal depending on the content viewed. Indeed, younger adults reported the highest levels of arousal for social content, followed by natural content, and finally the control content.

Preliminary analyses conducted on physiological responses indicated a HR deceleration for all participants while viewing natural contents. The HR deceleration was mostly apparent for older adults while watching the natural video contents under the HMD, supporting the relaxing properties of said contents. Additionally, an increase in electrodermal activity can be observed when participants watched social content under the HMD, confirming their arousing properties in comparison to natural content. This increase in EDA is more pronounced for younger adults than for their older counterparts, which is in line with the participants' self-reported arousal.

Conclusion

Overall, these findings suggest that while video content matters and leads to specific emotional responses in younger adults, older users reported high levels of positive emotions and arousal throughout most immersive experiences. These results are encouraging, as they confirm the acceptability of highly immersive VR for eliciting emotions in healthy elderly users. Additionally, our results suggest that video content are differently prioritized by users depending on their age: while younger adults have specific responses to different video contents, this was less the case for elderly users. This is an important finding because the lack of diversity in video content has been raised as a barrier to employing VR for improving well-being in older adults. Since these findings support the effectiveness of VR for fostering positive emotions in elderly users, it appears relevant to further investigate the efficacy of VR experiences for more vulnerable and/or isolated elderly users.

Acknowledgements

We thank the Bien Vieillir à Boulogne association for their help in elderly participants recruitment.

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Perspectives of older adults regarding the use of digital and technology-based services: a qualitative interview study

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Abstract

The significant growth in the number of elderly people at a time when many everyday services are being digitised raises the question of the accessibility of new technologies for this group. It is important to consider the abilities and needs of these users when developing these tools, to avoid a digital divide. Twenty-six of the expected forty interviews were conducted in order to gain a better understanding of this population's perspectives on digitisation. Participants were asked about their use of the technology, as well as their difficulties, opinions, and advice for improving accessibility. They were also asked about the ethical and societal issues involved. The results show the effort that needs to be made in terms of the vocabulary to be used and the training to be provided to enable older people to overcome their apprehension about using a new system. Opinions are mixed on the benefits and the risk of a lack of human contact. The main advice was to use a less technical vocabulary and to offer free, tailored training courses. These results and the way in which they address accessibility issues were discussed.

Keywords

seniors, technology, accessibility

Context

In recent years, more and more services have been digitized. At the same time, the number of older adults has increased considerably. The specific needs of this population must therefore be considered in the design of these new tools to avoid the digital divide as much as possible.

Digital services are omnipresent in everyday life. Therefore, technology designers and developers need to take into account a wide range of potential users, with different abilities and needs, in the conception of these products. Implementing an accessible digital service requires a thorough understanding of the interaction barriers that people may face when using each component of the application, depending on their skills, abilities, and preferences [1].

In this context, accessibility is a key issue. Accessibility can be understood in two ways. Firstly, regarding perceptual, cognitive and psychosocial dimensions (visual, auditory, physical manipulation, cognitive abilities, self-efficaciy, etc.); a central question in this regard is to assess whether the technology can be used by users with varying levels of functioning and competence, both sensory and cognitive. Second, accessibility can be studied in terms of the tangible access to technologies, which can be more or less available to individuals depending on their social and technological environment, their financial resources, *etc.* [2-3].

Through this research, we will therefore seek to better understand the perspectives and needs of older adults regarding the use of digital and technology-based services.

Methodology

A series of semi-structured interviews will be conducted in order to better understand the relationship of older adults, living in France, towards digital and technology-based services and the different barriers they may encounter in their use.

Forty older adults will be recruited from senior citizens' associations. Participants must be at least 65 years old and willing to take part in the study. The interview will include eighteen open questions and will last about 40 minutes.

The eighteen questions asked form an interview grid created on the basis of various themes raised in a literature review around the notion of accessibility of technologies for the elderly. Ease of use, perceived usefulness [4-5] and safety [6] seem to be essential criteria for the adoption of technology by the elderly. The dimensions addressed in the interview grid and some examples of related questions are shown in Table 1.

Interviews will be recorded in order to transcribe the verbatim obtained in a strictly private setting and with the written consent of the participant. An inductive thematic analysis will be conducted to explore the perspectives and opinions of older adults. The inductive approach involves **deriving meaning and creating themes from data without any**

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Table 1 . Areas of study	and example	s of auestions
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I hemes	Examples
How do older people approach the use of digital and techno- logical services?	What information tech- nologies do you use in your daily life? Do you find these digital services easy to use?
Older people's per- ception of barriers to digital accessibility and possible solu- tions	What is your opin- ion/view of the digitisa- tion of more and more services? What suggestions would you have for improving the accessibility of digital services for older adults?
Older people's views on ethical and social issues relating to dig- ital services, accessi- bility, digital inclu- sion, and social in- clusion	Are you concerned about the confidentiality of your personal information when using digital ser- vices? Could this dynamic lead to the exclusion of cer- tain groups?

preconceptions. In other words, you'd dive into your analysis without any idea of what codes and themes will emerge, and thus allow these to emerge from the data. All interview data will be anonymized.

To get an initial idea of participants' technology habits, they were asked two initial closed questions about how often and how easily they used the technology.

Results and Discussion

This study is ongoing, up to date 26 persons have taken part in the study. We saw fifteen women and eleven men with an average age of 77.3 (sd = 7,2, min = 63, max = 89). The results of the first two questions concerning their use of the technology are presented in Table 2.

Table 2. Use of technology	by	participants
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Variables	Details	Results			
Number	-	n = 26			
Frequency of use	Frequency of use Not at all/bare minimum				
	From time to time	n = 6			
	Frequently	n=19			
Comfortable with	Net et all				
Comortable with	NOL AL AII	n = 2			
technology	Medium	n=15			
	Comfortable	n=9			

All the people surveyed had at least one technology that they used in their daily lives (telephone and often computer or tablet). Most of the difficulties cited during the interviews concerned novelty. The participants said that they were comfortable using what they were used to (e.g., "When I know, I know"), but that they encountered more problems when they had to use something new, particularly because they were afraid of doing it wrong. Older people explained that they were not used to computers and were therefore afraid of making mistakes (e.g., "I panic as soon as I think I'm not going to be able to do it").

Opinions on the dynamics of digitisation are very divided. Some think it's great, citing in particular the speed, convenience and ease of access it makes possible. But the nuance concerns the risk that this dynamic presents: leaving people behind, isolated and lost. For them, this dynamic is mainly due to the logical progress of time (e.g., "It's progress, you can't stop it"), but also to the desire to save money. In fact, they place a great deal of emphasis on the loss of jobs that this entails, which in turn leads to a lack of human contact. This notion is central to all the participants; they like the human relationship and don't want to be faced with machines (e.g., "It cuts off the human connection!").

As we have seen in the literature, older people recommend that training courses should be adapted, free of charge and well known, to improve accessibility (e.g., "The key for me is with a capital F: Formation"). In addition, instructions should be simple, without using overly technical vocabulary, whether during training sessions, in user manuals or directly on the service interface (e.g., "They have to use a vocabulary we can understand"). Finally, the issue of data confidentiality was also raised. Half the participants were concerned about this issue, particularly when it came to bank details, while the others said they had nothing to hide and were therefore not worried about it.

The use of technology must represent a benefit for the elderly, otherwise they will revert to their initial habits. That's why the emphasis must be on ease of use and accessibility.

This is at the heart of the issue surrounding new technologies for the elderly. They are already concerned about the lack of human contact that they see as a consequence of the digitisation process. So it's important not to exacerbate this by creating a situation of failure, leading to feelings of frustration, anger and, above all, exclusion.

Despite these risks, they are aware of the speed, convenience and easy access to information that the internet offers. They appreciate its positive aspects and would not dream of going back on the progress to which it has contributed. By continuing to develop increasingly affordable tools, the willingness of older people to invest in this change will be encouraged.

Finally, formation seems to be the key, both in the literature and according to the people interviewed. The rest of the interviews will be used to complete this study.

Conclusion

Some specific characteristics of older adults may prevent them from accessing digital and technology-based services, when precisely their limitations and preferences should guide the development of these services. Participatory design approaches could contribute to the conception of more inclusive technologies, but there are still many questions to address in

this area. Through this interview study, we will have a better understanding of the expectations and difficulties of older people in terms of digital services.

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Correlation between the Ability to Manipulate a Touchscreen Device, Hand Strength, and Manual Dexterity among Community-Living Older Individuals

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Abstract

There is lack of evidence regarding the correlation between the ability to manipulate touchscreens and the level of hand function among the elderly. The study aimed to examine the correlation between the ability to manipulate a touchscreen device, as assessed by using the touchscreen assessment tool (TATOO), hand strength, and manual dexterity among independent community-living older individuals. Thirty-four community-living older adults (average age 79.4 \pm 6.7 years) participated in single-session assessments lasting 45 min each. The assessment included hand strength measurement using manual hand dynamometry and hydraulic pinch gauge, a functional dexterity test (FDT),#and TATOO. No significant correlations were observed between most of the TATOO items (22 out of 26), grip and pinch strength, and the FDT test. Yet, moderately significant correlations were demonstrated in more complex gestures in terms of accuracy (dragging task) and speed of movements (double tapping). The present study demonstrated that touchscreen manipulation ability among healthy elderly individuals was not correlated with grip and pinch strength and manual dexterity. Accordingly, the hand function assessment toolbox should be expanded to include new tools such as TATOO to measure the specific skills required to operate digital devices.# **Keywords**

Hand Strength, Manual Dexterity, Older Individuals

Context

The ability to manipulate touchscreens has become an essential skill in our modern society, particularly among older adults who rely on these devices for communication, social interaction, and access to information [1] However, information regarding the relationship between the degree of hand function among the elderly, as measured by traditional assessments, and the ability to manipulate touchscreens is not clearly known.

The objective of this observational study was to examine the correlation between hand grip strength, manual dexterity, and the ability to manipulate a touchscreen device among independent community-living older individuals.

Methodology

The study included 34 community-living older adults (23 women and 11 men), aged 65 or older, with an average age of 79.4 years, who were independent in basic and instrumental activities of daily living, with the ability to walk

independently without assistive devices, and follow simple commands.

The procedure included a single 45-minute session and consisted of three parts that were performed in a random order to: 1) capture the following data: age, gender, known health and medical conditions, functional level, use of a walking device, and experience with touchscreen devices; 2) assess hand function by traditional tests conducted in a fixed order - handgrip strength, pinch strength, and manual dexitry; 3) assess touchscreen manipulation ability. All the measurements were performed on the dominant hand.

Three types of hand grip strengths were assessed in a fixed order: (1) hammer grip,(2) tip to tip pinch, and (3) three-point pinch. These grips were chosen as they are assumed to be related to the skills required for touchscreen manipulation since they contribute to hand stability and fine motor coordination [2]. A calibrated JAMAR hand dynamometer (Sammons Preston Rolyan, Chicago, IL, USA) was used to measure hammer grip. Tip to tip and three-point pinch were measured using the JAMAR hydraulic pinch gauge (Baseline, Fabrication Enterprises Inc., Irvingston, NY, USA) [3,4]. Manual Dexterity was assessed by the functional dexterity test (FDT), which is a portable assessment tool [5]. Higher scores indicated a lower manual dexterity [5].

The touchscreen manipulation ability was tested by the TATOO software application composed of five tasks: (1) touch all corners, (2) double tap, (3) drag in all directions,

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(4) drag along straight horizontal paths of varying lengths, and (5) pinch balloon [6,7]. The tasks were performed in a fixed order. The subject performed the measurement while sitting in front of a stable table with the touchscreen device placed on it.

Descriptive statistics was used to present the outcomes measures. Spearman's correlation was used with Cohen's standard. Statistical analyses were performed using SAS version9.4 (SAS Institute, Cary, NC, USA)

Results and Discussion

All the subjects were right hand dominant. The majority of the sample (67.6%) owned smartphone devices. No significant correlations were found between most of the TATOO items (22 out of 26) and handgrip strength, pinch strength, and FDT results. Only four items were found to have moderate significant correlations. The reaction time under the "Double Tap" had a moderate significant correlation with the tip to tip pinch (r value: 0.31, p value: 0.08), while the number of tips under the "Double Tap" had a moderate significant correlation with manual dexterity (r value: 0.32, p value: 0.07). The number of drag attempts under the "Drag to different directions" task had a moderate negative significant correlation with the power grip strength (r value: -0.39, p value:0.02), and a moderate positive significant correlation with the FDT (r value: 0.36, p value: 0.04). The power of the correlation results was 66.84%.

Conclusion

The study suggests that the touchscreen manipulation ability among healthy elderly individuals, aged 65 or older, was not correlated with grip and pinch strength and manual dexterity. However, more complex gestures such as double tapping and dragging tasks appeared to require hand stability, accuracy, and rapid movements, which may be related to hand strength and dexterity. The results have important clinical implications as they indicate that to evaluate the unique skills that are required to operate digital devices, new tools such as the TATOO must be included in the hand function assessment toolbox. Further studies are required to explore the correlation between touchscreen manipulation ability, grip strength, and dexterity in different usage positions and with individuals with impairments.

For details, please refer to the full article - Elboim-Gabyzon, M., Danial-Saad, A., 2021. Correlation between the Ability to Manipulate a Touchscreen Device and Hand Strength and Manual Dexterity among Community-Living Older Individuals. International Journal of Environmental Research and Public Health 18, 9408.

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Care professionals' needs regarding hospital logistics and perceived usefulness of an assistive robot in geriatric hospitals

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Abstract

Over the last few decades, information and communication technologies have continuously boomed, making new uses possible in sectors that were previously unfamiliar with their use. The health sector is one of these fields with the advent of new technological devices in healthcare professionals' routine (e.g., new software, social robots, logistics robots that support the execution of logistical tasks for caregivers). All these tools are changing the practices of care workers and, at the same time, the overall framework of the care provided to patients. This research project aims to identify the conditions for a successful implementation of a hospital logistics robot considering the point of view of the future robot users. A total of 25 semi-structured interviews with care professionals were conducted at two geriatric hospitals, Broca Hospital (AP-HP, Paris, France) and Vaugirard hospital (AP-HP, Paris, France). These interviews enabled us to identify various logistics robot would be welcomed and useful. 1) Locate and fetch care equipment on demand; 2) Transporting meal carts and bringing them to the patients; 3) Carry and store the cartons of IV containers and associated carts.

Keywords

Hospital logistics; geriatric hospitals ; care professionals; logistics robots

Context

The scientific literature produced on the subject identifies a number of logistics robots that have already been tested and deployed in certain hospitals to assist caregivers in the following use cases:

- transporting medical equipment or medicines on demand for caregivers [1]
- delivery of medical supplies to caregivers [2]
- on-demand meal delivery for patients [2]
- assisting in the transport of hospital waste [3]

On this basis, the aim of this qualitative study consisted in gathering information on the needs of care processionals regarding the assistance with their logistical tasks, in order to confirm, refute or complete the use cases identified in the literature review.

Methodology

<u>Data collection method</u>: To tackle this objective, we conducted a series of semi-structured interviews with care professionals in the following survey sites: Broca Hospital (AP- HP, Paris, France) and Vaugirard hospital (AP-HP, Paris, France) with both day and night care staff. The interview guide used was composed of two sections including a total of eleven questions (each targeting one of the different dimensions of the implementation of a logistics robot in a hospital setting).

The first part of the interview guide is dedicated to getting caregivers identify all the logistical tasks they perform and for which they encounter recurrent workflow problems. The idea was also to ask them to assess the impact of these problems on their individual work-related tasks and on the organization of the department or on patient care.

The second part of the interview guide introduced a hypothetical logistical support robot: the aim was to ask participants to identify precisely how such a robot could do to assist them with the logistical tasks for which they are responsible, and to explain which benefits could they expect from this robotic help for them and for patients.

<u>Participants:</u> In total, we recruited 25 participants, all of which were healthcare professionals working in geriatric hospitals. The sample was designed to represent the points of view of several potential end-user profiles, thus implying a diversity of professions, level and type of exposure to hospital logistics tasks (doctor, psychologist, medico-administrative assistant, nursing assistant, nurse, archivist).

<u>Data analysis method</u>: All the interviews were recorded and transcribed for analysis purposes. Verbatims collected were analyzed using the following methodologies:

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- thematic analysis of the interviews collected on each of the thematic dimensions of the interview guide ;
- and analysis of the various use cases cited "by occurrence of quotations" (for example, this logistical need was cited X times among the X interviews carried out and by X professionals among the total of X professionals interviewed).

Results and Discussion

Results: These interviews enabled us to identify various logistics problematic situations encountered by the caregivers in their professional practice. All of them indicated in the interviews that they spend a lot of time and energy in the following logistical tasks: preparing the expected health equipment, searching for and identifying medical objects that are lost or not in their original place (e.g. syringes, blood pressure meters, ECGs, protections, etc.), putting away the ordered equipment (medication, boxes of solutions when delivered), or transporting heavy loads (meal trays, anti-bedsore mattresses, dedicated carts). It is specifically on these tasks and in these specific situations that the help of a logistics robot would be welcomed and acceptable and useful according to the caregivers.

Overall, the following priority needs were most often expressed by caregivers as real expectations for a hospital logistics support robot:

1) To transport, locate and retrieve health care equipment (e.g., thermometer, syringe, ECG, blood pressure monitor, protection) in a short period of time and through multiple trips;

2) To manage the inventory and the quantities of items available in the dedicated storage areas;

3) To tidy these storage areas;

4) To transport heavy objects over long distances frequently (e.g., meal cart in the hospitality function);

5) To receive, transport and store cartons of solute ; 6) to receive, transport and store medication delivery cartons (as part of the pharmacy function).

These repeated tasks are thus identified by the caregivers, in the interviews conducted, as being those causing the most physical and moral fatigue, the most non-essential travels and the most damaging waste of time for the quality of care.

These results will be presented in detail at the conference presentation in the form of a summary table showing the weighting of each of the use cases cited, by occurrence of citations by the caregivers surveyed. Results, put into perspective with the scientific literature cited in the preamble, show that our interviews tend to confirm the elements identified by our authors, i.e.: caregivers' needs in terms of possible robotized logistical support primarily concern the transport of medical equipment and supplies on demand; the transport and delivery of meals, as well as occasional assistance with certain other types of flow (waste, small objects, patient files, etc.).

Discussion: From a critical point of view, our work has the following limitations: the small sample size of caregivers interviewed (leading to conclusions that are currently exploratory but not very generalizable); non-inclusion of patients in these interviews. These limitations will serve as a basis for further work, including a larger sample size of caregivers and a similar needs study with patients.

Conclusion

The usefulness of a robot in the medical professional environment is conceivable for the caregivers interviewed if and only if the robot can relieve them of the physical and moral hardship associated with the realization of their logistic tasks, allowing them to save time and energy that they will be able to reinject into the quality of the care provided to their patients. The semi-structured interviews revealed certain limitations related to their daily logistics tasks in the context of their care routines. The problematic situations most frequently described as unresolved needs, by our participants mainly concerned the following tasks: transporting, locating and fetching care materials; managing the stocks and the quantities of items available in the dedicated storage spaces ; organizing and tidying the storage areas ; transporting heavy objects on long distances ; receiving and transporting the medical material and associated boxes. Thus, the most expected functions from a logistics robot are based on the following needs: 1) Locate and fetch care equipment on demand; 2) Transporting meal carts and bringing them to the patients; 3) Carry and store the cartons of IV containers and associated carts.

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Design, development and testing of DanceMove: A digital solution to promote physical and cognitive training for older adults

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Abstract

This study aimed to design and develop a user-friendly digital solution called DanceMove, which combines physical and cognitive training for older adults. The study was divided into four phases: i) concept and ideation, ii) design and development of the prototype, iii) testing of functional mock-ups, and iv) testing of the prototype in the laboratory and real context. Non-functional mock-ups were generated, and two functional mock-ups were developed and tested. The final prototype of DanceMove was evaluated with community-dwelling older adults, showing both good acceptance and usability. Despite that, a few usability issues were identified, including login, help, music selection, and score consultation features, which needed improvement. Additionally, five older adults used DanceMove for four weeks at home, and the system was found to be usable and the intervention feasible and acceptable. However, barriers to use were identified, including digital literacy and digital solution-related issues. The research team addressed these barriers by including IT training and developing a user manual. The study provides valuable insights for future work, including a randomized control trial. Further improvements and adaptations are necessary to enhance its usability.

Keywords

Physical and cognitive training, Older adults, DanceMove, Dance-mediated technology

Background

Cognitive training and physical activity are widely recommended interventions to improve the functional capacities of older adults as they contribute to the maintenance of both cognitive and physical health, and consequently, active aging.

Dance mediated by technology is a leisure music-associated activity that combines physical and cognitive training, and this type of intervention has been found to be effective in promoting cognitive and physical health in older adults. Studies suggest that this population finds technology-mediated dance interactive and appealing, however, existing dance-mediated technologies tend to be noisy, lack personalization, and may require high digital literacy, making them difficult to be used by older adults. Many of the currently available technologies for dance were not initially intended for older adults and typically feature contemporary music, visually complex graphics, and progress in difficulty at a rate that is not adapted to older adults.

Objective

This study aims to design and develop a user-friendly digital solution called DanceMove, to promote physical and cognitive training for older adults, and test its usability with community-dwelling older adults.

Methods

This study was approved by the Ethics and Deontological Council of the University of Aveiro (27-CED/2021) and is subdivided into four phases: i) concept and ideation, ii) design and development of the prototype, iii) testing of the functional mock-ups, and iv) testing of the prototype in the laboratory and in the real context of use.

During the Concept and Ideation phase, a team of professionals brainstormed ideas and generated non-functional mock-up interfaces for the digital solution. After generating the mock-ups, the pros and cons of each were discussed and evaluated until two were left for further development into functional mock-ups.

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The Design and Development of the Prototype phase consisted of the development of a prototype that includes a core unit, a back-office interface, and a user interface.

The testing of functional mock-ups phase involved testing two functional mock-ups by domain experts to evaluate which interface better fulfilled the objective of performing physical and cognitive training for older adults. The chosen functional mock-up was converted into a prototype that underwent a usability evaluation with community-dwelling older adults.

The Testing of the prototype phase consisted of a single laboratory-based usability evaluation session for all participants and the possibility of taking the digital solution home for four weeks for those expressing interest in doing so. Participants were individuals aged 60 years or older living independently in the community, recruited at activity groups directed at older adults. They were included if they had no cognitive impairment and reported no history of recent falls or usual dizziness. The evaluation aimed to assess the system's usability, acceptance, and feasibility to promote physical activity and cognitive stimulation in older adults.

The usability evaluation was conducted using a multimethod approach that encompassed: (i) user-perceived usability and acceptability and (ii) the usability evaluation based on the perspective of the usability assessment moderator.

Results

Four non-functional mock-ups of the user interface were proposed, and two functional mock-ups further developed and tested with five domain experts. The DanceMove was defined to have a user interface with minimal information, allowing the individual choice of dance choreographies and songs, offering a variability of songs and choreographies, assessing user performance, and being compatible with an external commercial device (mat) that could be easily accessible and affordable. The final prototype was then developed, and a usability evaluation was carried out with 14 community-dwelling older adults with a mean age of 71.6 (SD=7.2) years old (see figure1). The final prototype of DanceMove showed a good level of acceptance and usability when tested with community-dwelling older adults. The evaluation according to the opinion of the usability assessment moderator showed that DanceMove was a facilitator to seven participants and a barrier to the other seven. DanceMove presented some usability issues that occurred repeatedly, clearly indicating that the login, help, music selection, and score consultation features needed to be improved.

Five older adults with a mean age of 71.2 (SD=6.1) years old used the DanceMove for four weeks at home, and it was found that it was feasible to be used at home and well accepted by older adults.



Figure 1: Users testing DanceMove in the laboratory.

Discussion

This study describes the process of designing, developing, and testing the user interface of a digital solution aiming to promote physical and cognitive training for older adults.

The process included several phases, such as concept ideation, prototype development, and testing of functional mock-ups and prototypes. These phases were essential to creating a fully functional digital technology that meets the real needs and expectations of the users.

Usability tests, including a single evaluation and another after four weeks of home usage, indicated that DanceMove has good usability and acceptance levels and is a feasible intervention for older adults.

Even though, some barriers to use were identified, including digital literacy-related issues and digital solution-related issues. The usability issues identified in the testing of the prototype lead the research team to adapt the intervention by including basic IT training in the enrolment of new participants and developing a step-by-step user manual.

As limitations, the lack of digital literacy among the participants may have masked usability issues, and the small number of participants who owned a personal computer and internet limited the usability evaluation after four weeks of usage. Despite these limitations, the study provided relevant information for the preparation of future work, including a randomized control trial.

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Technological and organizational challenges for the use of a DiTV by older adults in geriatric settings

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Abstract

Digital Interactive Television (DiTV) systems could be a promising and accessible solution to help meet several psychosocial needs of Older Adults (OAs) living in geriatric institutions. A case study was conducted to identify barriers to DiTV use among geriatric residents and accessible specifications for the system. Semi-structured interviews were conducted within 3 French nursing homes already equipped with a DiTV (OAs: n=18; professionals: n=6). Interviews were then processed using a thematic deductive analysis inspired by a European multidimensional health technology assessment model, with a focus on the technological and organizational domains. Results showed that DiTV systems can be well accepted by OAs who recognize the advantage of this system in terms of communication and entertainment. However, its use may be hindered by several technological (e.g., ergonomic issues) and organizational (e.g., workload) factors.

Keywords

Digital Interactive Television; Geriatric Institutions; Health Technology Assessment; Usability; Acceptability

Context

Information and communication technologies have great potential to address the psychosocial needs of Older Adults (OAs) living in geriatric institutions [1]. However, ICTs are often not designed to support the natural changes that occur with age [2], exposing geriatric institutions residents to usability and accessibility issues [3], as this population is more prone to important cognitive and functional impairments [4].

With the development of Digital Interactive Television (DiTV) systems, communication, entertainment, and other functionalities are accessible directly on a television screen. Many authors agree that the TV support offers OAs a much more familiar interface to access new functionalities [5,6], the remote control being now a commonplace object of everyday life [7].Thus, DiTV could be an accessible solution for geriatric residents, enabling them to gain autonomy over some activities.

However, the addition of interactivity to the television system requires users to use their remote control more extensively [8], disrupting their usage habits, and raising other potential barriers to the acceptance of DiTV by OAs [9].

Moreover, the environment or context could influence the acceptance of technological innovations by OAs. For example, in the case of the use of video calling technology in nursing homes (NHs), OAs' relatives and staff members (e.g., animator, technical manager, care staff members) usually set up the video calling device and initiate the video calls [10,11]. Thus, they play a key role in the use, and the related adoption, of technological innovations by OAs.

This raises the question of what barriers exist to the adoption of DiTV in geriatric facilities, and the levers available to encourage its acceptance by residents and staff members.

Methodology

A case study was conducted, using user centered design [12], to identify barriers to DiTV use among geriatric residents from a multidimensional point of view. The aim was to specify the usage context to identify accessible specifications for the system, and recommendations for its implementation. Three French NHs that have been equipped with a DiTV system were approached between February and April 2022. First, 18 semi-structured interviews were conducted with residents, who had a DiTV installed in their rooms, to explore their perspectives on using the system and the difficulties encountered. Then, 6 semistructured interviews with professionals helped understand the organizational dispositions taken, or required, for the implementation of the DiTV in the facility. Interviews were then transcribed with the MAXQDA software and processed using a thematic deductive analysis inspired by a European multidimensional health technology assessment model (EUnetHTA) [13], with a focus on the technological and organizational domains.

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Results and Discussion

Results showed that DiTV systems can be well accepted by OAs who recognize the advantage of this system in terms of communication and entertainment. Four enablers and 11 barriers to the use of DiTV in geriatric settings were identified.

Among the technological factors for DiTV use, the training provided to residents on DiTV seemed to facilitate its acceptance and use, or at least trigger the residents' curiosity and willingness to learn. However, the current format and timing of training need to be more tailored (e.g., an errorless training with spaced retrieval) to an audience with mild to moderate cognitive impairment. Then, the resulting lack of knowledge to use DiTV independently, combined with the technical and ergonomic issues experienced with the DiTV, could discourage some residents from using the DiTV, who were then hesitant about bothering staff members or relatives.

Among the organizational factors for DiTV use, the training of a few key volunteer staff members (e.g., sociocultural animator, technical manager, and some care staff members) is an essential step in providing residents with the necessary assistance to use the DiTV. However, in the event of recurrent turnover, the skills acquired in using the system were lost. In addition, the interventions of the facility staff (e.g., technical manager or sociocultural animator) to solve technical issues represented an additional workload for them, which could contribute to reducing the professionals' satisfaction with the tool (e.g., regular visits by the technical manager to restart not working televisions).

Conclusion

The use of a television support seems to facilitate the daily life of NHs' professionals by making it easier for NHs' residents to access messages and video calls. However, organizational and technological issues highlight the importance of the presentation and training on the DiTV to reassure and accompany OAs and professionals in the discovery of a new device, even one as familiar as the television. Specific ergonomic issues encountered by geriatric residents will be explored via user testing in another study.

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Introducing an air-disinfection robot as assistive technology into residential care homes: A proof-of-concept study in Ireland and Japan

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Abstract

While there are high expectations for digitalization and automation of care work, bringing new technologies such as robots into a workplace remains a challenge regarding acceptance and usability, as well as reflection of user preferences and needs. Major obstacles include the process of learning new skills, arranging additional work, and embedding it into care processes. Against this background, an original air-disinfection robot was developed for our cross-boundary research project. The aims of this research therefore were to test how such a robot would be received by care professionals working in senior homes, and to explore the process by which the robots are adopted in different cultures. The robot was introduced first in Ireland, and following the completion of its eight-week long trial, the same equipment was transferred to and used in Japan for eight weeks. Prior to its installment in both locations, seven main users (physiotherapists, nurses and social care professionals) working full-time in each residential care home were trained. Semi-structured interviews, focus groups, and system usability scale questionnaires were carried out before, during, and after the trials. The findings demonstrate that the users had positive perceptions of the robot, primarily because the robot provided an additional layer of organizational safety and it was easy to use. Initial differences existed in staff's confidence levels, depending on prior experience with technologies in Ireland, while no such differences were observed in Japan. The study provides promising learning opportunities for co-design, development and implementation of AT.

Keywords

assistive technology, digitalization, global aging, care work, technology adoption, robot, safety

Context

Digital technologies in health and social care are increasingly expected to perform a broader set of functions and roles. A wide range of life support technologies, from electric carts to signal buzzers and communication robots, are attracting attention internationally. While there are high expectations for digitalization and automation of care work, bringing new technologies such as robots into a workplace remains a challenge due to acceptance and usability, as well as reflection of user preferences and needs, including those of care professionals. Major obstacles include the process of learning new skills and embedding it into care processes [1, 2].

On the other hand, care systems are under huge strain, and many industrially advanced economies are faced with demographic challenges as the percentage of older adults is expected to grow. To tackle the workforce shortage and create person-centered care systems, digitalization and AT have been adopted.

From this standpoint, the worldwide COVID-19 pandemic was transformative, as using assistive technologies (AT) became almost the only safe way to deliver care. The pandemic also heightened the safety in care settings, with cleanliness and infection control becoming an even more important aspect of care delivery.

Against this background, an original air-disinfection robot was developed for our cross-national research project (Fugure 1). The aims of this study were to test how such a robot would be received by care professionals, and to explore the process by which the robots are introduced as AT into residential care homes in two different countries.

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Figure 1. VAir

Table 1. Users' Characteristics in the Residential CareHomes in Ireland and Japan

			Years of	
			professional	Confidence in
IDs	Occupation	Gender	experience	using technology
IE-1	Nurse	F	≻ 10 yrs.	Moderate
IE-2	Healthcare	F	≻ 10 yrs.	Moderate
	Assistant			
IE-3	Nurse	F	≻ 10 yrs.	Weak
IE-4	Nurse	F	≻ 10 yrs.	Weak
IE-5	Physiotherapist	F	≺ 5 yrs.	Moderate
IE-6	Physiotherapist	М		Strong
IE-7	Physiotherapist	F	≻ 10 yrs.	Strong
JP-1	Care	F	≻ 10 yrs.	Strong
	Professional			
JP-2	Care	М	≻ 10 yrs.	Moderate
	Professional			
JP-3	Care Support	F		Moderate
	Specialist			
JP-4	Care Support	F	≻ 10 yrs.	Strong
	Specialist			
JP-5	Care	М	≻ 10 yrs.	Moderate
	Professional			
JP-6	Physiotherapist	F	≻ 10 yrs.	Weak
JP-7	Occupational	М	≻ 10 yrs.	Strong
	Therapist			

Methodology

In order to address the research questions, a few care homes were identified by the principal investigator (applied social scientist), and several discussions were held among care home managers, care professionals and researchers in Ireland and Japan. The two countries were selected based on practical feasibility and recent questionnaire results [3]. In Ireland, HSCPs' attitudes to the use of care robots have been positive. Japan also has a reputation for its 'robotics culture'. Subsequently, one residential care home (RCH) from the two jurisdictions was chosen. The study's aim and objectives were explained and demonstrations of the robot were carried out by the Akara Robotics team in the participating RCHs. As the research was conducted in the middle of the pandemic, we regularly consulted the participating organizations, discussing the situation (e.g. outbreaks) and their needs. Following the principle of user-centered design, care professionals' needs were reflected in the design and development of the equipment. The robot was developed and introduced first in Ireland, and following the completion of its eight-week long trial (March-May 2022), the same equipment was transferred to and used in Japan for eight weeks (June-August 2022). Prior to its installment, seven main users (physiotherapists, nurses and social care professionals) working full-time in each residential care home were given personal instructions and training. Semi-structured interviews, ethnographic observations and focus groups were carried out by a team of independent researchers, as care professionals interacted with the robot.

Results and Discussion

There was significant interest in this robot among the care professionals in both countries. The SUS uses a Likert Scale which includes 10 questions. The average scores for the two countries were 81.8 (out of 100) in Ireland and 74.3 in Japan, which means that the Irish participants rated VA as excellent, while the Japanese rated it above average (68).

They had positive perceptions of the robot, primarily because they thought that the robot provided an additional layer of organizational safety and it was easy to use. Initial differences existed in staff confidence levels, depending on prior experiences with technologies in Ireland, while no such differences were observed in Japan.

Conclusion

The study provides promising learning opportunities (e.g. team-based, cross-professional training) for co-design, development and implementation of AT, particularly in the context of care facilities.

Acknowledgements

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SHAPES Ethical framework and the need for support services when using digital tools

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Abstract

This paper discusses the relevance and necessity of various support services as part of the digital care service provision. The focus of our analysis in this paper is on the SHAPES ethical requirements related to user support and governance. These requirements, stemming from ethical principles, values and rights, were further analysed from the viewpoint of the latest research on digitally-enabled care for older persons. This study showed that different support services are needed for end-users but also for care providers to promote the adoption and use of digital tools in care provision. Therefore, the focus on the research and development should be on the creation of needed services around the digital tools - instead of regarding digital tools as services as such.

Keywords

older persons, care providers, digital tools, support services

Introduction

Digitalization is changing the moral division of labour in the welfare sector between service users and service providers. Many everyday processes, including the provision of care, are automated. For example, self-care is supported by collecting information about well-being with various sensors, and robots help with everyday tasks. In addition, essential part of the work that was previously done by a care provider is now done by the end-user, with the help of digital tools. On the other hand, support is still needed for the commissioning and use of digital tools. In addition, older people and care providers are not always sure whether they can trust digital tools and artificial intelligence in care service provision. Therefore, various support services - such as help in the decision making when choosing the services, and training in the use of the technology - are needed around digital tools to make them valuable and reliable for both end-users and care providers.

Methodology

This paper discusses the relevance and necessity of various support services as part of the digital care service provision for older people. The research question was: What kind of support do users of SHAPES digital tools and services need at different stages of their use and why? First, relevant values, rights and ethical guidelines for the SHAPES integrated care platform were defined and described in the SHAPES Ethical Framework. Based on those texts, ethical requirements for technology,

user support, and the SHAPES business and governance models were established subsequently. The focus of our analysis in this paper is on the ethical requirements related to user support and governance. These requirements, stemming from ethical principles, values and rights, were further analysed from the viewpoint of the latest research on digitallyenabled care for older persons.

Results and Discussion

The importance of informed consent and decision making for the choice of services must be highlighted. Regular assessment of the suitability of services in accordance with the principles of the UN Convention on the Rights of Persons with Disabilities (CRPD) is essential. General Data Protection Regulation (GDPR) and trust in digital tools impose several requirements on support services. In addition to users' information on data protection, it is also necessary to build support services for the realisation of their rights regarding the processing of their personal data (e.g. the right to be forgotten). Finally, the need of support services for care providers should also be taken into account since their work processes are changing.

Conclusion

This study showed that different support services are needed for end-users but also for care providers to promote the adoption and use of digital tools in care provision. Therefore, the focus on the research and development should be on the creation of needed services around the digital tools - instead of regarding digital tools as services in their own right. To develop the provision of support on a user-oriented basis, one must understand the different needs of people who require

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different support, including the consideration of relevant legal and ethical requirements. The perspective should be on the entire user service path, including support services. In addition, safe user experiences must be accessible for all users, regardless of their IT skills or digital literacy levels.

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Can assistive technologies improve older adults' quality of life? The case of remote monitoring system with interactive communication function

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Abstract

Do assistive technologies (AT) enhance QoL of older people and care professionals in long-term care facilities? We have previously reported the impact of using a monitoring system with an infrared camera and communication robots. Further improvements were made to detection accuracy of the camera and functionalities for verbal interactions were added. This paper report these efforts in nursing homes, and their impact on the ground. The study was conducted with 34 older people and 20 care professionals in nursing homes. An infrared sensor and a biosensor were installed on the ceiling of each room. When the camera detects movement of residents, it notifies the mobile terminal of care staff. Its detection accuracy was improved against sunlight and physical obstacles. A variety of qualitative and quantitative data (e.g. sleeping patterns and social participation of older people, system usability and staff task analysis) were collected before and after the installation. Communication functions were added to the system. False detection rates of the monitoring camera decreased significantly. Using the improved system for the duration of 34 days, 602 alerts were recorded in total and 430 staff visits to rooms during night shifts were spared. The task analysis revealed that time for direct caregiving increased, while indirect care activities decreased. After the introduction of communicative functions, the system usability decreased, primarily due to inaudibility. However, the qualitative data support the idea of an interactive system. The study indicates AT's potential for enhancing the quality of care for all.

Keywords

assistive technology, quality of life, older adults, afety, long-term care policy

Background

An integrated model of health and social care in the community has been considered to be the gold standard, although many obstacles and challenges still exist. Living at one's private home for as long as one wishes requires highly personalized arrangements, and therefore is costly, but assistive technologies (AT) can potentially facilitate this. In order to test the concept, we have previously developed a remote monitoring and care delivery system using a monitoring system with an infrared camera and communication robots, and tested its effects on care



Figure 1. System Set-up

[1, 2, 3]. Further improvements were made to detection accuracy of the camera and functionalities for verbal interactions were added. This paper report these efforts in nursing homes, and their impact on the ground. The usability and efficacy of the model were examined.

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Methodology

The study was conducted with 34 older people (aged 70 years and over) and 20 care professionals in nursing homes. Sensor devices (biometric, temperature sensor and infrared camera sensor) were set up in the homes of five older people (aged 70 years and over), and the information was sent online to each older person, plus his/her family and caregivers (Figure 1).

Using these devices, care professionals delivered home care and remotely supported the home life of the older adults between December 2022 and January 2023. A pre-post study design was adopted, collecting the system usability score (SUS), the International Classification of Functioning, Disability and Health (ICF) and the InterRAI assessments. The participating older adults and family members all consented to the research, which involved being observed or watched (all images are silhouettes only) when the system was in operation.

Results and Discussion

False detection rates of the monitoring camera decreased significantly. Using the improved system for the duration of 34 days, 602 alerts were recorded in total and 430 staff visits to rooms during night shifts were spared. The task analysis revealed that time for direct caregiving increased (e.g. direct communication: from 2 to 55 mins), while indirect care activities decreased. After the introduction of communicative functions, the system usability decreased, primarily due to inaudibility.

Remote monitoring with alerts and two-way communication functions was highly valued by caregivers, as it provided an alternative model of care delivery, particularly for those living alone. While the device usability was not highly rated (54.8 out of 100, Grade D), several improvements in ICF and InterRAI scores were recorded (e.g. interpersonal communication, self care, depressive tendencies). The qualitative data also support the idea of an interactive system.

The users' support derived from constant monitoring, connectivity and (possible) instant activation of care delivery. Even when a carer lives away from his/her care recipient, the devices enable timely interactions and interventions where necessary. According to one of the participants' carers, while she is currently on standby 24 hours a day, the 'watching over' system provides an alternative method of care. There is a sense of security and reassurance: "If anything happens, someone can rush to the scene" at any time.

Conclusion

Faced with the challenge of meeting increasing demand for person-centered care under limited resources, there will be a greater need for better integration of improved AT. While more research is necessary to increase the sample size and the duration of the data collection period, there is great potential for this model, embedding the use of assistive technologies into home care delivery.

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A new model of home-based psychological intervention after the COVID-19 pandemic

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Abstract

The research proposes the use of social robots in a long-term intervention for children with NDDs. Having established the potential of remote technology, an ESDM-inspired protocol will be implemented at home in a feasibility study.

Keywords

COVID-19 pandemic, digital mental health, social robotic, neuro-developmental disorder, home therapy

Context

The impact of the COVID-19 pandemic on individual mental health

The Coronavirus (COVID-19) pandemic has originated significant societal changes with stress-evoking consequences to the global population. [1] Regarding mental health, professionals faced an increased demand for psychological treatment interventions and, as a consequence, had to reorganise their working tools. All therapies were transferred to the home, including those for patients requiring hospitalisation [2].

Thus, different technological tools were employed in psychological treatment, like online psychotherapy for adults [3] and artificial social agents at home for children and adolescents [4].

The pandemic has also highlighted the existence of "medical deserts" in peripheral or rural areas of cities, where people find difficulties in accessing care due to several factors, including long waiting times, shortage of healthcare personnel, and long distances from the point of care [5].

In this scenario, it seems necessary to examine the consequences of the COVID-19 pandemic on individual mental health and on changes of clinical method due to the introduction of technologies in psychotherapy. This enables us to conceptualize and design the resources for rapid and personalized access to mental health services and ensure continuous and long-term mental care in facing disrupted circumstances [6].

Psychic treatment and new technologies

With the rise of remote therapy through the use of technology, waiting times have been reduced, fragmentations eliminated and regional barriers broken down. The therapist has been able to follow the evolution of the patients' pathology and support them. [3] While continuity of care is important in the treatment of the psychological distress of an individual at all stages of life, it is critical in the treatment of children with neuro-developmental disorders (NDDs). The support of technology has made possible to extend clinical intervention in a nomadic setting, transferring the recommendations of care to everyday life. [7] An "itinerant" intervention, which moves around from clinicians to parents, actively engages the parent and the child, who perceive the action of the cure as uninterrupted. [8] In this sense, artificial intelligence represents a new tool for the treatment of children with NDDs who require intensive care and a multi layered response that includes the related family. [9]

Social robots can produce verbal and non-verbal signals that are easy to understand. The introduction of an artificial agent into therapy can present an alternative, particularly to children who are more unresponsive with a human therapist. Therefore, potential stress caused by therapy can be mitigated and the patient is motivated to learn and concentrate. In addition, the robot provides encouraging feedback as the child progresses and thus reinforces the skills acquired. [10]

Preliminary scientific studies have been oriented, in a heterogeneous way, towards the use of technology in hospital and school settings and are mainly aimed at the treatment of Autism [11, 12] Learning Disabilities [13] and Attention Deficit and Hyperactivity Disorder. [14] Recently, some research has also concerned home intervention, focused on the family and aimed at stimulating parents' participation in therapy. [15]

Integrated into the family setting, the robot becomes a concrete object the child interacts with, encouraging the child to think and reflect, promoting its cognitive and motor activities and thus, their development. [16]

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Research proposal and scientific contribution

The aim of this research is twofold:

It attempts to explore and characterize the impact of the COVID-19 pandemic on health professionals' clinical method due to the use of technology in psychotherapy;

It exploits such experiences to propose effective mental health intervention in regions where population has inadequate access to healthcare.

In line with experiences of its use for continuity of care, this research extends the population to explore the use of remote technology in children. Specifically, the research proposes the use of social robots in the provision of reliable intervention for children with NDDs.

Methodology

The first part of this research will be an exploratory study and will compare the emergency management in Italy and France during the pandemic. The study will involve psychiatrists, psychologists, psychomotor therapists and speech therapists, who have devised technological therapies during and after the pandemic. Semi-structured interviews will be used for a qualitative survey.

The research will then move to the intensive rehabilitation of child with NDDs, in particular with Destructive Disorders. We will propose an intervention protocol inspired by the usual remediation procedures implemented at the hospital. The aim is to transfer such practices at home with the help of a social robot in a preliminary and feasibility study. A single case study will be carried out and will involve a family with a child in his/her school age with a diagnosis of Destructive Disorder - Attention Deficit and Hyperactivity Disorder (ADHD), Provocative Oppositional Disorder (PDO), Conduct Disorder (CD) – monitored by the Department of Child and Adolescent Psychiatry of Pitié Salpêtrière Hospital in Paris.

The study will encompass the progressive implementation of activities and programming of a robot. Personalized and simple activities with a robot-host, at home, will stimulate the interaction between parents and child. The research will focus on inhibition and planning skills of children with attentional, motor and emotional instability. These deficiencies are common in children with Destructive Disorders.

The child will be reassured by a robot resilient to these shortages that can burden the relationship with parents. Fun and attractive activities will be planned to push children to concentrate, including imitation games (charades), story building, team games and cultural incentives (music, drawing).

The child will be emotionally involved with the robot, which will be perceived as a "living creature" capable of thoughts and reactions. The child will play structured activities, while the robot will support them in focusing their attention on specifics tasks and will encourage them to plan strategies in order to achieve a goal. Exercises will have an increasing complexity, measured by patients' abilities, to stimulate their autonomy. However, the difficulty should never be excessive, to avoid frustration and impulsiveness. The robot should also support and reassure the child when it fails (positive reinforcement). Suitable stimuli will be programmed to reduce unstable movements (e.g. rhythmic dances, manual work, object-making). Finally, role-playing with the robot and parents, will train the children to respect and consideration.

Eventually that the child would not tolerate the interaction with the robot in the long term, for example by abruptly interrupting or changing the game. So it will be necessary to modify or choose more enjoyable games.

Results and Discussion

The appropriate protocol will be custom-made with the help of the pedopsychiatry team of the Pitié-Salpêtrière Medical Hospital based on the difficulties and resources of children with NDDs.

The family's involvement in the activities will be measured to assess the feasibility of the study: the persistence of the interaction of parents and child with robot will be logged by specifically designed devices (number of robot uses per day, parents-children play time per day, interruption/change of game, etc.).

At the same time, qualitative questionnaires will be proposed to parents to assess their adherence to the protocol, to explore their points of views on the child's development and to assess the relationship with them.

Conclusion

In order to protect individual mental health, it is fundamental to envisage interventions for psychological support. It is also imperative to provide attention and care at an early stage for those individuals who are most vulnerable.

This preliminary study will show the feasibility of using a social robot for home-based intensive intervention and will include different disciplines: child psychiatry, cognitive science, computer science.

The objective of the research is to check at which extent the artificial intelligence can be a complementary tool, without replacing human intervention.

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About welfare robot project activities at Tokushima Bunri University

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Abstract

Based on the analysis results of a survey to grasp the needs of nursing care sites, we aimed to develop a monitoring and communication robot to solve the labor shortage in nursing care sites and to ensure the safety and security of users. Many on-site staff said that it was difficult to keep track of all the residents because they were busy with daily and complicated work. It is known that it is expected to manage the risk of users who cannot be observed on behalf of staff, and to monitor facial expressions over a long period of time and use them as criteria for dementia prevention. Therefore, in the welfare robot project of Tokushima Bunri University, we aimed to research and develop elemental technologies such as face recognition to realize the true needs of the field, and to construct and develop a mobile system that can move autonomously.

Keywords

Assistive Technology, Welfare Robot, Electric Wheelchair, Communication Support

Foreword

Japan's society is aging substantially; it is estimated that the aging rate (the ratio of people aged \geq 65 years to the total population) may reach 33.3% by 2036 and 38.4% by 2065. We are entering a super-aging society where one person is over 65 years old; consequently, the number of people requiring nursing care is expected to increase, which in turn, will increase the demand for nursing care staff. However, the turnover rate for the nursing staff is considerably high due to problems, such as a large amount of work and back pain. Therefore, current research is increasingly aimed at the development of nursing care robots to address the human resource shortage and reduce the burden of nursing care work. In the 2022 Welfare Robot Project being conducted at Tokushima Bunri University, we are exploring the role of electric wheelchairs to facilitate the mobility of people with physical disabilities and evaluate the emotions to support communication between the care staff and recipients. Sections 2 and 3 of this report review these efforts, and Section 4 presents a summary and future work.

Methodology

(A) Development of a gaze-input electric wheelchair using a 360° camera [1][2]

By combining a commercially available electric wheelchair with a unique line-of-sight input device and input interface, we support the lives of patients with amyotrophic lateral sclerosis and quadriplegia. The prototype of the gaze-input electric wheelchair comprises two cameras installed and used for switching between forward and backward movement. If there were no obstacles, satisfactory operability similar to that of a joystick could be achieved; however, it was difficult to visualize when passing through the obstacles while turning due to the camera's viewing angle and position of installation. The user had to turn around to traverse such conditions. In addition, since the camera video was transmitted via Wi-Fi, video delay and frame dropping were often observed. Based on the performance results of the prototype, we started developing a second machine aimed at improving operability and safety. In Unit 2, in addition to the line-of-sight input device (Tobii Dynabox PCEye 5 made by Tobii Dynabox), a 360° camera (RICOH THETA V) was installed above the operator's head and directly connected to the control PC via USB to improve visibility and reduce the video delay. Furthermore, to improve user safety, we implemented a mode to check the safety of the surroundings and a function that displayed warnings on the operation screen based on the distance of the obstacle from the user's feet.

(B) Communication support [3]

To build a communication system that offers "comfort" and "healing" to people with disabilities through the use of robots and devices, we are currently undertaking the construction of a communication system that serves as an interface

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between humans and robots. To achieve this, there are two major research objectives planned for this year:

1) Pulse-based emotion estimation system

For evaluating the user's emotions, we proposed an emotion estimation model that assumes that when a person watches a video, they regard the video and/or audio as a sensory input that triggers emotions. At this time, the heart rate fluctuates according to the scene in the video. If we can detect this heart rate variability and determine the relationship between heart rate variability and emotional items, we can possibly estimate emotions based on this heart rate variability. 2) Estimating facial expressions while wearing a mask

Assuming that two users wearing face masks have a table conversation, we proposed that the system can be used as a communication device that can be placed on the table. We constructed a system with two cameras and two monitors for photographing each person's facial expression and showing it to the other party, and two computers for running the facial expression estimation algorithm. The facial expression judgment results were then used to aid communication. When a smile was detected on one user, a smiling mouth image was superimposed on the face mask, and a closed mouth image was displayed when the face was expressionless. This system can function as a communication support tool between people. Additionally, it can also be used as a method to judge the physical condition of facility users based on their facial expressions by incorporating it into nursing care robots and devices to be used in nursing facilities.

How it will be done in the future

The results of the Welfare Robot Project were first presented in 2022, but the ultimate aim is to make necessary efforts toward practical application and commercialization of the device. Currently, the Ministry of Health, Labor, and Welfare is developing a Needs/Seeds-matching Support project aimed at instituting nursing care robots in nursing care sites to deal with the labor shortage while implementing highquality nursing care in a super-aging society. The purpose of this business model is to promote the commercial production of nursing care robots that meet the true needs of nursing care facilities. In addition to the development of companies by introducing robots, it is essential that we set up consultation desks that can guide the commercialization process from development to utilization in the community, evaluation, and verification of the intended effects of nursing care robots. By forming a network of living laboratories and preparing demonstration fields, we intend to build a platform for the production, demonstration, and dissemination of nursing care robots and commission projects to accelerate this process.

This university is a distinguished institution with nine faculties and 27 departments, including the Faculties of Science and Engineering, Pharmaceutical Sciences, and Health and Welfare. The Kagawa Campus, where the Faculty of Science and Engineering is located, houses the Departments of Clinical Engineering and Radiology and has established a research system that transcends departments. In addition, the Tokushima campus is home to several notable departments, like human welfare, physical therapy, and nursing, involved in the continuous exchange of academics and information. In 2018, the Faculty of Science and Engineering launched a Welfare Robot Project; over the same period, I also participated in the Needs/Seeds Cooperation Council for Nursing Care Robots and the councils in Kagawa, Tokushima, and Ehime prefectures. The Kagawa Campus, where the Faculty of Science and Engineering is located, is proposed to be relocated to the Takamatsu Station Campus in April 2025. As a hub university in Shikoku situated in front of the JR Takamatsu Station (which is located at the gateway to Shikoku), we believe our living laboratory will serve as a base camp for regional contribution and information dissemination.

We would like to participate in efforts to propagate and affiliate the research findings of the Welfare Robot Project to commercial development agencies for practical use, as well as conduct demonstrations and verification experiments for a smooth transfer of the laboratory benefits of nursing care robots to clinical settings. We would be pleased to use our living laboratory as a place for the dissemination of knowledge about the use of welfare equipment to the students and local facility staff of the four prefectures of Shikoku.

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Verification of optimal sensor placement system for gait assessment in living space

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Abstract

This study aims to validate our system that calculates the optimal placement of a sensor for evaluating gait in living spaces by measurement experiments conducted in actual living environments. The proposed system optimized sensor placement based on the following three evaluation criteria: (1) the system can measure walking motions, (2) the system does not interfere with the subject's walking, and (3) the system does not cause discomfort to the occupants. As a result, our system selected the flow line spaces for the sensor's positions in all the subjects' houses. Although the number of measured data varied among subjects, straight walking was measured for more than 40% of the total data in all subjects. In addition, the number of data that could not be used for gait evaluation, such as dual tasks, was large, and the available data ranged from 10 to 30% of the total walking data.

Keywords

Optimal sensor placement, Living space, home-based sensing, physical function assessment, Non-contact sensor

Introduction

There is a growing need to monitor disease risk through daily gait assessment in response to the rapid aging of the population. In recent years, detailed and easy gait assessment using sensors has become possible instead of conventional physical fitness measurement [1]. Furthermore, considering the stress and psychological effects on the subject, it is preferable to evaluate gait during daily life by introducing non-contact sensors into living spaces. However, gait evaluation requires more detailed data acquisition than fall detection systems. Furthermore, more careful consideration should be given to the conditions for sensor placement from the viewpoint of privacy protection. Therefore, we have proposed an optimization system for sensor placement in a living space for gait evaluation. This study aims to validate our system and investigate the data that can be measured in the living space.

Proposed system

Our proposed system [2] optimizes sensor placement based on the following three evaluation criteria: (1) the system can measure walking motions, (2) the system does not interfere with the subject's walking, and (3) the system does not cause discomfort to the occupants. We focused on straight walking, the most basic movement frequently used in motor function assessment. First, the positions

and dimensions of walls and obstacles were loaded from the house's floor plan image, and the occupants' walking paths were simulated using the PRM method [3]. Next, we calculated the measurable amount of walking for each sensor placement in the floor plan and deducted points if the sensor interfered with the walking. We assumed horizontally set Azure Kinect DK(Microsoft, Redmond, WA, USA) as the sensor used, with a horizontal viewing angle of 60° and an operating range of 3.85 m. Furthermore, we assumed that only walking points unobstructed by walls or obstacles are measurable straight ahead. In the case of the lateral view, the body part on the far side tends to be hidden, but this was not considered in this study. Finally, the ranking of each position was calculated, and the optimal sensor position and walking trajectory were displayed on the floor plan, as shown in Figure 1.

We installed Azure Kinect DK in the optimal layout output by the proposed system using the floor plan information of the subject's house as input. We conducted measurement experiments for about one week and a questionnaire survey after the experiment for subjects who gave consent. This experiment was approved by the Keio University School of Medicine Ethics Committee (approval number: 20200165). In addition, we classified the acquired data and investigated how much data could be used for the gait evaluation.

Results & Discussions

The number of subjects was 7 (5 houses), and in all the houses, the floor plan components were an entrance (flow line space), a living room, a kitchen, a washroom, a walk-in closet, and bedrooms. The optimal sensor placements were in all subjects' homes' flow line space. In the floor plan, the highest measurable walk calculated by the proposed system was found in the house with a

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Subjects	A1	A2	B1	B2	С	D	Е
Number of total gaits	127	25	321	92	208	182	229
Number of available gait data for gait assessment	25	4	53	27	25	22	26
Availability ratio / %	20	16	17	29	12	12	11

Table 1. Total number of walking data and results of classification

central hallway with many branches. On the other hand, the number of walkable spaces was the smallest in a house with a hall-like corridor due to the dispersion of walks.



Table 1 shows the classification results of the walking data obtained in the subject home experiments. The ratio of straight walking to the total number of walking data was more than 40 % for all subjects. In addition, the questionnaire survey showed that the system did not disturb the subjects at all in all subjects' homes, suggesting that the system was arranged to meet the conditions. However, the number of gait data that could be used for gait evaluation ranged from 10 to 30 % of the total gait data due to dual tasks and short walking distance. Therefore, it is necessary to consider the walking distance that can be continuously measured when calculating the optimal sensor placement by the system.

Conclusion

In this study, we verified our system to calculate the optimal placement of a sensor for gait evaluation in a

living space. As a result, the optimal placements were found in the flow line spaces in all subjects' homes. The results of the measurement experiment showed that all subjects were measured more than 40% of the total gait data as straight walking, although the number of measured data varied among subjects. However, most of the gait data could not be used for gait evaluation due to dual tasks, and the available data ranged from 10 to 30

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Organizational and legal problems of assistive technologies: The case of inheritance laws addressed to speech-impaired people

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Abstract

In this contribution we will focus on the conflicts deriving from the lack of coordination between technology, law and society when considering the case of inheritance laws addressed to speech-impaired people. In fact, succession law systems in the world prevent speech-impaired persons from expressing their will through speech synthesis. Through the analysis of voice technologies and the legal frameworks, we will highlight the limits of narratives of "technological enhancement" typical of AI in the face of juridical frameworks where the augmentative possibilities of those devices are not recognized and complied. We argue that this kind of contradiction exasperates the discomfort inherent speech-impairment and produces exclusion from social and juridical institutions. In response to these problems, we propose a legal framework that overcomes testamentary formalism in accordance with the UN Convention on the Rights of Persons with Disabilities.

Keywords

Inheritance law, speech synthesis, digital will

Context

Al-based voice technologies such as speech synthesis are being employed in the framework of disability, in example to allow speech-impaired people affected by SLA to express their will orally. Nevertheless, the augmentative and assistive potential of those technologies clashes with a series of social and legal issues. In this contribution we will focus on the conflicts deriving from the lack of coordination between technology, rights and society when considering the case of inheritance laws addressed to speech-impaired people. There is, in fact, no protection in relation to the possibility of validly expressing one's will for the time after death for people who have lost certain physical functions necessary to exercise their negotiating autonomy in a mortis causa perspective due to severely disabling pathologies. In particular, almost every succession law system in the world prevents speech-impaired persons from expressing their will through speech synthesis or other assistive technologies.

This is especially due to the adoption by almost all the legal systems, even in different historical periods, of the principle of testamentary formalism [2] as the cardinal principle of succession law, given the so-called diachronic effectiveness of the testamentary transaction: the will only takes effect after the death of the settlor and for this reason the intention is to make the settlor aware of the importance of the legal consequences that it may determine when they will no longer be able to modify them.

The will – in addition to being a personal, unilateral, exclusive, revocable, patrimonial act – is also a formal act, because it must necessarily be made in one of the forms established by law. The described formalism, however, is a source of unacceptable injury to the rights of persons with disabilities, appears to be particularly rigid and not otherwise surmountable.

Methodology

In this contribution we focus on the Italian legal system and compare it with European and US legal frameworks. The peculiarity of the Italian legal system is that it is a particularly complex regulatory framework, also because of the various sources from which the discipline derives and which must be coordinated with each other:

- The second book of the Civil Code;
- Law No. 89 of 16 February 1913, regulating the notarial function (Notary Law).

We also refer to the English, US, Canadian and Australian legal system, also with reference to The Uniform Electronic Wills Act.

Besides legal frameworks we analyse voice technologies and their social representations.

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Results and Discussion

The fundamental principle laid down in these regulatory texts is that of the written form ab substantiam of the will since the testator cannot make a will in oral form. Not only in the hypothesis of a speech-impaired person, but in all cases in which the subject is unable to use his upper limbs to write and affix his signature at the foot of the testamentary form, he could only resort to the public will. This choice becomes compulsory as it is the only form in which it is possible to express one's will without signing the deed drawn up by the notary. This fact makes it clear that suppressing the freedom of choice between the various forms of will envisaged results in unreasonable inequality.

In the contribution we discuss a series of implications inheritance law systems have for organizations and society, starting from the questions: can technological innovation alone guarantee an adequate level of autonomy for people with disabilities if their use is not recognized by State laws? What should be the kind of interaction between technology firms, organizations, individuals and jurisprudence law that allows an effective use of assistive devices in the respect of the person in situations of relational vulnerability?

Through the analysis of voice technologies, their social representations and the legal frameworks, we highlight the limits of "solutionist" representations inherent narratives of "technological enhancement" typical of AI in the face of juridical frameworks where the augmentative possibilities of those devices are not recognized and complied. We argue that this kind of contradiction is a classic case of social construction of disability [4], since it exasperates the discomfort inherent speech-impairment and produces exclusion from social and juridical institutions. In response to these problems, we propose a legal framework that overcomes testamentary formalism in accordance with the United Nations Convention on the Rights of Persons with Disabilities. Accordingly, we make three proposals for an integration of juridical tools into organizational contexts, also recalling Jasanoff's concept of "technologies of humility" [3].

Conclusion

In the specific, we propose the adoption of a "digital will" [1], in accordance with the United Nations Convention on the Rights of Persons with Disabilities [5] whose ratio is not to be found in recognizing "new rights" for persons with disabilities, but in making them able to enjoy the same rights recognized to other citizens on equal terms. The inspiring principles of the Convention are, in fact, those of autonomy, equality and non-discrimination of persons with disabilities, which are reflected first and foremost in the freedom to be able to make their own choices in an autonomous manner (Art. 3 letter A).

This implies that in official activities the use of any means of communication enabling the expression of the choices made must be guarantee, resorting for this purpose not only to sign language, Braille or other known forms of communication but also 'to augmentative and alternative communications and to any accessible means, modalities and systems of communication of their choice' (Art. 21(b)).

Two distinct scenarios could be imagined in this regard that could inspire the legislature with a re forming intervention on this point:

a) The creation of a digital platform entirely managed by legal experts in succession law, to which people with disabilities could easily be given access, which provides the possibility to draft digital wills by persons with disabilities, using every possible form of communication, with the support of the legal professional, or to provide wills drawn up by only the legal professional (notary in Civil Law countries) at the express request of the testator and not as an obligatory choice due to the lack of admissible alternatives.

b) To recognize, in any case, the right of persons with disabilities to be able to use, as an alternative to the platform described above, "any other accessible means modalities and systems of communication of their choice", thus giving effect to the principle of equality and full autonomy of persons with disabilities expressed in the UN Convention.

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The effectiveness of using eye-gaze assistive technology in the verification of diagnosis of children with profound intellectual disabilities in Poland - a case study

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Abstract

The subject of the presented research is to verify the level of intellectual development of six children with profound intellectual disability (without speech) aged 5-12, with the use of eye-gaze assistive technology (EGAT). The diagnostic and exploratory purpose of the research is the assessment and verification of diagnoses (certificates) issued by Psychological and Pedagogical Counselling Centres in Poland which diagnose children without the use of eye-tracking technology (NEGAT). The practical goal is to define the types of exercises from the Look to Learn software and evelearn software that enable the examination of visual-spatial skills (perception ability, visual-auditory coordination, the precision of vision), language skills (comprehension and expression), logical thinking (from cause-effect action to choosing from several elements). In Poland, Psychological and Pedagogical Counselling Centres should be equipped with EGAT to correctly diagnose children with suspected profound intellectual disability. Research shows that issuing a certificate of profound intellectual disability ought to be abandoned and a functional diagnosis/assessment should be introduced.

Keywords

verification of diagnoses, profound intellectual disability, eye-gaze assistive technology (EGAT), non eye-gaze assistive technology (NEGAT), eye-gaze controlled computer (EGCC), eyeLearn software, Look to Learn software

Context

Research in Sweden (total population survey) shows that thanks to eye-gaze control devices (EGCD) we can construct new knowledge about children and adults with multiple disabilities [1]. Research studies comparing the use of eye-tracking technology (EGAT) in communication and without the use of this technology (NEGAT) in communication were conducted in Sweden, Dubai, and the USA [2].

In Poland, it was noticed that this technology allows the verification of diagnoses (certificates) issued by Psychological and Pedagogical Counselling Centers. In my country, data from 2023, we have 7,890 people (including 3,404 girls) under 25 with a certificate of participation in rehabilitation and education classes, which means a diagnosis of profound intellectual disability¹. Due to the lack of communication with a child with cerebral palsy or a rare genetic defect (con-

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genital defects), the diagnosis of profound intellectual disability is not always correct. With EGCD, we can discover unexpected intellectual capabilities in a non-speaking child. The eye-tracking technology allows to assess the pattern of eve movement, visual attention, field of viewing, preferences, and the ability to point and choose with eyes.

The aesthetic value of interactive digital programs: eye-Learn, Look to Learn attracts the eyes of a child with profound intellectual disability, and develops completely new skills in children: from spontaneous "cause-effect" actions and screen exploration to precise pointing, from intentional looking to computer control. This allows to reassess the level of intellectual development of children with profound intellectual disability. It is important to create the right atmosphere and prepare the room (e.g. darkening). Since children have serious motor disorders and problems with auditory and/or visual perception, it is necessary to properly position the child and the computer screen with the camera. This requires additional competencies from the therapist, tailored to a particular child's individual needs and capabilities. At first, children need time and appropriate exercises to learn how to control their eyesight. Once children have mastered this skill, the therapist can arrange diagnostic situations with eye-gaze controlled computer.

¹ Available from: https://dane.gov.pl/pl/dataset/510/resource/45541,liczba-dzieci-z-orzeczeniem-o-potrzebie-zajec-rewalidacyjno-wychowawczych-w-roku-szkolnym-20222023-w-podzialena-wojewodztwa-oraz-rodzaj-placowki-ktora-organizuje-zajecia

The subject of the presented research is to verify the level of intellectual development of children with profound intellectual disability (without speech) aged 5-12, with the use of eye-gaze assistive technology (EGAT). The diagnostic and exploratory purpose of the research is the assessment and verification of diagnoses (certificates) issued by Psychological and Pedagogical Counselling Centers in Poland (NEGAT). The practical goal is to define the types of exercises from the *Look to Learn* software and *eyeLearn* software that enable the examination of visual-spatial skills (perception ability, visual-auditory coordination, the precision of vision), language skills (comprehension and expression), logical thinking (from cause-effect action to choosing from several elements).

Methodology

The research was carried out at the Rehabilitation and Education Center in Wroclaw, Poland attended by 73 participants aged 3 to 25 with a diagnosis of profound intellectual disability. I selected for research six children aged from aged 5-12. As part of the action research method, I used methodological triangulation: analysis of medical and therapy documents (certificates from the Psychological and Pedagogical Counseling Centre), the participant observation technique (explicit and structured), and the multiple (collective) case study method. Sessions were held once a week for half an hour for each child from September 2022 to March 2023 in a speech therapy office.

The PCEye Mini Track & Learn tool—Featuring Gaze Point & Gaze Viewer was used in the research. The tool allows recording gaze&sound or only sound, playback, and basic analysis of data collected during the study with heat maps and gaze plots to assess physical capabilities and cognitive understanding. The first software (eyeLearn) used in this research was created by combining academic knowledge and practitioners' experience in Poland (AssisTech). I am the co-creator of this application. From the eyeLearn software, I chose 4 exercises out of 170: Locating (a bee), Horizontal Tracking (snails), Developing Thinking (toys), Visual Perception (blocks), and a simple communication board (yes/no; stop/more). The second software Look to Learn examines activities in five key areas of learning and development (Tobii Dynavox). I made a selection from 40 exercises from one of the following exercise categories: Sensory, Explore, Target, Choose, and Control.

Figure 1. Example of *eyeLearn* video featuring Gaze Point & Gaze Viewer – Emilia



Figure 2. Example of *eyeLearn* video featuring Gaze Point & Gaze Viewer - Agnieszka



Results and Discussion

During sessions with the use of EGAT, children with profound intellectual disability discover their potential for creative tasks and new ways of engaging in activities. Research has proven that using EGCC is an effective intervention in diagnosing children with complex communication and developmental needs. It shows that children's diagnoses issued by Psychological and Pedagogical Counselling Centers in Poland can be questioned. Thanks to the implementation of eye-gaze assistive technology (EGAT) and the re-diagnosis of 6 children previously diagnosed as children with profound intellectual disabilities, higher skills in speech understanding, logical thinking, visual-spatial skills, and learning speed have been found.

- 1. All the children were able to do many exercises in the categories Sensory (*Look to Learn*) Locating (a bee), and Horizontal Tracking (snails) from the *eyeLearn* software.
- 2. Each of the children was able to develop thinking (toys) and visual perception (blocks) from the *eye*-*Learn* software. Three of them were able to get through not only 1 but 2 and 3 difficulty levels.
- Children could answer closed-ended questions starting with "whether" on a simple communication board by pointing with their eyes (EGAT).
- 4. Children mastered basic skills such as: looking at the screen, tracking, understanding the principle of eye control, i.e. from cause and effect, experimenting, early exploration, and making simple choices. However, they were not to move and hold elements with their eyes, as in the Control (Forest) exercise from *Look to Learn*. Exercises in this category turned out to be too difficult.

Conclusion

At first, I tried to use EGAT in art therapy sessions. I found that the use of eye-tracking as an assistive technology tool (EGAT) in art therapy enables participants to be relatively autonomous and independent in their creative activities. It allows them to express their emotions and reveal their abilities. Eye-tracking brings a positive change in the well-being and quality of life of children participating in the research [3]. During my work as a practitioner, I found that the most

benefits from the implementation of eye-gaze assistive technology (EGAT) are for children with cerebral palsy, rare genetic defects, neurodegenerative diseases, muscular atrophy, and children with multiple disabilities (intellectual disability and mobility problems, with sensory and communication disorders) for whom the only communication channel is vision and children who do not use their hands intentionally. This category also includes children who have not made eye contact so far due to numerous undesirable behaviors, and for whom interaction with the computer has become attractive, predictable and allows for the first intentional acts. In their case, the use of EGAT revealed hardly measurable acquisition and processing of information, the use of memory, thinking, or visual attention (conscious, controlled, intentional vs. unconscious, automatic, reflexive). In Poland, Psychological and Pedagogical Counselling Centers should be equipped with EGAT to correctly diagnose children with disabilities and non-speaking children. Issuing a certificate of profound intellectual disability ought to be abandoned and a functional diagnosis/assessment should be introduced.

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Eye-Gaze Control for Children with Cerebral Palsy: Contribution of Functional Vision Skills

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Abstract

Limited research exists on the early skills that impact on children's learning to use eye-gaze technology. This paper will examine the impact of functional vision skills on children's performance with a novel eye-gaze task. The results, obtained using a freely available measure designed for non-vision specialists, suggest that good functional gaze control skills were related to better performance. Implications for clinical practice will be discussed.

Keywords

Cerebral palsy, Eye-gaze technology, computer access, accessibility, functional vision

Context

Eye-gaze access technology can offer a method of direct access to a computer or assistive technology system, which can dramatically increase the participation and independence of children with motor disorders [1]. At present, however, research into the technology is limited, with very little published literature on its effectiveness, how it is assessed for and provided, and the skills which underpin successful acquisition and use [2-4]. This paucity of evidence has resulted in a situation where clinicians and AT professionals lack the tools to manage the expectations of families and support teams around this complex and alluring technology.

This paper will present experimental work from the lead author's doctoral thesis, examining the impact of three factors linked to the early acquisition of eye-gaze control skills: developmental level, functional vision skills and previous eyegaze experience. The lead author's previous research has shown some emerging associations between aspects of children's development and their performance on simple eyegaze control tasks [5-7]. In particular, several experimental rounds demonstrated that the way in which children acquire the causal relationships between eye movements and control of the device may differ from the way in which they develop cause and effect for physical objects. In several rounds of experiments, it was observed that typically developing children below 22 months of age were not able to engage with cause and effect games presented on an eye-gaze system without support and scaffolding, even though they could demonstrate cause and effect understanding with real-world objects. However, typically developing children above 32

months of age were able to use the eye-gaze system to complete the game with no coaching, suggesting that they could infer for themselves the causal mechanism by which the device is controlled.

Whilst these results have proved informative, the clinical population of children most likely to make use of eye-gaze technology have additional challenges that may make use of the technology more difficult. it is known that children with cerebral palsy (CP) have an increased instance of damage to all aspects of the visual system. Whilst many anatomical and physiological impairments are well documented, less attention has been paid to impairments in functional vision - a term relating to how vision is used to perform critical or meaningful tasks, such as directing attention or signalling a choice [8,9]. Where children are not able to affect an accurate point with any single part of the body, the use of gaze as a response modality can assume great importance [10,11]. This is often the case for children with CP, however this ability is variable within this group of children. The component skills needed to use functional vision for communication (fixation, gaze transfer, visual searching) are similar to those required to make purposeful use of an eye-gaze system, so their careful assessment and understanding could provide insight into performance with this technology.

Methodology

This paper will report on experimental work conducted with children with cerebral palsy (n = 9; Age 55 – 119 months) who were recruited as being representative of the population of children most commonly considered for eye-gaze technology. All children recruited were GMFCS level V – meaning their CP severely impacts their movement and volitional limb control – and had some degree of learning difficulty. All children were able to demonstrate established cause and effect for real-world objects during an initial play session with a switch operated toy.

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An assessment of functional vision skills was undertaken for each child, using the Rapid Assessment of Functional Near Vision, developed by the team at University College London (https://www.ucl.ac.uk/gaze/funvis). This resulted in a group of children with "good" functional vision skills (n = 5) and a group of children with "poor" functional vision skills (n = 4). Both groups contained children with and without previous experience using eye-gaze devices. Performance of children on an eye-gaze game was then compared. The game was presented in two sessions: the first with minimal instruction and the second with explicit prompting, feedback and direction. In this way, children's ability to infer the access method for themselves was assessed, as well as their ability to understand it with support.

Results and Discussion

The results presented in this session suggest that, whilst performance is likely influenced by a complex interplay between the three factors detailed above, good functional gaze control skills were related to better performance with a novel eye-gaze task. The findings suggest that some children may be at a "developmental advantage" when it comes to eyegaze technology if their functional vision and cognitive skills are more advanced.

Conclusion

The work underlines the importance of understanding children's visual abilities (as distinct from impairments of vision) and the use of a freely available measure of functional vision designed for use by "non-vision specialists" appears to offer insight that may support professionals in decision-making and managing expectations around this technology. Whilst this study includes a small number of participants, the results suggest that a sound understanding of children's functional vision skills is important for clinicians considering the use of this technology.

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Virtual Reality Based Intervention to Improve Neurocognitive Function in Post-COVID Syndrome: Preliminary Results

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Abstract

The main focus of this research is to present the protocol and preliminary results of a 6 week long virtual reality (VR) based cognitive intervention developed for post-COVID patients.

All cognitive VR game scores significantly improved throughout the intervention. Participants judged cognitive VR games as challenging, they demonstrated high levels of perceived immersion, presence, enjoyment, motivation and perceived usefulness of VR games.

Neuropsychological tests compared to a control group demonstrated a significant main effect of time in attention, verbal fluency, post-COVID functional status and perceived health status. An interaction between time and group was found for perceived cognitive status.

Keywords

virtual reality, post-COVID, neurocognitive functions

Introduction

Since the outbreak of the COVID-19, an increasing number of longitudinal follow up studies indicate that various persisting deficits of neurocognitive functions can be observed following infection such as deficits of executive functions, memory, attention, motor planning and psychomotor coordination [1-7]. These prolonged symptoms are commonly described as part of post-COVID sequelae or long COVID [8].

Neurocognitive deficits can significantly affect patients' capacity to work or act in everyday situations, their psychological status and quality of life.

Despite the urgency of the situation, targeted neuropsychological interventions and rehabilitation programmes are still on call to improve cognitive problems and mental health of post-COVID patients [9-12].

Due to the engaging and motivating nature of virtual reality (VR) and its capacity to divert participants' attention from focusing on fatigue and anxiety, VR might be a beneficial tool to obtain the above-mentioned aim [13]. VR interventions can promote neuroplasticity, the reactivation and

development of various cortical functions [14], thereby having the ability to improve cognitive functions such as executive functions, attention, and memory [15-19].

The main focus of this research is to present the protocol of a 6 week long virtual reality based cognitive intervention developed for post-COVID patients and to showcase the preliminary results of the study. We hypothesize that participant performance in cognitive VR tasks will increase throughout the programme and neurocognitive functions, subjective cognitive functions, health status and quality of life will significantly improve. We also hypothesize that the increase in latter functions will be significantly higher in the intervention group compared to a control group. The study also investigates VR participants' satisfaction, perceived immersion, presence, usefulness, motivation and enjoyment with the intervention.

Methodology

Our sample consists of 15 adult post-COVID patients (5 males, 10 females; M_{age} =37.27+/-15.76; $M_{education}$ = 16.63+/-2.42) who took part in a 6 week long VR intervention and 15 post-COVID adult patients matched in age and education level (12 males, 3 females; M_{age} =41.53+/-9.16; $M_{education}$ = 15.47+/-3.86) who took part in physiotherapy for 10 occasions in a 2 week long period.

The VR intervention included diaphragmatic breathing exercises and cognitive tasks targeting neurocognitive functions such us memory, attention, executive functions, mental flexibility, inhibition, working memory, visuo-spatial skills, planning, deductive skills and reaction time. The control

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group took part in physiotherapy with breathing exercises where no neuropsychological functions were targeted.

Objective neuropsychological tests such as the revised form of D2-test (attention), forward and backward digit spans (working memory), verbal fluency tests, Frontal Assessment Battery (FAB, executive functions), and self-report scales such as the Perceived Deficits Questionnaire (PDQ), Post-COVID-19 Functional Scale (PCFS) and EQ-VAS (perceived health status) were administered pre-, and post-intervention. Furthermore, performance in VR tasks and a self- developed VR questionnaire were monitored at every VR session, which measured perceived immersion, presence, perceived difficulty, enjoyment, motivation and usefulness of the intervention on a 5-point Likert scale.

Results and Discussion

At the beginning of statistical analysis, matching of the VR intervention and the control group was tested by comparing age and education of groups. Since data regarding years spent in education showed normal distribution, but age did not meet the assumption of normality (using Shapiro-Wilk test), independent T-test was performed in case of education, and Mann-Whitney test was performed for age. Tests showed no significant difference in age and in education between the groups.

Regarding (neuro)psychological tests, mixed ANOVA analysis was carried out. D2-R scores showed a significant main effect for time: F (1, 28) = 6.52, p<.05, ω^2 =0.05 with an overall decrease in error percentages between baseline and post-intervention. Fluency scores for the letter K showed a significant main effect for time: F (1, 28) = 5.45, p<.05, $\omega^2\!\!=\!\!0.06$ having an overall increase in number of words beginning by the letter K between baseline and post-intervention. Significant main effect of time was found in fluency of letter S: F (1, 28) = 15.01, p<.001, ω^2 =0.13 showing an improvement between baseline and post-intervention. PDQ scores showed a significant main effect for time: F(1, 28) =14.55, p<.001, ω^2 =0.05 with a decrease of scores between baseline and post-intervention, and an interaction timeXgroup F (1, 28) = 9.63, p<.01, ω^2 =0.13. PCFS scores showed a significant main effect for time: F(1, 25) = 8.69, p<.01, ω^2 =0.07 showing an overall decrease in PCFS between baseline and post-intervention. EQ-VAS also showed a significant main effect for time: F (1, 25) = 6.37, p<.05, ω^2 =0.03 showing an increase in EQ-WAS between baseline and post-intervention.

Tests of forward digit span, backward digit span, fluency of letter A and T and FAB showed no significant main effect of time, group or interaction.

VR games' scores followed normal distributions except for the mental flexibility game. For short-term memory game, paired T-test showed significance t (14) =-10.48, p<.001 with Cohen's d (-2.71). Long-term memory game scores were also normally distributed and showed significant paired T-test with t (14) =-2.97, p<.05 with Cohen's d (-0.77). Paired T-test for attention game showed t (14) =-5.96, p<.001 with Cohen's d (-1.54). Paired T-test of executive function game showed t (14) =-8.06, p<.001 with Cohen's d (-2.08). Paired T-test of visuo-spatial game showed t (14) =-4.2, p<.001 with Cohen's d (-1.09). Paired T-test of working memory game showed t (14) =-4.37, p<.001 with Cohen's d (-1.13). Paired T-test for deductive reasoning game showed t (14) =-14.66, p<.001 with Cohen's d (-3.79). For the mental flexibility game nonparametric Wilcoxon's signed rank test showed that first session's scores (Mdn = 8.49) significantly improved for last session (Mdn =13.76) scores, W=0.0, p<.001. The rank-biserial correlation was (rB) = -1.0.

VR Game	Mean (SD)	Mean (SD)	Cohen's d
	$1^{\rm st}$ session	Last session	and p
			value
Short-term memory	9.88 (1.42)	13.62 (1.84)	-2.71***
Long-term memory	5.52 (1.01)	6.48 (1.66)	-0.77*
Attention	12.01 (3.57)	15.09 (3.78)	-1.54***
Executive functions	6.65 (2.6)	10.62 (2.39)	-2.08***
Visuo-spatial skills	4.49 (1.53)	5.91 (1.42)	-1.09***
Working memory	5.72 (2.4)	8.62 (2.16)	-1.13***
Deductive reasoning	9.13 (3.6)	19.39 (2.87)	-3.79***

Table 1. Results of the VR game scores between first and last sessions

Means and standard deviations of the VR experience survey across all VR sessions can be seen below:

Table 2. Results of the VR	experience	questionnaire
----------------------------	------------	---------------

Measure	Mean	SD
Perceived immersion	4.58	0.42
Perceived presence	4.39	0.49
Perceived difficulty	3.09	0.65
Enjoyment	4.6	0.37
Motivation	4.56	0.4
Perceived usefulness	4.71	0.38

Conclusion

For the VR intervention group, all VR game scores (shortterm memory, long-term memory, attention, executive functions, visuo-spatial skills, working memory, deductive reasoning and mental flexibility) significantly improved between the first and last session.

Even though VR participants judged cognitive VR games as challenging, they demonstrated high levels of perceived immersion, presence, enjoyment, motivation and perceived usefulness of VR games.

Cognitive functions measured by neuropsychological tests for the VR intervention group compared to a control group demonstrated a significant improvement between baseline and post-intervention in attention, verbal fluency, post-COVID functional status and perceived health status regardless of groups. An interaction between time and group was found for perceived cognitive status. No significant difference was found for working memory and overall executive functions.

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Factors contributing to innovation readiness in health care organizations: a scoping review

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Abstract

The adoption and implementation of technology in healthcare organizations largely depend on the abilities of these organisations to innovate. This scoping review aims to clarify the concept of innovation readiness and identify which factors contribute to innovation readiness in health care organizations. Innovation readiness indicates the level of maturity of an organization to succeed in any type of innovation. Analysis of 44 included let to four main factors; strategic course for innovation, climate for innovation, leadership for innovation and commitment to innovation. Research into innovation readiness of health care organizations is a rather new field. Future research could be directed towards defining the concept of innovation readiness and the development of a framework for innovation readiness.

Keywords

Innovation readiness, scoping review

Introduction

The adoption and implementation of technology in healthcare organizations largely depend on the abilities of these organizations to innovate. Increasing innovation readiness of healthcare organizations is necessary to meet upcoming challenges, such as population aging and staff shortages, that may require more use of care technology. Although of great importance, embedding innovation structurally is not simple and health care organizations differ in the extent to which they are innovation ready. Health care organizations can greatly benefit from knowledge about how to prepare to be successful in innovation, with or without technology.

Aim of Study

This review aims to clarify the concept of innovation readiness and identify which factors contribute to innovation readiness in health care organizations. Innovation readiness indicates the level of maturity of an organization to succeed in any type of innovation. Moving to a state of readiness for innovation has a broader scope than the introduction of a specific innovation.

Methods

A scoping review was conducted based on the framework from Arksey and O'Malley. PubMed/MEDLINE, CINAHL and Web of Science were searched for studies that (a) aimed to contribute to scientific knowledge about innovation readiness of health care organizations, (b) were peer-reviewed, (c) reported empirical data and (d) were written in English, Dutch or German. Factors researched in the included studies were bundled into 4 overarching main factors and 10 subfactors.

Results

Of the 6,208 studies identified, 44 were included. The majority (n = 36) of the studies had been conducted since 2011 and almost half of the studies (n = 19) were performed in hospitals. Of the 44 studies, 21 researched factors contributing to innovation readiness in the implementation stage of the innovation process.

The authors used a variety of words and descriptions addressing innovation readiness, with hardly any theoretical frameworks for innovation readiness presented. The most frequently use words are: capacity for innovation, innovation capacity, capacity to innovate, ability to innovate, organizational innovativeness, organization's innovation ability, innovation performance, innovativeness of organizations, organizational innovation and organization's innovative potential.

Four main factors and 10 sub-factors contributing to the innovation readiness of health care organizations were summarized: strategic course for innovation, climate for innova-

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tion, leadership for innovation and commitment to innovation. Climate for innovation (n = 16) was studied the most and individual commitment to innovation (n = 6) was the least studied.

Strategic course for innovation refers to top management preparing the organization's long-term direction to become innovation ready. It articulates the role and the importance of innovation for the organization in terms of strategic course and defines the allocation of resources between current operations and innovation. This main factor consists of the subfactors innovation strategy, innovation program, innovation process and inter-organizational links and is focused on the organizational level.

Climate for innovation concerns creating a supportive organizational environment that contributes to innovation readiness and focuses both at the team and organizational levels. This main factor consists of the sub-factors innovative organizational culture and room for learning.

Leadership for innovation concerns the role of leadership of top and middle management to contribute to innovation readiness. This main factor consists of the sub-factors leadership style and middle manager's role.

Commitment to innovation concerns organizational actions aimed at the attitude, training and development of individual employees to support them in their individual readiness to get better at innovating. This main factor consists of the sub-factors innovative behavior and innovative competencies.

Conclusion

Our study identified four main factors contributing to the innovation readiness of health care organizations. Research into innovation readiness of health care organizations is a rather new field. Future research could be directed towards defining the concept of innovation readiness and the development of a framework for innovation readiness. More understanding of the interplay of factors contributing to innovation readiness in all stages of the innovation process and in diverse health care settings can support health care managers to structurally embed innovation.

Relevance for research and practice

Healthcare organizations struggle with embedding technology in daily practice. More understanding of the interplay of factors contributing to innovation readiness in all stages of the innovation process and in diverse health care settings can support health care managers to structurally embed those kind of innovations. This review contributes to the first stage of theory building on factors contributing to innovation readiness of health care organizations.

Literature

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The Assistive Technology Passport: a user-centred approach to empowering AT users to play a central role in identifying and addressing their own AT needs

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Abstract

AT services internationally are frequently fragmented and opaque. Prospective AT users often struggle to understand how assistive technology can contribute to their independence and are frequently unable to source or access skilled AT services in a timely manner. In 2016 Enable Ireland and the Disability Federation of Ireland (DFI) published Assistive Technology for People with Disabilities and Older People: A discussion paper, which made 7 key recommendations around the establishment of a national AT ecosystem. An AT Passport has been proposed as a foundation stone to the development of this national AT ecosystem.

Keywords

co-design, user centred, passport

Context

In 2022, five partners came together, funded by the Health Service Executive, to develop an AT Passport prototype. Four of the partners are service delivery agencies and the fifth is DFI, a federation of member organisations working with people with disabilities to implement the UN CRPD and ensure their equal participation in society.

AT Passport design approach

Central to the process has been the co-design of the AT passport by a diverse cohort of AT users drawn from the four service delivery partners: Enable Ireland, St. John of God Community Services, Multiple Sclerosis Ireland and Headway, a brain injury service. Working closely with the technical development partner, and with the additional benefit of mentoring from Microsoft, the AT Passport pilot project will deliver real and tangible immediate benefits to 50 AT users, through a dedicated AT grant.

The passport development process has identified 6 key steps in the user journey from self referral and self-assessment (where appropriate and possible) to screening/assessment, technology trials, funding and provision of solutions and training. The purpose of the passport is to provide a user-centred, accessible tool which delivers valuable data to funders on impact and value for money of AT investment.

Following a review of a number of AT service delivery models eg: (HAAT, MPT) Joy Zabala's SETT Framework was adapted to enable a uniform process of assessment to proceed across all service provider partner agencies. Retitled PETT (Person, Environment, Tasks and Tools), the PETT Framework offered a user-friendly and accessible approach to the diverse stakeholders involved in this project. All participants were adults with disabilities, ranging in age from 22 – 65 years.

Co-design was an essential factor in this project in order to create an AT Passport that meets the needs of all parties involved. The co-design process followed the steps of discovery, interpretation, workshops and ideation, experiment, evolution, implementation and evaluation.

Technical development of the Passport

Identifying a suitable technical partner was crucial to the successful design and delivery of a user portal and funder dashboard. Microsoft Power Apps was identified as the preferred platform, and through the development process, a bespoke AT Assessment course was developed to support the building of competencies across all partners. With a limited budget, the partners worked to find efficient solutions to the capture of device/feature matching outcomes, as well as ensuring that the passport included an accessible satisfaction rating mechanism, to enable the delivery of a Proof of Concept product. Further funding will be sought to progress the AT Passport to Phase 2 of development in late 2023.

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Project Evaluation/Summary

The project is being evaluated on three levels: at a metalevel the capacity to support shared learning and development through organisational collaboration is explored, while co-design and assessment are being evaluated at a meso project level and individual outcomes for AT are being evaluated at the micro-systems level.

This presentation will outline the outcome of this pilot project, and identify key steps to ensure the further development of the passport to a point where it can be integrated with national systems across health, education, employment and independent living.

The intersection of technical development, effective storytelling and advocacy in enabling this innovative approach to progress will also be discussed.

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Person-centered model for the assessment of Communication Assistive Solutions: an Italian case report

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Abstract

The identification of complex assistive solutions should be part of a rehabilitation project. A case report of the AAC Assistive Technology assessment path is here described, developed by the SIVALab of the DAT (Home Automation, Aids, Occupational Therapy) Unit of Fondazione Don Carlo Gnocchi in Milan, in collaboration with the Healthcare Residential Facility for Disabled, in line with the "participation model". The assessment path has been implemented by a multidisciplinary team, composed by physiatrists, engineers, therapists, educators, keeping in mind the complexity of communication needs and its systemic implications, the need to put the person and his/her main caregivers at the centre of the process, in all the phases of assessment and selection of the assistive solution, with the aim of providing the most appropriate solution, both in terms of effectiveness and efficiency and costs. **Keywords**

AAC AT, AT assessment, rehabilitation

Context

The identification of the most appropriate Assistive Solution (AS) for Augmentative Alternative Communication (AAC) should be part of a rehabilitation project and based on a holistic and participatory assessment conducted on the basis of the scientific evidence of the "participation model" [1]. This model suggests to evaluate participation and communication needs in life contexts (home, school, workplace, day-care or residential centres, hospice or communication Needs (CCN). If these assessments were neglected the AS would risk to be underused or abandoned, causing a waste of resources, a failure to meet user needs, and his/her possible resignation.

The goal is to implement interventions and introduce ASs for persons with CCN, in order to improve the environmental control and to promote and consolidate communication strategies. The AS has to meet the following appropriateness criteria: effectiveness in pursuing the objectives for which it has been chosen, significance for the user's quality of life and efficiency compared to the economic investment [2]. The following describes the model of AAC Assistive Technology Assessment Path (AACAT-AP) implemented by SIVALab [3] of the DAT (Home Automation, Aids, Occupational Therapy) Unit of the IRCCS S.M. Nascente (SMN) of Fondazione Don Carlo Gnocchi (FDG) in Milan.

Methodology

The SIVALab is a specialized laboratory on Information and Communication Technology (ICT) Assistive Technology (AT). The SIVALab offers technical-methodological support to FDG clinical units and socio-educational services when they consider to activate a AACAT-AP for their patients/users.

The AACAT-AP it proposes is not continuous, it starts and repeatedly can be resumed during particularly important phases or periods in the user's history or when there is a substantial change in his/her living environment. The assessment sessions cannot follow a predetermined timetable because they have the purpose of developing a dynamic intervention adapted to the needs and life context of the person to whom it is intended.

The duration of the AACAT-AP is affected by: the duration of the project; the number of assessment sessions, interviews and meetings with the user and his/her caregivers, updates and organizational contacts with the user, caregivers, companies, etc.; the time necessary to prepare the material and tools to be tested; sessions for testing the solutions; meetings for intermediate and final checks; the time needed to prepare the AT assessment report.

A case report of the AACAT-AP is here described, developed by the SIVALab team, in collaboration with the Healthcare Residential Facility for Disabled (RSD), part of the Socio-Educational Service, in coherence with the theoretical model above.

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Results and Discussion

Michele is a 57-year-old man, with dyskinetic tetraparesis in cerebral palsy, resident at the RSD. He moves independently, in known contexts, using an electronic wheelchair that he controls with his right hand by a joystick. At the time of the request for a new AACAT-AP, he communicates with a VOCA (GO TALK 20+), which proves to be an effective solution in terms of autonomy in use, accessibility, robustness and battery life. He also uses a mobile phone with large physical keys and a PC with Microsoft Windows 7 OS, keyboard with shield and personalized keyboard settings (key filter, mouse control through numeric keypad), which he uses to write, manage e-mail and to watch videos online. Michele expresses the need for a more versatile solution which could offer him a greater communicative effectiveness in expressing his needs, choices, thoughts, ideas, desires, consent or rejection, even with people who do not know him well enough to be able to interpret the alternative communication strategies that accompany and clarify his messages (words/gestures). In particular, the layout of his VOCA, is no longer congruent with the recorded messages: the most frequently used have been written on a sheet of paper applied on the back of the communicator. In addition, he needs to use the PC more effectively and in different places. The assessment of the new AS was requested by the physiatrist in charge of Michele.

The AACAT-AP required several sessions and was conducted by the SIVALab team in collaboration with Michele, his brother, the RSD rehabilitation professionals and the educator with a specific know-how in AAC. Different solutions have been tested with the objective of identifing an ICT device and the most appropriate interface allowing Michele to communicate simple messages, to undertake an articulated dialog and to perform activities such as writing texts, manage e-mail communication, watching videos. In four sessions Michele could try and use alphabetical and symbolic communicators controlled throught eytracking, touch screen, joystick with an external switch for mouse-click. After these sessions Michele, his ceregivers and SIVALab professionals discussed in order to assess efficacy and efficiency of tested ASs. The AS that best met the complex communication needs has been identified: a tablet for augmentative and alternative communication with 10.1" screen with an alphabetical communication layout (simplified-enlarged-capital letters, word prediction) and a tailor-made plexiglass shield protection for direct access with the fingers, a proportional joystick and a pressure switch for clicking allowing a complete use of the tablet (e.g. you-tube, social media). The wheelchair in use has been customized with a special made table for the placement of the tablet. The new solution was judged effective by Michele and the three devices have been prescribed through the Regional Health System. The AT assessment report was produced, containing all the information for the acquisition. VOCA has not been discarded because it can still be useful to michele in some situations, but an update to its communication content is recommended. It is not recommended to let Michele handle independently the new tablet, instead it must be firmly placed by a caregiver in front of him. The RSD operators, under the supervision of the educator specialized in CAA, carried out the training and all further customizations to the communication contents each time it was necessary. In addition to this, they have worked on the continuous assistance and support in the transition from the use of the previous solution to the new one, respecting Michele's fatigue or discouragement and guiding him to the resolution of the encountered difficulties. Today, Michele claims to be satisfied with his greater communicative autonomy.

Conclusion

The SIVALab AACAT-AP model has been implemented by a multidisciplinary team, composed by physiatrists, engineers, physiotherapists, educators, keeping in mind the complexity of communication needs and its systemic implications, the need to put the person and his/her main caregivers at the center of the process, in all the phases of assessment and selection of the assistive solution, with the aim of providing the most appropriate solution, both in terms of effectiveness, efficiency and costs.

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Scoping review of quality guidelines for Assistive Technology provision

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Abstract

This rapid scoping review of quality assistive technology service provision guidelines was conducted by an international research team during Feb - March 2023, aiming to inform the development of globally useable provision guidance. Systematic search strategies yielded 8,626 results. Screening identified 41 publications for full review, drawn from both the published literature and expert sources. Publications spanned 40 years, with most published in the last 15 years. Study designs varied widely: 20% were written with some sort of systematic guideline process, 40% were commentaries, and the rest used various qualitative methods. General AT provision principles and specific AT service delivery steps can be found in multiple sources including policy documents; the competency standards of different professions; and within sections of ISO product standards addressing clinical evaluation and useability. Strong consensus is evident regarding the key ingredients of service provision, despite the use of different vocabulary and variations in the focus placed on service delivery steps. Repeated calls are made for widely applicable guidance for the provision of AT. In conclusion, there is a strong case for globally applicable AT provision guidelines with the literature providing a firm foundation for their development.

Keywords

Assistive technology; services; provision guideline; standard; quality; documentation

Context

The definition of 'Assistive Technology' (AT) includes both assistive products and the services or actions necessary for the safe and effective provision of assistive products to people who need them. International standards and product specifications exist for assistive products however, no widely useable and accepted guidelines regarding AT provision and service delivery currently exist. This scoping review focused on the process whereby a person needing AT becomes a safe and effective user of AT. That is, enabling provision contexts featuring specific service delivery steps. This paper aims to identify and synthesise globally existing evidence regarding quality guidelines for AT provision and service delivery, delivering on global calls [1, 2].

Methodology

Research questions included :

i) What quality guidelines exist for assistive technology service provision?, and

ii) What do authors in this field see as key elements of such guidelines?.

A research team, drawn from three global regions, conducted a rapid scoping review of the (scientific and grey) literature over the past 35 years. The formal scoping review method utilized six steps and included sourcing relevant reports, policy documents and/or scientific publications from key stakeholders [3]. The search strategy across 4 key databases was conducted February – March 2023. The search, analytical framework and knowledge synthesis steps were guided by a Scoping Project Joint Steering Group.

Results and Discussion

Systematic searches located 8,626 records for screening, with full data extracted from 17 publications. A further yield of 18 publications was obtained through consultation with the GAATO and other networks. Six additional references were included after a secondary screen for the term 'quality'.

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Analysis of these 35 publications identified that 20% were written with some sort of systematic guideline process, 40% were commentaries, and the rest used various qualitative methods. Publications spanned 40 years, with most published in the last 15 years. The yield contained guidelines for AT in general, as well as for specific assistive products such as mobility, cognition and communication. Some publications focused on function, for example local guidelines about provision for education and vocation or work. Most documents are national commentaries on what good processes and quality indicators might be for different types of assistive products. Two global guidelines address specific assistive products for mobility. National guidelines about service provision in particular nations or regions were usually written by AT organisations. Multiple calls were made for the development of AT provision guidelines, with 128 manuscripts proposing that AT provision guidelines are needed.

Table 1. Service provision steps and synonyms	Table 1.	Service	provision	steps	and	synonyms
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HEART Steps	Synonyms
1. Initiation	 Initiative
	 Identify a problem in functioning
	 Formulate a demand for care
	 Information about how to access
2. Assessment	 Goal setting assessment
	 Evaluation
	 Support pathway facilitators and
	barriers
3. Selection of	 Formulate a care plan
the assistive	 Selecting
solution	 Equipment trials +/- prescription
	 Equipment recommendation
	Prescription
4. Selection of	 Typology selection
equipment	Choice of relevant device
5. Authorisa-	 Delivery Funding and procurement
(obtaining	 Funding and procurement Submission of request for replace
(obtaining)	ment / new equipment
runung)	• Ordering of assistive devices (special
	fund for donations)
	Payment
6. Implementa-	■ Use/ usage
tion (delivering	 Supplying the AT and instructing its
equipment to	use
user, fitting	 Fabrication and fitting
and training)	 Teaching and training plan
	 Product preparation, fitting, training
	and delivery
7. Manage-	 Evaluating the effects on function-
ment and fol-	ing
low up	Follow-up
	Maintenance
	Repair (including training individuals
	in repair strategies)

This rapid scoping review demonstrated conceptual alignment, yet differences in terminology in the field of AT provision (Table 1). The literature did not distinguish clearly between provision and service delivery, and these terms were often used interchangeably. The longstanding European service delivery steps developed from the HEART studies remain applicable and have formed the basis of the majority of scholarly work regarding AT service provision [4].

Most authors in this field suggest guidance includes service delivery processes and criteria for service delivery quality; as well as guidance regarding the broader provision contexts. There is strong consensus on the key steps in the process, despite some different terms being used and some variability regarding the number of steps. There is also strong consensus on quality criteria for service delivery [5] and on the importance of broader elements of AT provision.

Conclusion

This scoping review has collated core evidence regarding universally applicable elements of service delivery within broader provision contexts. It is feasible to build on this body of work to enable global guidelines on the provision of AT that will support a unifying, overarching inclusion framework and enable stakeholders to capture granular (detailed) guidance as needed for specific assistive products or contexts. Implications of the current limited 'patchwork' of guidelines in relation to current policy directions and unmet need have been articulated in the 2022 WHO and UNICEF Global Report on Assistive Technology [2]. It is timely to address this.

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Assistive Technology Outcomes: Global Consensus on Key Challenges

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Abstract

Assistive technology is critical to realizing the United Nations Convention on the Rights of Persons with Disabilities and to promoting participation and health for people with functional limitations. However, with only 1 in 10 globally having access to the assistive products and related services they need, we are facing a global challenge in ensuring access to these rights. Chief among the challenges is a gap in our understanding of the need for assistive technology, the outcomes and impacts of assistive technology provision, and data to inform policy. The purpose of this initiative was to capture a wide range of perspectives from assistive technology stakeholders in all six of the WHO health regions, and to develop consensus regarding the key challenges in assistive technology outcomes. We identified six key thematic 'grand challenges' which must be addressed: measuring need, documenting inputs, measuring outcomes, measuring impacts, sharing data, and informing policy. Addressing these challenges will allow the development of improved evidence generation in the field, and provide the necessary data to improve access to AT for all.

Keywords

Assistive Technology, Outcomes, Consensus, GAATO

Context

Assistive technology is understood to be critical to realizing the rights agreed in the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) [1], and to promoting participation and health for people with functional limitations. Furthermore, assistive technology has been demonstrated to be critical for the achievement of the UN Sustainable Development Goals (SDGs .[2]. However, with only 1 in 10 globally having access to the assistive products and related services they need, we are facing a global challenge in ensuring access to these rights and the achievement of the SDGs. [3] This global challenge is multifactorial, and is well understood through the lens of the WHO GATE 5P model, which acknowledges the importance of people who use assistive products at the centre, and their experiences with the interlinked factors of policies, products, personnel, and provision systems.[3]

Chief among the challenges is a gap in our existing and potential future understanding of the need for assistive technology, the outcomes and impacts of assistive technology provision, and data to inform policy direction at local, national and international levels. This gap is itself multifactorial, and spans all of the identified 5Ps. Addressing this gap requires a sustained, concerted, and coordinated effort by global stakeholders in the area of assistive technology outcomes.

The Global Alliance of Assistive Technology Organizations (GAATO) set out to identify key challenges in assistive technology outcomes on a global scale. The purpose of this initiative was to capture a wide range of perspectives from assistive technology stakeholders in all six of the WHO health regions, and to develop consensus regarding the key challenges in assistive technology outcomes which must be addressed to close the gap in access to assistive technology.

Methodology

We adapted an innovative collaborative consensus method to 1) document and distil AT challenge data from global regions, 2) to refine this data with global stakeholder organisations, and 3) to publish a shortlist of AT Grand Challenges.

A standardised set of questions and iterative democratic voting software were used in different language groups across seven regional consultations to determine regional priorities. Independent blinded thematic analysis of the pooled regional data was conducted by 3 practitioners/researchers, resulting in a long-list of 39 challenges. Via consensus meetings, including a Side Event at the 2022 Global Disability Summit and a two-phased survey, global stakeholders were invited review and synthesize the longlist of 39 challenges.

Review of feedback from global stakeholders, and a further round of independent coding and consensus discussions by 3 practitioner/ researchers identified a shortlist of AT challenges and an 'impact model of AT outcomes'.

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Results and Discussion

Regional consultations involved 307 participants across 57 countries and 9 languages. Analysis reduced n-109 Grand Challenge statements down to a longlist of n-39. The global consultation involved n-31 global stakeholders and regional leads. Analysis found no agreement on further consolidation across the 39 statements. A six-point impact model of AT outcomes was presented for comment and ratification.

The participatory process undertaken gives voice to many hundreds of AT stakeholders from across the globe. We identified six key thematic 'grand challenges' which must be addressed: measuring need, documenting inputs, measuring outcomes, measuring impacts, sharing data, and informing policy. Each of these is comprised of specific challenges which must be addressed to ensure data and outcomes are available in future to drive global assistive technology policy and systems.

Conclusion

Global consensus is evident regarding key challenges for our time. Identification of these challenges provides direction for researchers, policy makers, and global and regional service organizations to addressing key gaps in assistive technology outcomes. Addressing these challenges will allow the development of improved evidence generation in the field, and provide the necessary data to improve access to AT for all who need it.

Acknowledgements

We would like to acknowledge the work of the GAATO Global Challenges in AT Outcomes Working Group, as well as the participation of regional leaders across all six WHO health regions.

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An interim evaluation of the assistive technology service delivery in the Faroe Islands from a user perspective

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Abstract

Purpose: This study provides a preliminary evaluation of the AT services in the Faroe Islands from a user-perspective by using recommendations from the Horizontal European Activity on Rehabilitation Technology study (HEART) Materials and methods: The study enrolled 101 persons aged 8-95 (mean 69 years). A study specific questionnaire was used to describe the AT service provision process. The satisfaction was assessed with KWAZO and the service subscale of QUEST. The steps in the AT provision process were described with frequency distribution. The KWAZO and QUEST results were analysed item-by-item and grouped in 'Satisfied' and 'Not fully satisfied'. A threshold of 33% was used to identify the proportion of 'Not fully satisfied'.

Results: Below the threshold were 'Instruction', 'Professional services' and 'Follow-up'. The AT centre performed application and implementation in 9.6% and 12% of the cases, respectively, and other institutions in 62.3% and 43.7% of the cases. No contact had been with professionals in the application-phase and the implementation-phase in 28.7% and 37.6% of the cases.

Conclusions: The provision system appeared fragmented, which the low satisfaction with related quality-items reflected. Often the role of the AT centre seemed reduced to delivering AT. The findings confirm the importance of ensuring user-centeredness and coordination in AT delivery.

Keywords

Assistive Technology provision, evaluation, user perspective, quantitative study

Context

Providing assistive technologies (AT) is a complex process with several steps depending on each other to be achieved efficiently to obtain a positive outcome of the AT provision. Having a user-centered approach in all the steps of the provision process is important to ensure that the provided AT function as intended [1,2]. Knowing how AT users experience the AT provision is important for AT service providers and governments.

The Faroe Islands, a small-scale remote island-society with 17 inhabited islands and 54,000 inhabitants, has one nationwide AT center. Other institutions for example the municipal elderly care-centers are known to participate in the service delivery process. However, there is a lack of information regarding their role and how the services are organized. The remote location away from other AT professionals might entail challenges regarding knowledge sharing with other AT professionals and participating in AT related research.

Having in mind the request for context specific knowledge to evaluate the AT-service delivery process there is a need to investigate the AT service delivery process in the context of a small-scale society. Research in AT service provision from a user perspective is scarce, and there is a lack of research regarding AT provision in small-scale societies.

Objective

The aim was to provide an evaluation of the AT service in the Faroe Islands from a user perspective based on recommendations from the Horizontal European Activity on Rehabilitation Technology (HEART) study.

Methodology

The study enrolled 101 home-dwelling persons aged 8–95 years (mean 69 years). A study specific questionnaire, which was administered "face-to-face" was used. The "provision process questions" included questions with answering options about who took part in the application and the implementation of the AT services. The satisfaction with the AT services was assessed by using the questionnaires KWAZO [3] and the service subscale of QUEST [4], which had 7 and 4 questions, respectively. The sample and the steps in the AT provision process were described using frequency distribution. The results from KWAZO and QUEST were analyzed item by item and grouped in 'Satisfied' and "Not fully

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satisfied". A threshold of 33% was used to identify the proportion of 'Not fully satisfied'.

Results and Discussion

The AT center performed the application and implementation in 9.6% and 12% of the cases, respectively. The municipal elderly care-centers performed the application and implementation in 37.5% and 22.6% of the cases, respectively. There had been no contact with professionals in the application phase and the implementation phase in 29% and 37% of the cases, respectively. Below the threshold in KWAZO was 'Instruction' (46%), and above were 'Accessibility' (82%), 'Information' (73%), 'Coordination' (84%), 'Knowhow' (81%), 'Efficiency' (87%), 'Participation' (75%). Below in QUEST were 'Professional services' (37%) and 'Follow up' (47%), and above were 'Service delivery' (72%) and 'Repairs & servicing' (77%).

To our knowledge, this is the first investigation of AT service in a small-scale remote island society. As emphasized in the HEART study "each country needs to design systems that are best tailored to its context" [1]. Our findings show a randomness concerning the AT delivery process, marked by a lack of professional needs assessments and implementation. Although the municipal care centres had performed many of the applications and implementations no information was identified about their formalized role in the AT delivery process.

Lack of diversification and institutional capacity within the university context and tertiary education characterize small-scale societies [5], which might be applied to the AT field as AT personnel require continuous training to attain both the general and specific skills needed in client-centered AT services [8].

The large proportions of AT that were provided without professional involvement might entail several problems. Studies have shown that not making good needs assessments might both lead to providing inappropriate AT and lead to abandonment of the provided AT [9]. Moreover, a professional implementation is important to ensure that the AT fits the users' needs, fits in with their living environments, and that the AT users know how to use the AT [2,9). Lack of implementation from professionals is known to lead to abandonment of AT or result in the users not getting the full benefit of the AT [9].

Only about half of the QUEST showed satisfaction with the follow-up, which should be mandatory to ensure that the AT is adjusted to the users' needs change over time [9].

A discrepancy was between the lack of professional involvement in the provision process and the relatively high level of satisfaction in the KWAZO answers. Compared to this the QUEST answers showed less satisfaction and thus were more in line with the lack of professional involvement. A reason for the high level of satisfaction according to the KWAZO answers might be that many AT users do not know that professional support is a part of the provision process [9].

Conclusion

The AT provision system appeared fragmented, and the AT center's role seemed reduced to delivering AT based on other institutions' choice of solution or without rendering professional assistance. Despite this, the AT users' satisfaction level was quite high. More professional involvement in all the AT provision steps is needed to ensure that the AT services are effective and person-centered in all the AT provision steps.

A formalized cooperation between the AT centre and the other organizations who participate in the AT provision process is needed. An initiative should be taken to ensure that everyone who needs AT gets support from professionals. Moreover, a structured follow-up is needed to ensure that the provided AT are adjusted as the needs change.

Acknowledgements

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Setting up a mobility Assistive Technology Centre in an underserved part of India: Challenges and Outcome

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Abstract

There are 26.8 million Persons with Disabilities (PwDs) in India out of which approximately 8.7% reside in Bihar. Out of this, approximately 18 million PwDs (69% of the disabled population) live in rural India out of which 39% have locomotor and vision impairments. PwDs from lower-income groups, and those residing in remote rural areas have limited or no access to assistive products and expertise. The aim of the program was to set up an Assistive Technology (AT) Centre in Bihar, India where a beneficiary can get a host of comprehensive solutions such as neurorehabilitation (which includes physiotherapists and occupational therapists), AT aids and appliances, peer mentoring, counselling etc. under one roof. This centre is mainly for the benefit of PwDs who are below the poverty line or from low-income households. This paper will discuss the methods, challenges and outcomes of establishing an AT centre in Bihar – one of the poorest states of India.

Keywords

Assistive Technology, Service Delivery Challenges, India, Mobility, Vision

Context

Article 20 on personal mobility of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) requires the State to ensure that persons with disabilities have independence in their mobility in a manner and at a time of their choice [1].

To give an idea of the Indian context and our project focus, there are 26.8 million Persons with Disabilities (PwDs) in India out of which approximately 8.7% reside in the state of Bihar. This represents one of the highest disabled populations in the country. Out of this, approximately 18 million PwDs (69% of the disabled population) live in rural India [2]. PwDs from lower-income groups, and those residing in remote rural areas have limited or no access to assistive products and expertise, affecting their Quality of Life (QOL).

Even though there is scarce and low-quality data on met and unmet needs for AT, it is evident that there is a significant gap between needs and access to appropriate, highquality, affordable AT services in India. This is largely due to healthcare inequality, high cost of product, limited availability in the market due to low local production, and poor awareness among PwDs, caregivers, healthcare professionals etc.

Program Objectives

The main aim of the program was to help lay the groundwork for a cohesive ecosystem integrating healthcare professionals, AT innovators, government agencies and international organisations for the benefit of PwDs in an underserved state of India – Bihar. The Assistive Technology (AT) Centre is where potential beneficiaries can get a host of comprehensive solutions such as neurorehabilitation (including physiotherapists and occupational therapists), Assistive Technology aids and appliances, peer mentoring, counselling etc. under one roof.

The Mobility AT programme is focused on conducting a multidisciplinary needs assessment and delivering customised wheelchairs and other mobility devices (walkers, callipers and orthosis for mobility) to those who fall into the category of low-income or BPL. The goal of the programme was not only to provide an aid or an appliance, but to enable the enduser to live an as independent life as possible and develop ADL skills for themselves and their caregivers.

The Vision AT programme is a pilot study that is focused on establishing an AT Skills Lab at a boarding school for blind girls from low-income families in Patna, Bihar. By increasing their digital literacy, the aim is for the students to be on par with the national curriculum.

Methods

To do this, the following factors were addressed:

Location: The Centre was established in a central location in the capital city of Patna (Bihar) with easy transport links to inter-city railway and bus stations. It is spread over 2 floors with a dedicated space of 2,200 sq. ft. per floor. There is a neuro-rehabilitation facility on the ground floor with a Gait

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Harness system, a PABLO system etc. In addition to this, the Centre has full telehealth capabilities to increase the outreach to satellite towns and villages.

Personnel: The Centre is staffed by physiotherapists and occupational therapists whom we have upskilled with a clear focus on Assistive Technology.

AT Products: The most economical and reliable customized wheelchairs were identified that are available in the country and that could be assembled locally at our Centre as well. The assessment, measurements and fittings are done in-house at the Centre. Through the assessment, including terrain and type of use, different types of customized wheelchairs are allocated to the beneficiaries such as rough terrain wheelchairs, sports wheelchairs and active folding wheelchairs. For the vision program, the needs of the students at the school were assessed and a combination of low-tech and medium tech vision aids and products were supplied.

Beneficiaries: A potential beneficiary population was identified through a database obtained by the Ministry of Disability and Social Empowerment; patients undergoing neurorehabilitation at other healthcare organizations/hospitals/NGOs; spine injury patient support groups; social media and word of mouth.

Discussion

Data: The data on disabilities is not wholly accurate as it is under reported in India, either due to social stigma or lack of awareness about disability classifications and assistive technology. This lack of accurate data is a challenge when formulating policies and programmes for PWDs in India.

Ecosystem: The market for accessible assistive products and the government support is fragmented and regionalized. This task requires the collaboration between medical/rehabilitation professionals, product innovators/manufacturers, service delivery agents and funding agencies.

Provision: In a country as big and populated as India, there is no centralized, comprehensive system for access to AT products or their service delivery. People from lower income groups must rely on donations or government schemes and, even then, receive low-quality, non-customized that are not appropriate for their individual requirements.

AT Products: The transfer of AT technologies to low-resource settings in limited. There is a limited number of assistive products designed, produced and maintained in India. Assistive products from outside India, do not consider things like terrain, language or maintenance in their product design. **Personnel:** Since Patna is not one of the major metropolises, finding trained healthcare professionals in the field of AT is difficult. There is also no training program in AT for physiotherapists and occupational therapists in their training curriculum.

Skills training: The caregivers of PwDs from lower income groups are generally family caregivers who were used in our training and support.

Outcomes

The Mobility AT Program

In 6 months of the pilot project, 43 patients (between the ages of 19-50) have been assessed virtually and all have received customized wheelchairs to their specifications.

 Table 1. Type of wheelchairs donated.

Type of wheelchair	Count
Standard Folding	36
Rigid	3
Rough Terrain	2
Electric	2

There has been increased participation and beneficiary retention in the neurorehabilitation and AT program with the introduction of the teleassessment module – the adapted WHO TAP guidelines. Also, the skills training and peer mentoring for beneficiaries and their families has meant a greater long-term impact on the beneficiaries.

The Vision AT Program

The program helped install 5 new desktops, 2 orbit readers along with text-to-speech devices, note-takers, braille-kits and smart canes. The special educators were also upskilled to reflect the updated technology. As part of the collaboration, the school also received tactile graphic books for the national curriculum and the students and educators were trained in how to read the visual components of the curriculum.

Conclusion

With the help of our cohesive ecosystem approach, we have increased our reach and impact to PwDs in satellite towns and districts of Bihar, increased the efficacy and efficiency of our medical personnel through our WHO adapted assessment guidelines and are able to provide customized wheelchairs to our beneficiaries. This has, in turn, improved the usability of the wheelchairs and reduced their rejection rate which has helped to improve the QOL of our beneficiaries and increase their employment opportunities. Not only this, but our skills training and peer mentoring modules for our beneficiaries, and their family caregivers, have resulted in a much higher engagement and impact than our efforts in previous years.

To conclude, PwDs will be benefited greatly by the development of a sustainable ecosystem in India in which they can receive medical & rehabilitation support, assistive products, skills training and peer mentoring.

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Designing inclusive learning with the use of assistive technology: teachers' capacity development in Eastern Europe and beyond.

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Abstract

This contribution presents the method and rationale behind the development of a teachers' and school teams' guide for the use of assistive technology for inclusive education in Eastern European countries, which is supported by UNICEF. The design and development of the guide structure and is informed by academic work, UNICEF existing resources, real-case scenarios from educational practice and consultation with and feedback from groups and individuals as potential users of the guide.

Keywords

assistive technology, inclusive education, children, capacity development

Introduction

The efforts to promote inclusive education specifically in low/middle income countries are increasing at a global level. Within this framework UNICEF has turned its efforts in empowering educational systems and the teachers' communities for developing policies and implementing education for all [1], though segregating educational practices are still prevailing in many European countries, including Eastern Europe.

Recognizing the disparities among disadvantaged groups of students and the call for equal opportunities in education, regional efforts have shifted focus of educational strategies to changing national policies towards inclusive education [2]. At the same time, following the advancements in assistive technology and the needs for digital inclusion in a rapidly digitally transforming world, focus on inclusive education has been connected to the provision and implementation of assistive technology in education [3].

Arguably, the realization of inclusive education, with the support of assistive technology is a multifaced process within the broader assistive technology ecosystem. Assistive technology itself has multiple roles in making inclusive education happen. These lie from making the school physical environment accessible to redefining the learning environment in order to enable learning for all [4]. Furthermore, stakeholders of various roles, with various responsibilities and perspectives need to interact and collaborate in and with different subsystems for successful implementation of assistive technology in education and beyond, with a shared vision. Each stakeholder regardless of the service and setting in which assistive technology is provided holds a unique but interconnected role. Teachers and school teams as education professionals retain an essential role in this ecosystem. Therefore, one of the main endeavors in supporting inclusive education through assistive technology is the empowerment of teachers and school teams to build their professional capacity within the educational and the assistive technology service delivery system.

In the following the method and the final output of developing a guide responding to the capacity building needs of teachers and school teams is presented.

Method

Research evidence highlights that limited assistive technology and digital competences of stakeholders in the educational sector has been one of the main barriers to inclusive education, especially for learners with disabilities [6].

In response to this challenge several competency and capacity building frameworks have been developed. Thorough study of the current literature and the existing frameworks led to the establishment of four main principles upon which the AT Teachers' Guide has been developed. These principles constitute fundamental assumptions in relation to teachers' readiness in (a) identifying barriers to equal access to education and the needs of learners for the use assistive technology; (b) choosing and integrating assistive technology in inclusive pedagogies design for learning; (c) developing accessible and assistive technology enhanced learning activities and material in which technology has an added value; and (d) working collaboratively in a whole school approach.

Assumptions deem very relevant for countries in where steps towards inclusive education are turning towards a sys-

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temic approach, promoting either the establishment of educational resource centres [7] or educational reforms in centralized systems.

Findings as final Output

In order to develop guidelines that build capacity upon the four principles mentioned in method above a set of competences selected and adapted from existing frameworks was mapped across the four assumptions. The SKATE Competency Framework was mainly adopted and adapted here, also informed by other frameworks relevant to inclusive education, digital competences and assistive technology.

Based on the identified sets of competences, the main pillars of the Guide have been developed. Further development of the content is informed by academic work, UNICEF existing material and resources as well as real-case scenarios from educational practice indicating advancement of inclusive education through the use of assistive technology.

The final UNICEF Guide titled: 'The use of Assistive Technology in Education: A Guide for Teachers and Schools' includes four sections. The first two sections aim to contextualise the guide in the framework of inclusive education and inclusive pedagogy and the Assistive Technology ecosystem respectively. These refer mostly to the pedagogical and technology resources aspect of teachers' and school teams' empowerment. Section 3 focuses on the principles and guidelines of integrating digital and assistive technology into lesson planning and learning activity building. This covers the instructional aspect of competencies, in terms of designing inclusive learning experiences with assistive technology. Section 4 concludes to the imperative of a whole school approach. The importance of planning short term and long term implementation through a systemic approach is highlighted.

Concluding remarks

For the development and finalization of the Guide consultation with and feedback from groups and individual educators and experts as representatives of potential users of the Guide was obtained in various stages. This process facilitated the emphasis on keypoints, which lead the elaboration of each section. Validation of the Guide is anticipated in the next phases through the design of learning modules for teachers' professional development and the possible collection of relevant data and experiences.

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Eight years of AAC in Bulgaria: achievements and problems

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Abstract

In 2014, the term Augmentative and Alternative Communication (AAC) was unfamiliar in Bulgaria. It was first introduced in 2015 by ASSIST – Assistive Technologies a foundation created to increase awareness about AAC and ensure its provision in Bulgaria. Since then, significant progress has been made, and the use of AAC is now officially part of the programs for developing inclusive education in Bulgaria. Full or partial financial support for AAC devices has been available for several years from the social institutions like the Ministry of labour and social policy. At the same time, although reasonable funding is available via various mechanisms, paradoxically the adoption of AAC by professionals – SLPs, resource teachers, occupational therapists, psychologists and others – is not at the level of the existing possibilities and more importantly the existing needs of children with communication needs. The presentation and analysis of the process of introduction and development of the use of AAC in Bulgaria can be interesting and instructive for other emergent countries in this field and help them benefit from the existing experience and avoid some errors. **Keywords**

AAC, countries emergent in AAC

AAC in Bulgaria

In 2014, the concept of Augmentative and Alternative Communication (AAC) was unknown in Bulgaria. However, since its introduction in 2015 by ASSIST – Assistive Technologies (ASSIST – AT), a foundation dedicated to raising awareness and ensuring AAC provision in Bulgaria, significant progress has been made. AAC is now more and more used in inclusive education in the country funded by various large scale national projects. Families with children with complex communication needs have had access to AAC systems via a temporary funding mechanism set by the Bulgarian Ministry of labour and social policy.

Despite the availability of reasonable funding through various mechanisms, the adoption of AAC by professionals, including speech-language pathologists (SLPs), resource teachers, occupational therapists, psychologists, and others, has not reached the level commensurate with the existing possibilities and the needs of children with communication difficulties and their families.

The talk presents the analysis of the above-mentioned processes with the main goal to inform activities in emergent countries in AAC and allow them to benefit from the Bulgarian experience and avoid potential pitfalls. At the same time, several barriers have been identified existing also for countries with a longer history in AAC.

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Strategy

ASSIST – AT has adopted a holistic approach to engage all relevant stakeholders, including individuals with communication impairments, their families, professionals, inclusive education centers, social services institutions, and governmental bodies such as the Ministries of Education and Science, and Labour and Social Policy. Emphasis has been placed on organizing large events, generating media coverage, and fostering a sustainable network of AAC stakeholders.

The main activities of ASSIST – AT are:

- Raising awareness via media and public events.
- Training in AAC and access AT for professionals, parents of people with complex communication needs, and students in relevant disciplines.
- AAC AT provision, needs assessment, consultations, and support of users.
- Development of educational publications and products related to AAC for the system of inclusive education and social service providers.
- Training and certification of professional in AAC and access AT.
- Development of university courses on AAC in related programs.
- Projects in inclusive education and social services.
- AAC policies and legislation initiatives.

Areas of Intervention

The most important areas of intervention in Bulgaria turned out to be the basic understanding of the goals and means of AAC, and especially the need for early intervention. The latter requires a healthcare system which starts from the physicians who diagnose the children, and a system of needs evaluation and support for the families – financial and professional.

To address these problems, the main stakeholders have been identified – neurologists, SLPs, resource teachers, psychologists, occupational therapists, etc. However, direct contact and organization of activities turned out to be difficult, and the focus of ASSIST – AT actions started to be the system of inclusive education where considerable funding from the European Union is available via several projects at the scale of the entire educational system.

Attempts to raise awareness among the existing university programs related to the use of AAC was not so successful but it was possible to create courses on AAC in one university (the New Bulgarian University) which are successfully taught for two years now.

As the qualification of the professionals turned out to be a major barrier to the fast implementation of AAC solutions, several projects with UNICEF Bulgaria, the Ministry of labour and social policy, the Agency for people with disabilities and others focused on training courses and work with specific groups of people with complex communication needs – people with additional motor impairments, children, and youth in residential home type facilities. Most efforts provided qualification for the professionals from the inclusive education system with a focus on the 28 regional resource centers and 42 centers for specialise educational support – instrumental in the sustainable development of inclusive educational.

An important part in this process played the international conferences on AAC (e.g. https://eceraac2021.assistfoundation.eu and https://aac2022.assistfoundation.eu) which gathered all stakeholders and covered topics from good practices to legislation to policies.

The introduction of AAC and access to computer technology in Bulgaria required a critical number of publications and tools in Bulgarian to support the activities in schools, social services, and families at home. A considerable number of publications covered the practical aspects of AAC. Among them two books must be mentioned [1,2].

The fist of them (the product of a 3 year project with the European Social Fund)[1] targeted children with CCN and severe motor disabilities and introduced in detail the work with AAC systems with eye-control, together with an extensive program for cognitive development and basic literacy implemented in Communicator 5 (Tobii Dynavox) and Grid 3 (Smartbox). Any effort in making AAC adopted in a country with no prior experience cannot be successful without appropriate changes in the legislation which provide the needed regulation to the provision and use of AAC. The initiatives of AS-SIST – AT in this direction led to the explicit inclusion of AAC and access to computer technology as part of the required equipment in the system of inclusive education. Additionally, provision of AAC devices and software were included for several years in a funding mechanism of the Bulgarian Ministry of labour and social policy via the so-called "Social support" fund.

Acknowledgements

The achievements and activities reported above would not be possible without the support of the Ministry of education and science, UNICEF Bulgaria, the Ministry of labour and social policy, and the European social fund.

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Assessment of AT and AAC capacity for children in Ukraine

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Abstract

The presentation will report the main outcomes of a country assessment regarding Ukraine's capacity to respond to the needs of children with disabilities regarding Assistive Technology (AT) and Augmentative and Alternative Communication (AAC). The assessment was commissioned by UNICEF's Regional Office for Europe and Central Asia (ECARO) and conducted in the period May-October 2022 by the author with the support of colleagues in Ukraine. **Keywords**

Ukraine, AT Capacity, UNICEF

Introduction

The main objective of the study commissioned by UNICEF was to complement the WHO surveys (r-ATA and ATA-C) regarding Ukraine [1] by providing an additional assessment of challenges and needs of children with disabilities for AT and AAC for learning and participation as well as a AT system gaps analysis specific to children with disabilities.

Different resources have been used to assess the state of the art of AT and AAC access and use in Ukraine, the most important ones being official reports, scientific articles, and, semi structured interviews and unstructured interviews with colleagues that know the national situation well.

The limited timeframe and available resources did not allow to equally investigate all aspects of AT provision. Especially the availability of products on the Ukrainian market and barriers to access that market require a more in-depth analysis.

Ukraine is a big country with a large population, which makes it difficult to pretend that this study provides a complete picture of the complexity at stake when discussing access to AT for children with disabilities in Ukraine.

Due to the war, it was not possible to visit the country to observe practices, or to gather information directly from a larger number of relevant stakeholders, including government officials. Also, some experts were hard to reach.

The AT and AAC Capacity Framework for Children

The data were collected using the Assistive Technology and Alternative and Augmentative Capacity Framework for Children which was written on purpose by the author and David Banes for UNICEF. UNICEF identified the need to establish such a framework that addressed the needs of children throughout their lives and across settings such as home, school and community. The framework could help low- and middle-income countries to improve national AT provision and build functioning AT ecosystems. The design of a specific framework to address the needs of children with disabilities drew heavily upon the work of the WHO GATE initiative that has identified 5 areas of intervention relevant to foster access to AT. The 5P's identified are: People, Policy, Provision, Products, Personnel.

The framework does not specifically take into account disruptive changes or humanitarian crises, reason why the assessment primarily refers to pre and post war scenarios.

The Framework lists a coherent set of objectives for any AT delivering ecosystem responding to the needs of children with disabilities. The objectives can also be seen as high-level areas of desired performance of the system, with indicators that can be used to assess the current state of the art. Having these high-level objectives referring to different aspects off access to AT makes it possible to define global and interconnected strategies to move from A to B, from where we are and where we would like to be. These high-level objectives are:

The disabilities and educational needs of children are identified as early as possible, and provide the basis for allocation of support, including assistive and communication technologies, to achieve their full potential. (People)

Policies are in place that guarantee that children with disabilities have access to appropriate assistive and communications technology to develop their full potential and for their inclusion and participation. (Policy)

A range of AT and AAC products are available that address the needs of children with a disability and are distributed across the country in a timely and cost-effective manner. (Products)

AT and AAC Provision systems offer effective supply and support of the technologies required by children with disabilities and are flexible, efficient, competent, and outcome-oriented. (Provision)

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Professionals in Education, Health and Social Care have the skills, knowledge, attitudes and understanding to provide guidance and support needed to implement AT and AAC solutions fully into practice. (Personnel)

Findings

Ukrainian society is moving towards a more person-centred inclusive approach in addressing the challenges of disability. Parents associations and NGOs are drivers of change.

In all areas of public policies relevant for children with disabilities there are significant steps made over the last years, in particular in inclusive education and early intervention. New structures and intervention models are developed or under development. Nevertheless, the situation on the field remains behind. Action plans should focus on creating a culture of inclusion, providing workable strategies and tools for those that need to implement inclusive policies.

The market for digital AT and AAC products and tools for learning and communication is not very well developed, largely due to the lack of demand. Barriers include awareness about their existence, the competences to choose and use them effectively, the absence of software in Ukrainian. However, there are initiatives in the country that could boost the demand, although the choice of appropriate technologies for the individual learner should not be left entirely in the hands of commercial players.

AT provision at the moment is fragmented and not person or whole-life-project-centred. The main players are the Ministry of Social Policies and the Ministry of Education that provide assistive products and solutions for inclusive learning. This fragmentation risks to lead to inefficiencies and inadequate public expenditure if needs are not assessed professionally and according to international good practice. A provision system should be put in place that values the role multidisciplinary teams composed of professionals with a technical, education and health related background that can advise the different actors in the care, education and support ecosystem about the role that technology can play for the development of the child and its future.

At this stage there is not a clear picture of who should support the AT or AAC adoption of children with disabilities. Most relevant professionals have not received specific training on this and therefore are not professionally prepared to conduct AT needs assessments or implement AT adoption pathways. Learning opportunities in AT and AAC are not delivered systematically yet.

Discussion and recommendations

At policy level, in Ukraine, there is an increasing support for inclusive quality education for children with disabilities, recognising the importance of inclusion in mainstream settings and person centred approached. Legislation and action plans have been developed on early childhood intervention, on inclusive education and more recently guidelines on AAC have been published. The inclusive education model has thus made progress, but is not completed yet [2,3]. The situation on the ground is remaining behind and many schools are not prepared to support learners with disabilities in an appropriate way. Special classes in mainstream public schools are the result, while for a significant part of the children special education in schools or institutes remain the norm.

Inclusive Resource Centres as promoted by the government are definitely an already existing opportunity to boost inclusive education and the fact that they work with multi professional teams definitely put them in the right position for picking up a leadership role and drive the change. However, these teams need training and resources to be able to advise parents and school staff appropriately and to monitor inclusive pathways in schools. A more in-depth analysis of their training needs and service standards would be advisable. When it comes to AT and AAC they should have good knowledge on available technology-based solutions and strategies for their use, to be able to transfer this knowledge and the related skills to teaching professionals.

Further the classroom conditions should be assessed, as well as the available staff in schools and their preparation, to make inclusive education increasingly a reality. The presence AT and AAC users in classrooms might require different space management, appositely prepared workstations, the need for Wi-Fi connections, attentive management of the relations within the group, etc.

An important challenge is to put an AT service delivery system in place that can bridge the gap between the needs of the child and the available solutions, including the strategies of use. This requires a multidisciplinary or transdisciplinary assessment during which all factors that impact on the technology adoption should be considered, including the health and social condition of the child, his or her stage of development and expected development, needs, ambitions and talents, contextual and environmental resources, next steps, etc. Once that picture is clear available solutions must be identified. Locally produced or already adapted and lowcost solutions should be privileged, as long as quality standards are met and the matching between the child, the context and the technology is optimal. Investing in services that can guarantee the most effective expenditure in AT provision does not only lead to cost savings, but also to reduce the risk of AT abandonment with related frustrations and a negative impact on self-perception.

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How to consider the real benefit of an assistive technology for visually im- paired people: test in real-life with a controlled environment

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Abstract

Consideration of the effectiveness of new technologies known as electronic headmounted aids for visually impaired people (e-LVAs) is based primarily on functional vision tests. While the focus should be on the ability of these systems to provide visual benefits, it is also necessary to ensure that these benefits can be translated into practical use. Indeed, e-LVAs are intended to help with activities of daily living and therefore also to meet the requirements of the environment. In this study, we test one of these e-LVAs through activities of daily living in vivo (at home) and in a controlled-apartment (Homelab - Vision Institute, Paris XII), to understand how and where this type of assistive technology can help visually impaired users in their daily lives.

Keywords

Real-life testing, low vision, electronic head-mounted aids, usability

Context

The marketing and the registration of electronic headmounted low vision aids (e-LVAs) as Class I medical devices has led to the need to evaluate the visual benefit of using this aid [1]. The three main e-LVAs on the market these days, the smart glasses eSight (esighteyewear.com), the augmented reality headset SightPlus (givevision.net) and the voice-reading device OrCam MyEye (orcam.com), answer for different needs of daily difficulties. OrCam My-Eye is specially designed to help with the reading of text on paper or daily objects. eSight and SightPlus have been designed for image processing for the global enhancement vision, and are intended to facilitate a wider range of daily activities. These two head-mounted displays have each been studied for their benefits with respect to functional vision [2, 3] using standardised ophthalmological tools such as the ETDRS, the Pelli-Robson scale or the MN-READ test. In addition to these tests, questionnaires are used to report on the daily activities that can or have been performed with the e-LVA. By using these methods, these studies show significant improvements in functional vision, but they also show that the subjective appreciation and benefit for the users is not unanimous. Although visual improvement is proven, the purpose of these e-LVAs is to allow people with visual impairments to regain autonomy and quality of life. The evaluation of the practical benefit cannot be satisfied with questionnaires alone, it would be more relevant to have a new field-based approach to

evaluate the benefit in daily life of the use of e-LVAs and the possible improvement of autonomy for people with visual impairment [4, 5]. In this study, we tested one of these e-LVAs, SightPlus, by proposing to evaluate the functional and subjective benefits through three activities of daily living. This study is unique in that it conducts these three tasks in a controlled apartment-environment before and after a home use phase. The aim of the study was to describe how and where this type of device can help the visually impaired users in their daily life.

Methodology

Twenty participants (8 females and 12 males; 54.3 \pm 15.72 years) were recruited, with a variety of ophthalmological deficiencies, visual acuity in the better eye having between 1.6 and 0.3 logMAR and at least "hand motion" for visual acuity in the other eye. Among them, fifteen participants had a central visual field deficit, and five participants had a mixed visual impairment. The e-LVA SightPlus was chosen for this study for its wide range of features (magnification solutions, filters, brightness management, image stabilisation and personalised settings), its ergonomics and that it has already been tested on its benefits for functional vision. The study was divided into three phases: (1) a discovery and familiarisation phase to help at become acquainted with of the e-LVA and the practice of the daily life tasks used for the evaluation; (2) A further of the familiarisation and the beginning of using the e-LVA in a familiar environment such as their home thus allowing the participants to test the e-LVA in their daily activities; and (3) an evaluation phase with and without the e-LVA through three tasks of daily life (sorting and reading mail, identifying images on a TV screen, pouring a glass of cordial with water) carried out in a controlled apartment (Homelab – Streetlab/Vision Institute, Paris XII). At the end of these tasks, the time

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and efficiency to perform the task and the type of action (visual, manual, hand-eye coordination) in the two conditions (with and without device) were statistically compared. A questionnaire was used to capture the difficulties encountered during the tasks by the participants. The objective and subjective measures were then correlated with the characteristics of the population (VA, CS, NEIVFQ 25, age) and with the adaptation to the use of the device.

Results and Discussion

The participants' familiarisation and understanding of the e-LVA was considered successful, on the one hand, because more than half of the participants succeeded in mastering 9 of the 13 functions proposed and, on the other hand, because the performance variables were not correlated with learning. During the home trial period, participants used the e-LVA between one and three times a week for between 11 minutes and 79 minutes each time. Nineteen activities were experienced with the e-LVA, the main ones were reading (14 users), watching TV/a screen (13 users) and looking at an outdoor landscape (10 users). 14 participants found the e-LVA useful for their daily activities and 12 thought that the e-LVA offered an advantage over their usual visual tools, particularly for the greater possibility of zooming. Comparisons between performance with and without the use of the e-LVA show that tasks and actions involving manipulation and hand-eye coordination are performed more slowly (p < 0.001) with the e-LVA. Nevertheless, participants were better and faster with the e-LVA on the viewing task (for success: p=0.002; for duration: p<0.001). Subjective feedback from participants also showed that the majority saw a benefit from using the e-LVA when they had to perform the task of reading mail and identifying images on a TV screen. However, for the task of pouring a glass of syrup with water, the e-LVA was considered to be visually restrictive (visual field) and uncomfortable (spatial offset) for completing the task. A strong and significant correlation was observed between the performance outcomes with the AV (r=-0.71, p=<0.001) and the CS (r=0.66, p<0.01) when the tasks were performed without the e-LVA. With the use of the e-LVA, task efficiency was no longer correlated with VA and CS (r=-0.39, p=0.111 and r=0.44, p=0.069). The distribution of subjective data (K-Means), shows trends towards the e-LVA being perceived as more useful for participants with low visual acuity (p=0.07)and a low NEI-VFQ score (p=0.067).

Conclusion

The aim of this study was to evaluate the functional and subjective benefit of an e-LVA during the performance of three activities of daily living. We found that the benefit of using an e-LVA is primarily related to comfort when reading and viewing screens. However, as soon as the task integrates motricity skills such as grasping, writing and pouring, it becomes very complex for the user, with a loss of fluidity. These observations were confirmed by the feedback from their home use. The users see this type of aid as beneficial but for a specific and punctual use. Our work has been to propose a new approach to assess these e-LVAs so that they can be better presented to potential visually impaired users but also so that the health authorities can understand the real added value of these medical devices. This approach has allowed us to go further in the evaluation and consideration of these assistive technologies for visually impaired people.

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The importance of the user's cognitive skills and opinions in evaluating the outcome of assistive technologies – The ATTAIN Protocol

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Abstract

The longitudinal observational pilot study ATTAIN (Outcomes of ICT Assistive Technology in RehabiliTAtIoN Pathways) aims to improve the quality of prosthetic intervention and verify the adequacy of assistive devices and measurement outcomes. Fifty patients needing prosthetic interventions for Augmentative Alternative Communication, computer accessibility, and environmental control are being recruited within the DAT Unit of the Fondazione Don Carlo Gnocchi "IRCCS S.Maria Nascente" in Milan. At baseline (T0), a physician and a psychologist perform a clinical evaluation and the AT outcome assessment. The participants will be contacted for the follow-up phase (T1) 3 to 6 months after receiving the assistive solution. At T1, clinicians will re-administer the AT outcome assessment. In order to make the assessment accessible to all participants, these tests and questionnaires are administered on Windows PCs, using Grid3 software, or on a specifically created accessible web page.

Keywords

ICT AT, AAC AT, AAL AT, Assistive Technology, Outcome Assessment

Context

The World Health Organization (WHO) defines assistive technologies (AT) as the fourth pillar of global health and the impact of AT interventions as one of the main priorities in research. Nonetheless, there is still very little evidence of the real impact of AT on patients' daily life [5]. When the recipients of AT are patients with communication deficits or difficulties in computer accessibility, it is much more complex to administer the tests and questionnaires. Indeed, decisionmaking ability assessments rely heavily on verbal expression, which is problematic for patients with communication difficulties who cannot express their thoughts verbally [4]. Furthermore, traditional test administration methods (paper and pencil) are rarely accessible. In this framework and based on evidence from a previous study (OMAT) [1], we have developed the longitudinal observational pilot study ATTAIN (Outcomes of ICT Assistive Technology in RehabiliTAtIoN Pathways) that aims to improve the quality of prosthetic intervention and verify the adequacy of assistive devices, and measurement outcomes.

Methodology

Fifty patients in need of prosthetic interventions for Augmentative Alternative Communication (AAC), computer accessibility, and environmental control (for example, communicators, facilitated keyboards, mouse emulators, eye pointers, accessibility software, and remote controls for home control) are being recruited within the DAT Unit of the Fondazione Don Carlo Gnocchi ONLUS "IRCCS Santa Maria Nascente" in Milan. At baseline (T0), a physician administers the Barthel Index 20 [9], the Modified Cumulative Illness Rating Scale (CIRS) [7], the ICF Generic Core Set-7, the ICF-core set for profiling communicative competence for AAC AT assessments or the ICF-Vocational Rehabilitation Brief Core Set integrated with some items of the Comprehensive one for ICT AT [14]. A psychologist assesses patients' cognitive status using the Oxford Cognitive Screening (OCS) [10], the CPM-Coloured Progressive Matrices [12], the Palm and Pyramid Trees Test - short version [2], the Aachener Aphasie Test (AAT) subtest on written and oral comprehension of words and sentences [8], and the Multiple Features Targets Cancellation (MFTC) [11]. In order to make the cognitive assessment accessible to all participants, these tests are administered on Windows PCs, using The Grid3 software, or on a specifically created accessible web page. According to the clinical and cognitive assessment, the health practitioner decides whether to administer the assessment protocol to the patient or the closest relative. The AT assessment protocol includes at baseline (T0): the EQ-5D-5L questionnaire [6] for quality of life and the Individual Pri-

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oritised Problems Assessment (IPPA) [13] to assess the importance and severity of the problems the participants expect to improve with the AT use. The DAT multidisciplinary team conducts the AT assessment, and the most appropriate assistive solution is identified, prescribed, or suggested. The assistive devices received are classified according to the international standard ISO 9999:2016 and the Ministry of Health Prosthetics and Assistive Products List (DPCM 12/01/2017). The participants will be contacted for the follow-up phase (T1) 3 to 6 months after receiving the assistive solution. At T1, clinicians will administer the IPPA, ICF Core Sets, EQ-5D-5L, and Quebec User Evaluation of Satisfaction with Assistive Technology Questionnaire (QUEST) [3]. Appropriate descriptive statistics will summarize quantitative data (mean, standard deviation, median, and ranges). Qualitative data will be summarized in contingency tables.

Results and Discussion

ATTAIN researchers implemented the cognitive test battery and the IPPA, QUEST, and EQ-5D-5L questionnaires on the Grid3 software or a dedicated accessible web page. Specifically, neuropsychological tests provide an overview of the patient's cognitive functions and investigate specific aspects helpful in identifying the most appropriate assistive solution. The evaluation of the patient's ability to understand written language can, for example, drive the choice of alphabetic or symbolic communication vocabulary. Similarly, assessing the ability to explore objects in space can facilitate the customization of-communication software. In addition, the possibility for patients to interact with accessible tests and questionnaires allows them to express their own opinion on the impact of AT in their daily life.

Conclusion

In conclusion, the ATTAIN study aims to improve the quality of prosthetic intervention by introducing clinical scales and patients' ability to express their opinion through AT outcome assessment accessible instruments.

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Cocreation with community-dwelling older adults to develop a mobile health application for promoting physical activity and a healthy active lifestyle

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Abstract

This study explores a co-creative process to develop a mobile health application promoting physical activity among elderly. The resulting app includes personalized tips, workouts and a community calendar. **Keywords**

Physical Activity, Older adults, mHealth, digital technology, cocreation

Introduction

Research has demonstrated the beneficial effects of regular physical activity (PA) on physical, cognitive, and mental health in older adults [1, 2]. The World Health Organisation (WHO) recommends that older adults aged 65 and above engage in at least 150 minutes of moderate-intensity aerobic or 75 minutes of vigorous-intensity aerobic PA per week. Additionally, muscle-strengthening activities should be performed at least two days a week. Despite the evidence supporting PA, older adults often fail to meet the recommended levels, increasing their risk for health complications [3, 4]. Efforts to promote PA in older adults have explored the use of portable and affordable technology, such as mobile health (mHealth), with promising results in terms of acceptance and adoption [5]. However, sustaining long-term engagement with these interventions remains challenging. To address the lack of PA and awareness of its benefits in older adults. it is crucial to understand the barriers and facilitators to acceptance and adherence and effectiveness of mHealth apps. Involving end-users in the design process can lead to more effective solutions [6]. Co-creative methodologies have shown promise in understanding the needs, desires and motivations of end-users [7]. Though, the involvement of endusers in the development of health technology is an underexplored area, with most studies focusing on prototype testing rather than the co-creative process itself [8]. Therefore,

the aim of this study is to develop and test an mHealth application, promoting PA and an active healthy lifestyle, through a co-creative design process with community-dwelling older adults, resulting in a more user-friendly and engaging mHealth app that has a long-term impact [9, 10].

Methodology

To gain a deeper understanding of the requirements of older adults, a co-creative process was employed, using the design thinking methodology [11] which encompassed comprehensive interviews (n = 22) to accomplish two primary objectives: comprehending the needs and motivations of the target population and delineating the problem associated with the insufficient levels of PA through information synthesis and problem framing. Subsequently, two co-creative workshops were conducted, involving older adults (n = 21) and experts (n= 8), to generate innovative ideas for tackling the identified problems. Inclusion criteria for participants included age (\geq 65 years), no severe illness, Dutch language proficiency and active participation ability. Results were qualitatively thematic analyzed and coded by the first and fourth author.

Finally, a prototype – concept was developed and tested on a small sample (n = 65) of the target population in Flanders, Belgium. This approach facilitated the iterative and user-centered design process that addressed the complex and multifaceted needs of older adults in relation to PA with the support of technology.

Results

In-depth interviews (n = 22, mean age of 76,05 \pm 6,27) revealed older adults had different perceptions of PA, but agreed on its importance. They recognized various health benefits of regular PA, e.g. enhanced mobility, balance and reduced risk of falls. They also valued the social and mental

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aspects of PA. Barriers to engaging in PA included subjective poor health, lack of time, lack of perseverance, bad weather, fear of falling, and the absence of a friend to exercise with. Additionally, some participants (n = 6) preferred enjoyable activities like walking or gardening over structured exercise programs. The majority of participants (n = 19) did not exhibit a high level of technology readiness when it came to using technology to assist in their PA habits, but were generally receptive to the idea.

Data-analysis of the co-creative workshops resulted in the identification of five main topics, i.e. perception of a healthy lifestyle, coping strategies, features of the mHealth App, visualisation of the screens and tailoring motivational notifications. Participants perceived a healthy lifestyle as one that prioritizes physical and cognitive health, as well as social connections and emotional well-being. The sessions also revealed that older adults use a variety of coping strategies to stay healthy and active. Preferences for the mHealth app included engaging and personalized content, ease of use, clear fonts and large buttons. Tailored notifications based on their specific needs and preferences were seen as crucial. The content, delivery method, and wording of these messages were deemed crucial. Through the process of co-creation, a mobile application aimed at promoting PA and fostering an active healthy lifestyle was developed, containing four major features: tailor-made tips, raising awareness and providing information, exercise workouts, and a community calendar aimed at enhancing social connections. The app was stepwise prototyped with specific attention to fonts, user-friendliness, size, and the development is still ongoing.

Discussion

The design thinking method is a powerful tool in technology development, particularly for addressing the needs of the elderly population. This study aimed to develop an mHealth application for promoting PA through a co-creative design process involving older adults and experts. The research methodology included in-depth interviews and co-creation workshops, allowing for comprehensive data collection on technology experiences and PA. By combining these methods, the study gathered nuanced data with implications for technology-based PA interventions. Motivating older adults to engage in PA requires a holistic approach that considers social, individual, and environmental factors. The study gained insights into areas such as perception of PA, coping strategies, barriers and facilitators, and attitudes toward mHealth apps. Coping strategies should focus on personal choice, natural inclinations and socialization. Barriers include physical limitations, fear of injury, and lack of social support, while facilitators include social support and companionship. Implementation challenges include addressing the digital divide and providing personalized solutions that align with older adults' lifestyles and preferences. Emphasizing positive benefits, reliability, and effectiveness can encourage longterm technology use among older adults.

Conclusion

This study tried to identify coping strategies, motivators, barriers, and facilitators for engaging in PA, highlights the challenges of implementing mHealth apps and the importance of personalized solutions. By considering these findings, interventions might effectively support older adults in leading active and healthy lifestyles. Future research should evaluate the long-term impact and consider holistic factors influencing behaviour change in this population.

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Design thinking used to develop a VR protocol for arm and hand rehabilitation after stroke

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Abstract

The method of design thinking was used to develop a VR protocol for arm and hand rehabilitation after stroke. Stakeholders included researchers, physical therapists and occupational therapists, and VR specialists. A working prototype where real life activities could be performed in a garden, was tested with both stroke patients and health care professionals. Using VR in arm and hand rehabilitation proves to be promising. Further research on effectiveness and implementation is necessary.

Keywords

rehabilitation, stroke, virtual reality

Introduction

Patients often suffer from problems in arm and hand function following stroke. Rehabilitation does offer effective treatment methods, by physical therapists and occupational therapists [1]. Technology is already often used to make treatments more efficient. However, due to lack of time, not all arm and hand skills can be practiced in rehabilitation, leading to suboptimal results. A VR protocol to train arm hand skills in rehabilitation could provide a solution. The research question in this research project was 'What should an immersive VR application look like in order to optimally support training of arm hand skills for patients after stroke?'

Methods

The method of design thinking was used to create a working prototype [2]. The project took place at rehabilitation center Adelante in Hoensbroek, the Netherlands. Stakeholders in the project included health care professionals, VR specialists and researchers. In phase one: *'empathize'*: a focus group with health care professionals at Adelante Zorggroep and individual interviews were held, in order to assess the needs for a VR application. The interviews were audiotaped and transcribed. The data was analyzed using qualitative content analysis [3].

In phase two and three: 'define' and 'ideate' sessions with all stakeholders were held to determine the program of requirement for the VR application. This led to three use cases and matching persona. The most promising use case was chosen for the development of the prototype.



The test phase consisted of two rounds of testing the prototype with each 6 physical and occupational therapists and 6 stroke patients with problems in arm hand skills. Think aloud method was used for the test phase. After each round of testing, feedback was processed and the prototype was improved.

Results and discussion

Using the method of design thinking, a prototype VR application was developed for use in arm hand rehabilitation following stroke. It was concluded that immersive VR could be promising for patients with a mildly affected arm and hand following stroke. Patients should be able to practice in realistic daily life situations that were not possible in the rehabilitation center, for example gardening. Therefore a VR application was developed, were working in a garden, picking fruits and vegetables was possible with two hands, seated, using hand tracking. This application was tested and feedback was processed. Feedback focused on accuracy of the movements, safety and the creation of a realistic environment. The end result was a working prototype.

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Conclusions

Patients and therapists were positive, despite minor issues in the use of the application. The application is user-friendly and invites the patient to move both hands. Further research for effectiveness and implementation is necessary.

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Is it reproducible?: A case study on a dissemination of the CAD method for the visually impaired

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Abstract

One visually impaired (VI) person became interested in the CAD methods for the (VI) that the author is researching. This paper describes the skills he acquired through e-mail correspondence and explores dissemination of CAD for the VI.

Keywords

LATEX, Visually impaired, 3D CAD, 3D printing, E-learning, DIY assistive technology

Background

The visually impaired, who cannot see graphics displayed on a screen, are not capable of 3D modeling using commonly used CAD software. Based on this awareness of the problem, the author, who is himself visually impaired (totally blind), has promoted the direction of programmable CAD and devised a form of CAD modeling that does not require confirmation of the modeled object on a screen.[1]

The method examined in this presentation, which has been validated as a modeling tool in addition to a self-help device production tool, should be made readily available to a wider range of visually impaired people (VIP). There is a question as to whether this method is only available to the author and not to VIP in general. The group led by the author has regularly organised online symposia to publicise the usefulness of models and self-help devices created with 3D printers.^[2] At the symposium held in August 2022, in order to concretely demonstrate the usefulness of that method as a DIY AT, [3] an actually 3D printed white cane holder modelled by the author (Fig. 1) was sent to those who wished to use it in advance. The source code used for its modelling was also Released. One visually impaired participant (Part.A) contacted the author with a wish to perform 3D modelling using programmable CAD. This report analyses the interaction between the author and the Participant A and explores the dissemination potential of the modelling method proposed by the author.

Method and process

The Part.A had analysed the white cane holder and its source code, then wrote the sample source code for his own object and emailed it to the author. His source code was sent to the author prior to the symposium.



Figure 1. The white cane holder modelled by the author.

Therefore, the Part.A could not relied on the author's oral explanations at that symposium. In addition, at this point in time, he did not have 3D printing hardware/software. This fact confirms the high motivation of the Participant A to 3D modelling and the understandability of the author's method.

The sample sent by the Part.A was entitled 'sushi restaurant teacup' (Fig. 2.' The object was a combination of two cylinders from which a thinner cylinder had been removed. The participant A had analysed the functions and their variables contained in the source code of the author's white cane holder to write this source code. The participant did not understand the 3D coordinates in which the object (in this case, the cylinder) was placed by default, so this 'sushi restaurant teacup' was not properly modelled.

Soon after that symposium, the author pointed out the error in the source code and sent him an e-mail with the corrected source code. The author also printed out the 'sushi restaurant tea cup' using his corrected source code and shipped it to the Part.A.

After some e-mail exchanges, the author then introduced the processing software and API documentation used to compile the source code.[4] Thereafter, the Part.A continued to learn programming CAD on his own.

The key conditions under which the participant A was

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Figure 2. The 'sushi restaurant teacup' modelled by the Part.A and corrected by the author.



Figure 3. A coaster and a Braille plate which are modelled by the Part.A after a half an year.

placed were as follows. 1. He had general programming experience. 2. He has a family member who can see the generated STL data as a graphic on the screen. 3. He is able to ask a vendor to 3D print the STL data. These conditions are advantageous for debugging the source code.

In January 2023, the Part.A showed the author coasters and a Braille plate (Fig. 3) as examples of his progress. For the printing of this Braille plate, the Part.A has implemented a function that can output arbitrary Braille

patterns. A function that can output arbitrary Braille would be useful for the visually impaired, but is not easy to realize.[5] The implementation of this function is noted as an achievement, although the versatility realized by the Part.A needs to be verified.

Considerations

This series of activities by the Part.A is an example of how the modelling method proposed by the author can be learnt if he/she has experience in programming, a desire for 3D modelling and the means to check the results of the modelling. It is also noteworthy that the communication for this learning was completed only by e-mail exchanges between the author and the Part.A, both of whom are visually impaired.

Acknowledgements

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Can time assistive technology help persons with dementia improve their daily time management? A randomized controlled trial

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Abstract

This study provides knowledge of effective time-related interventions for persons with dementia, knowledge that is important for clinicians and policymakers if access to assistive technology for persons with dementia is to improve. **Keywords**

Ageing, Alzheimer's disease, Time aid, Time orientation, Time processing ability

Context

Dementia affects the ability to perform desired daily occupations, many of which are dependent on daily time management. In time-dependent societies, the ability to manage time in daily occupations is of great importance for independence, participation, and well-being. The increasing number of persons suffering from dementia is leading to new demands, in terms of costs and care burden, for society as well as for significant others. The lack of medical cures entails a major need for non-drug interventions, e.g., the use of assistive technology. However, research investigating the effect of assistive technology use on occupational performance for persons with dementia is scarce. Thus, the aim of this study was to investigate to what extent time assistive technology supports persons with mild to moderate dementia to achieve their time-related goals regarding the occupational performance and satisfaction with the performance.

Methodology

This multicenter single-blinded randomized controlled intervention study is part of an international research project, "Manage time with dementia". A study protocol is registered at www.clinicaltrials.gov (US website) NCT03677284.

Twelve registered occupational therapists working with memory investigations in 10 different regions in Sweden recruited persons with mild to moderate dementia and carried out the data collection at baseline before allocation of participants to intervention or control group. The randomization was conducted by independent researchers in the project using a computer algorithm. After the allocation, all participants received a brochure developed for the study at baseline. It included common difficulties to manage time due to dementia. The brochure also provided examples of strategies to handle the problems. In addition, the intervention group received an individually prescribed time assistive technology as support in daily time management, including instructions and training in using the device. The control group that only received the brochure was offered individually prescribed time AT three months after inclusion.

The primary outcome measure Canadian Occupational Performance Measure (COPM) is a client-centred measure to detect change in self-perception of occupational performance over time. It was used at baseline to identify activities in which the participants should use prescribed time assistive technology as support in daily time management. In COPM, the participants rated current occupational performance and satisfaction with performance on a scale from 1-10. The secondary outcome, Kit for Time-Processing Ability – Senior (KaTid-Senior®), is an objective measure that was used to describe the level of time processing ability. Three months after the baseline, a follow-up with COPM and KaTid-Senior was carried out by researchers in the project that were blinded for the participants' group allocation and intervention.

To examine the outcome of the intervention, a comparative analysis of the differences in COPM scores for performance and satisfaction, at baseline and at follow-up after three months, was conducted for the intervention group and the control group.

Preliminary results and Conclusion

Of 73 randomised participants, 34 were allocated to intervention group, and 39 to control group. At postintervention assessment after three months, data from the primary outcome measure COPM were available and analysed for 26 participants in intervention group and 31 in control group.

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Preliminary analyses show that the intervention group was supported by time assistive technology in carrying out the specified time-related activities. Although there was no significant difference in the time processing ability (KaTid-Senior) before and after the intervention in none of the groups, ratings in COPM regarding performance (p = 0.04) and satisfaction with performance (p = 0.01) was significantly improved in the intervention group. Moreover, the difference between ratings at baseline and 3 months

was ≥ 2 points for performance and satisfaction with performance, showing clinically significant changes in the intervention group.

The preliminary results suggest that time assistive technology is effective in supporting persons with mild to moderate dementia in daily time management. Thus, such intervention should be offered at an early stage of dementia when time-related impairments are observed.

Further data analyses, carried out during spring 2023, will be presented at the conference.

Right to Connect: Case Study exploring the role of Co-Researcher in the Co-Designing of an Accessible eLearning Platform.

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Keywords

Co-researchers with intellectual disabilities, Inclusive and Accessible Research

Introduction

There is a growing need for more people with disabilities to be co-researchers, especially in accessibility projects. People with intellectual disabilities can share their experiences and good ideas about how to make things more accessible for more people. [1] This paper talks about how people with intellectual disabilities can help with research. We will share what we did to help more people understand the research and what we were trying to do. We will also share some of the challenges and barriers. This case study shares why it is important to help more people become from diverse backgrounds to take active roles in research. One of the toughest challenges is finding accessible literature to support co-researcher to take part in each step of the research process.

Background

As a part of the European Funded Right to Connect project¹, a 40 people with intellectual disabilities from five Eu countries are co-designing an accessible eLearning platform and creating accessible courses to support their peers in courses exploring 'using digital technology, Internet Safety, social media and being part of our communities. The project hired co-researchers to help the teams first discover more about the needs of adults with intellectual disabilities before the co-design happened. Then, the co-researcher discovered what is and is not working during the co-design. Finally, they learned more about the co-designers' experiences through interviews with other co-designers. People with intellectual disabilities (PwID) helped make the e-learning platform from start to finish. So, when we did the research, we wanted to involve co-researchers with intellectual disabilities too!

¹RTCN https://righttoconnect.entelis.net/

They were part of the research team and helped with the tasks. We used assistive technology to support the co-researcher's understanding of the topics and accessible communication to ensure everyone was understood.

Methods – Who, what and how the coresearcher supported the research?

The co-researchers played a vital part in this project. In this case study, the co-researcher will share what it was like to be a co-researcher, what they learned and what was challenging. [2] They will also tell us about tools that helped them. We hope this will help other people with disabilities to be co-researchers too. In this case study, the co-researcher will share the role and tasks they did:

1.	supported the ethics	6.	made the accessible
	application		surveys
2.	co-designed the re-	7.	co-designed the In-
	search questions		group questions
3.	co-designed acces-	8.	analysed the results
	sible information;		of the research
	consent forms, and		
	videos		
4.	choose an accessible	9.	co-designed a re-
	survey tool		search report
5.	trained peers on	10.	shared the results
	how to use the sur-		
	vey		

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Positive Impact	Negative Impact
Feeling more confident: When people with disabili- ties work as co-researchers, they can feel better about themselves and more confident because they are doing important work.	It can be tough emotionally: Research can be hard, especially if it's about something difficult to talk about or if it brings up bad memories. Co-researchers with disabilities might feel emotional stress if they don't get enough support. Having a circle of support team members is important to support the co-researcher. [3]
Meeting new people: articipating in research can help people with disabilities make new friends and build re- lationships with others in their community and take on new social roles.	It can be physically tiring: Some research might take time. There is a need to ensure that tasks are spread out over a few sessions and that everyone is comfortable with the amount of work.
Learning about research: By working as co-researchers, people with disabilities can learn more about how research works and how it can help people. They also gain new skills in; curiosity critical thinking skills, problem solving, communication, teamwork, data analysis and ethics.	There might be power differences: Co-researchers with disabilities might feel like they don't have as much say or power in the research process, especially if they're not treated equally, or their ideas aren't taken seriously. It is essential to have accessible research Ground Rules established at the start of the study where everyone understands their roles and responsibilities and agrees on the study plan.
Feeling more powerful: People with disabilities can feel more powerful and in control of their lives when they work as co-researchers and have a say in what happens during the research.	Some people might discriminate: Sometimes, being a co-researcher with disabilities might make people treat you differently, especially if the research is about something people are unsure about. The team mustn't judge others and work together.
Getting access to new resources: Participating in research can help people with disabilities learn about new resources that can help them in their daily lives	Sometimes the information could be easier to un- derstand. Every effort must be made to ensure everyone understands the research study's information.

Table 1. Positive and Negative Impact of being a co-researcher

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Assess eye tracking as a controller's effect on player's experience and feel

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Abstract

Because of eye tracking's effect on cognitive load and its simplicity of use, we hypothesized that positive effects of eye tracking as a controller would be higher for players with low focus abilities such as players coming from cognitive diversity or with low numeric literacy.

Objective: We want to verify the effects of eye tracker as a controller on player's experience and check if these effects' intensity are more pronounce or not on players identifying as part of cognitive diversity or with low numeric literacy. Methods: We developed a module allowing to select, activate, move and link items on a 2d game using ET as a video game controller. We designed two interaction solutions based on the literature and developed them both as options in a Unity3D package. Participants will be asked about their digital literacy and difficulty to use informatics and if they

identify as part of cognitive diversity.

Results: Data are currently being collected and will be ready for the conference.

Keywords

Accessibility, alternative controller, eye tracking, video game

Background

Eye tracking has long been reserved for research due to its prohibitive cost. Recently, a new trend saw the development of cheaper, less precise models aimed at a broader public for nonscientific purpose such as gaming.

When using an alternative game controller, especially one that could improve accessibility, it's necessary to assess its effects on player's interaction and feel for different publics in order to use the controller to its fullest and recommend best practices.

Previous work on eye tracker compared it to more traditional controller. Eye tracking used as a controller has shown interest in accessibility, pleasure of use and increase of performance.

Concerning accessibility, eye tracking has shown to reduce cognitive load and is felt as more "natural", "less tiring" and "easier" to use [1].

Concerning pleasure of use, eye tracking has been showed to increase immersion [2]. Smith and Graham (2006) showed that Eye tracking is preferred by players on one out of three tested interactions but hypothesized that when mouse was preferred it was due to the "midas touch" problem that arise when a player activate an element of the game unwantedly by looking at it.

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It is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0), which permits copy and reproduction of the material in any medium or format, provided the original author and source are credited. Concerning performance, speed of interaction is generally better [3] but not all studies find the same results [4]. It is important to note that these differences may be explained by difference in selecting method. Usually, to select or activate an object, game using eye tracker rely on dwell time which are not the same for each studies.

Because of its effect on cognitive load and its simplicity of use, we hypothesized that the eye tracking as a controller intensity of player's experience increase would be higher for players with low focus abilities such as players coming from cognitive diversity or with low numeric literacy.

Objective

We want to verify the effects of eye tracker as a controller on player's experience while taking into accounts the "Midas touch" problem. We want to check if these effects' intensity are more pronounce or not on players identifying as part of cognitive diversity or with low numeric literacy.

Methods

In order to test that, we developed a module allowing to select, activate, move and link items on a 2d game using ET as a video game controller.

We chose to develop our module for 2d games as a Unity package. We chose Unity3D as a game engine because it is wildly used and we therefore think that it would allow a better re usability of our module

We designed two interaction solutions based on the literature and developed them both as options in a Unity3D package. The first method needs only ET as a controller and use dwell time to activate looked upon interactible elements. The second method use ET as a controller and require another controller for input to activate looked upon interactible elements.

Participants will be recruited from within CGI, where the project is funded, via internal communication channels. They will be asked about their digital literacy and difficulty to use informatics and if they identify as part of cognitive diversity.

We hypothesized that the second version will have better results in speed of interaction due to the absence of dwell time and with interaction where the "midas touch" problem could hinder the player. We hypothesized that the first version will have better results overall in ease of use and pleasure of use with interaction where the "midas touch" problem doesn't exist.

We hypothesize that while an increased player experience will be seen for all players, increase will be stronger for players with low numeric literacy and players identifying as part of the cognitive diversity.

Results

Data are currently being collected and will be ready for the conference.

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Doing more with dialogue: Harnessing virtual assistants and artificial intelligence to discuss disabilities, provide support and overcome barriers

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Abstract

Conversational user interfaces such as chatbots and virtual assistants can support disabled students to talk about needs, barriers, technologies and strategies. This has great potential to tackle the administrative burden associated with assessing needs and gaining appropriate support, and the lack of support for the use of assistive technology. As artificial intelligence advances, new forms of advisors and assistants could help students to overcome a wider range of barriers due to their potential to hold an adaptable dialogue and play multiple roles in making learning more accessible.

Taylor, a virtual assistant that has been introduced to support Open University UK students to disclose disabilities and ask questions about study and support, will be used to highlight some of this potential. Evaluation findings and areas for enhancement to Taylor will be described, along with areas for further exploration such as how to map disabilities and barriers to technologies and strategies, and the positioning of these innovations in relation to individual and institutional responsibilities. In our current work, we want to develop collaborations and co-create designs to explore this space further.

Keywords

Education, Artificial Intelligence, Virtual Assistants, Chatbots, Student Support

Context

Innovations in assistive technology and the wider use of online and blended learning approaches present greater opportunities than ever for disabled people to study equitably. Restricting this potential, however, are factors including a lack of support for the use of assistive technology [1], the administrative burden placed on disabled people to gain support and adjustments for study [2] and the continued use of inaccessible platforms and media in teaching and learning [3].

More positively, assistive technologies, accessibility features and plugins are now often available at low cost or as part of mainstream operating systems, applications, and mobile platforms [3, 4]. We also increasingly see the potential of online tools and networks based around artificial intelligence (AI) approaches to support individuals to overcome a wide range of barriers to learning. Researchers have highlighted opportunities for AI such as simplifying complex language or providing recommendations based on context and preferences [5]. Large Language Models open up further potential to overcome communications barriers and make it more realistic for systems to understand complex descriptions and dialogue [6].

Approach

We take a participatory approach to design and evaluate how a dialogue between students and an AI-powered chatbot assistant could address these issues. We recognise the value of dialogue between expert human advisors and students, but also that this expertise is a limited resource which is often either under pressure or not available to students who would benefit from it.

We began with a focus on administrative burden in the ADMINS (Assistants to the Disclosure of Management about Needs and Support) project. Working with students and advisors we explored the potential to replace a formbased process for disclosure and support with a dialogue with a virtual assistant. The assistant 'Taylor' asks students a series of questions about their needs, explaining aspects of study along the way, and can be interrupted by students to ask questions, therefore having the potential to improve their understanding of what study entails and what support could be appropriate to them. Feedback from a trial of 134 new students comparing Taylor with the existing form-based process for disclosure was positive and provided us with further directions as to what students wanted from such a system [7].

Across institutions, countries and forms of study, differences exist in the processes and requirements around supporting disabled students, and in the support that is most appropriate for each individual. But there are also commonalities in what is required of such processes, such as the ability to understand various functional needs, conditions and potential support options and to present relevant information

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to both students and staff. Exploratory workshops with a range of staff from other institutions suggested broader applications for Al-based dialogue in disability support and accessibility across educational settings [8].

Aims and Future Work

Building on this foundation, we continue to enhance Taylor as a live system available to students at The Open University UK, for example through provision of personalised suggestions to students based on what they have told us. In parallel, our Digital Access Advisor project seeks to develop partnerships, participatory design and contributions to a knowledge base, and a prototype for a new kind of assistant which can hold an effective dialogue with disabled students from wider contexts, providing them with useful support to their studies.

This presentation will highlight key areas for research and development in achieving this vision:

- Effective ways to capture and use data that maps the space of disabilities, educational contexts, assistive technologies, study strategies and relevant resources
- The participation of disabled people, experts in accessibility and inclusion in education, and wider stakeholders in the design of these systems
- The gaps in understanding that still exist in how to make these conversational user interfaces accessible [9].
- The positioning of technological innovations like this in relation to institutional responsibilities and individual empowerment.

We welcome contact from interested practitioners, researchers and organisations as we build collaborative efforts that can create the fullest impact of the potential identified.

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Beyond Helping: Uncovering the ethical considerations of deploying Digital Voice Assistants to support participation by people with disabilities and older citizens

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Abstract

As the numbers of people with disabilities actively using technology to support their day-to-day activities increases the benefits afforded by these technologies are ever more evident (Enable Ireland Disability Federation of Ireland, 2016). Much of the technology used by people with disabilities is often characterised as Assistive Technology (AT) which is designed and developed to address the specific needs of people with disabilities (Boot et al., 2018; Copley Ziviani, 2004; Draffan et al., 2015). In contrast to AT which is focussed on serving the needs of people with disabilities, consumer digital technology refers to those technologies that are developed for use by the general public. The aim of this study was to explore the assistive potential of a range of exemplar consumer digital technology, namely, digital voice assistants and internet of things. A qualitative study was conducted in the context of a field-trial of a range of digital consumer technologies which included a Digital Voice Assistant alongside voice-operated Internet of Things technologies. This field-trial saw a total of ten participants with disabilities recruited and the technology listed above installed in their homes for a six-week period from April till June 2022. Each participant engaged in pre and post-trial, semi-structured interview. Both the pre and post interview data were analysed thematically using the method outlined by Braun and Clarke (2006). Thematic analysis yielded three major themes; 1) how technology changes the nature of the home, 2) the joy of exploring possibilities and 3) technology as a member of the family. Further sub-themes uncovered participants' views and perceptions as to how people with disabilities made optimal use of the technology available, the processes by which they set-up and embedded technology use in the routines of the household and ways in which technology changed their lives and the functioning of their homes. The use of Digital Voice Assistants and other consumer Internet of Things technologies by people with disabilities is likely to increase over the forthcoming years as the inter-connectedness and assistive functionality of such devices increases. Although the development of such technology is not aimed explicitly at meeting the needs of people with disabilities and older people, developers and manufacturers of consumer technologies understand that reflecting the diversity of users will increase their market share. Furthermore, this study showed also that there are hitherto unanticipated benefits that can be accrued by people with disabilities and older people simply by making the technology available to them and supporting them to use it. As developments in networked capacities increase people with disabilities and older people will look to extend their use of voice-controlled technology for convenience, entertainment, and for connecting with real and virtual communities.

Keywords

Consumer Technology, Assistive Technology, Digital Voice Assistant

Background

There are myriad ethical concerns relating to the use of commercially available Digital Voice Assistants (DVAs) or Smart Speakers as assistive devices for people with disabilities. The most prominent of these issues is privacy, which is our starting point; but discussions around privacy by no means exhaust the scope for ethical research. Many of the ethical issues apply equally to people with disabilities and those without, though some aspects are peculiar to persons with disabilities. It is worth bearing in mind that the use of DVAs, such as Amazon Echo, as assistive devices takes place in a political and economic context. DVAs are designed for commercial reasons by massive corporations such as Amazon, Google/Alphabet or Apple. Such devices form an important element of the development of "surveillance capitalism" in which large companies compete for people's data in order to better attract, keep and direct users' attention. The extent of

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the data gathered and the uses to which it is put is not easy to determine. This broad point applies to DVAs too: "The big tech firms are coy about exactly what they are planning to detect in our voices and why, but Amazon has a patent that lists a range of traits they might collect, including identity ("gender, age, ethnic origin, etc."),health ("sore throat, sickness, etc."), and feelings, ("happy, sad, tired, sleepy, excited, etc.")" [1]. This paper explores several areas of ethical and philosophical consideration including, privacy, autonomy, informed consent, bias and anthromorphizing and discusses these as they relate to the use of DVA's as assistive devices.

Privacy

Privacy is the most prominent concern relating to the use of Digital Voice Assistants (DVAs) as assistive devices. In order to function, DVAs must be able to listen to users, thus creating threats to privacy. Simply put, DVAs have the capacity to continuously listen to users and to events in the users' homes. Philosophically, privacy is a complicated and contest idea, with various different accounts having been advanced [2, 3]. That said there exists a consensus that privacy is of great importance, a consensus that is reflect in a number of international documents that enshrine privacy as a basic right by the United Nations [4] and by the European Union (Council of Europe, 1997) According to these documents, states, institutions, and individuals have a general obligation to respect privacy. Depending on what a DVA is recording, any of these aspects of privacy could be threatened. Different data sets can reveal much about the user, including information they did not want to reveal or information they were unaware of themselves. Such data could be revealing of habits, preferences (political, cultural, sexual), psychological well-being, and physical health.

Informed Consent

Obtaining informed consent from users will be a central plank in widespread use of DVAs, including Amazon's ECHO. Whilst the value of informed consent has been recognised in medical ethics for the last few decades, it has recently entered debates around Big Data, data mining, and novel technologies [5, 6, 7]. There have been countless academic debates regarding the threshold of being sufficiently informed. However, it is clearly the case that a person has not been sufficiently informed when they have been deceived, lied to, or not been given full disclosure about their new circumstances. Beauchamp and Childress, who have written extensively on medical ethics define informed consent as "an individual's autonomous authorization of a medical intervention or of participation in research" [2, p 122]. However, the fact that DVAs will be able to gather data that can be used to make inferences about the physical or psychological conditions of users suggest that ethical principles around consent in research and medical contexts are explored in relation to the use of DVA as an assistive device in domestic settings.

Autonomy & DVA's

By their nature DVA's have the capacity to influence their users, as such it can impact on their autonomy. Autonomy is often understood as the capacity for self-rule, the capacity of a person to make decisions for themselves [8, 9, 10] and is of immense moral significance. These issues are more prominent for users with Intellectual and Developmental Disabilities (or, indeed, cognitive decline). Such users may have a reduced capacity to query or ignore suggestions or nudges from the DVA. This is not to claim that being influenced by another person of a DVA is the same as abandoning autonomy or being brain-washed; this is clearly not the case. However, the potential to be manipulated is increased by the presence of DVA that are capable of continuously surveilling the user or simply gathering limited data over a long period of time. The potential such a DVA to nudge people or impinge their autonomy connects quite clearly with decisional privacy, as this aspect of privacy is rendered close to meaningless if a person is no longer acting autonomously.

Conclusion

This sketch of the ethical issues likely to arise from widespread use of commercially available DVAs in disability contexts suggests that there are a number of areas that should concern interested parties, as well as some significant benefits. If we are to maximise the benefits and minimise the harms associated with DVAs such as Amazon's ECHO, these areas need to be explored in more detail. A fuller ethical exploration of the issues can result in ethical recommendations that will benefit users, institutional policymakers, and legislators.

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Unlocking Opportunities; A Q-methodology informed examination of the ways in which adults with disabilities utilise their smartphones to assist with daily living

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Abstract

The importance and use of assistive technology for adults with disabilities is well documented. However, there is limited research in the area of mainstream technology and adults with disabilities. The function of a smartphone and its associated uses is progressing at a rapid rate offering features that can be essential for daily living. It is important that the research remains up to date with this rapid expansion of technology. The aim of the study is to analyse the subjective views that adults with disability have on smartphone use, and to explore the possibility of how the use of smartphones could enhance the quality of life for adults with disabilities in Ireland. It is suggested that mixed methods research is useful when seeking to gain a better understanding when investigating complex problems in healthcare. This study is guided by the Q methodology, a mixed-methods approach. This study suggests that the mainstream nature of the technology, the diversity of functionality and the ability to personalise a smartphone contributes to a subjective positive impact upon a person with a disabilities' quality of life.

Keywords

Smartphone, Quality of Life, Adult, Disability, Mixed Methods, Q Methodology, Ireland

Context

Quality of life is both complex [14] and subjective [3]. As a result, it is a concept that has been difficult to define [2], and measure [18]. Research has highlighted that often, those who have a disability experience a reduced quality of life [9, 10, 11]. Furthermore, there is strong evidence indicating that assistive technology is used to aid and enhance the quality of life of adults with disabilities [1, 7, 12, 13]. Although the importance and use of assistive technology for adults with disabilities is well researched, there is limited research in the area of mainstream technology and adults with disabilities. Considering an assessment conducted by the Central Statistics Office in 2019 more than 77% of all Irish citizens between the ages of 16-74 use a smartphone [4], this suggests that we are living in the era of the smartphone. Studies suggest that the function of a smartphone and its associated uses is progressing at a rapid rate offering features that can be essential for daily living [15, 19]. However, research failed to explore how adults with disabilities in Ireland are using smartphones daily, and there has been little exploration of its impact on their quality of life. Furthermore, there is an absence of mixed-methods studies to analyse the subjectivity of smartphone use.

Methodology

It is suggested that mixed methods research is useful when seeking to gain a better understanding when investigating complex problems in healthcare [17]. As aforementioned, quality of life is a complex and subjective experience. Thus, for the purpose of this study researchers utilised a mixed methods approach informed by the Q methodology to explore and examine the usage of smartphones, and how it has impacted upon quality of life from the perspectives of those who have a disability. First developed by William Stephenson in the 1950s [16] Q-methodology uses both qualitative and quantitative techniques to study subjectivity [6]. Guided by the Q-methodology, data collection and generation involved the following steps: (1) concourse development, (2) development of the Q sample, (3) selection of the participant set (P-set), (4) Q sorting, (5) post sorting activities, (6) factor analysis, and (7) interpretation of factors [5, 8, 20]. Relating this to the study, a concourse of statements was derived from a review of the literature. These statements reflected all the different things people may say or think about smartphones and quality of life. (1) A total of thirty statements capturing the essence of the full set were selected as the Q sample. (2) Fourteen adults who live with a disability were recruited (P-set). (3) The Q sample was ranked according to what the P-set felt was most important to enhance their quality of life. (4) A follow

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up semi-structured interview was completed immediately after statements were ranked allowing time for the P-set to explain and expand on why they placed the statements the way they did. (5) Data from ranked statements was analysed using factor analysis to reveal different ways statements were grouped. (6) The resultant factors were interpreted and named as themes which will be supported by the qualitative data gathered in the semi-structured interview.

Results

Responses from Q-sort represented a ranking of their perceptions as to the statements presented to them. These underwent factor analysis using the SPSS ver27 software with a view to identify relationships between these perceptions. The factor analysis identified three key "users"; (1) Pocket Networkers (2) Digital Organisers (3) On-the-go tech users. The qualitative data gathered contributed further to the analysis and provided valuable elaboration for the key themes identified here.

Discussion

This study examined the subjective perceptions of adults with disabilities in Ireland with regard to their ownership and use of mobile phones. Participants in this study expressed a shared understanding that their relationship with their mobile phone was one of growing interdependency where their reliance on their technology increased with its utility in their daily lives. Their mobile phones were seen not only as devices for communication, accessing information, services and leisure but provided additional functions such as ensuring their safety and their ability to optimally participate in many community activities. Furthermore, this study suggests that the mainstream nature of the technology, the diversity of functionality and the ability to personalise a smartphone contributes to a subjective positive impact upon a person with a disabilities' quality of life. However, a certain caution should be exercised with regards these results as the study is modest in scope and ultimately exploratory in nature.

Conclusion

To conclude this study explored the daily use of smartphones among adults with disabilities, to better understand how smartphones are enhancing their daily life and to determine specific smartphone features that can be utilised to improve autonomy, engagement, and overall quality of life.

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Application of the Cognitive Orientation to Daily Occupational Performance (CO-OP[™]) Approach to Training in the Service Delivery of Mainstream Smart Home Technologies

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The Autonomy, Safety, and Social Integration via Smart Technologies (ASSIST) Project was initiated to develop an evidence-based, best-practice service delivery model for Mainstream Smart Home Technologies (MSHT). The project has been implemented in several phases and is nearing its conclusion in serving the needs of persons with complex physical disabilities. The service delivery model our team has developed includes a comprehensive assessment, technology selection, implementation, training, and follow-up. This presentation focuses primarily on the training aspect of the ASSIST Service Delivery model, which has applied the CO-OP Approach[™]. The CO-OP Approach[™] is client-centered and enables persons to actively engage in problem-solving. Verbal self-guidance serves to aid in the generalization of skills with the support of the therapist providing the training. The session will highlight several case studies of research participants who benefitted from the CO-OP ApproachTM in effectively using MSHT in their daily lives.

Keywords

Smart home, mainstream technologies, physical disabilities

Context

Under the Assistive Technology Act of 1998, the federal definition of assistive technology (AT) is "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain or improve functional capabilities of individuals with disabilities." Traditionally, AT refers to technology specifically designed for people with disabilities, including wheelchairs, environmental control units (ECUs), augmentative and alternative communication (AAC) devices, and adaptive equipment for sports and recreation. Research in the field has focused on various aspects of traditional AT, such as new design and development, service delivery, and training.

With the rise of digital consumer electronics, mainstream smart home technologies (MSHT), such as home automation devices and smart speakers, are becoming increasingly powerful, affordable, and relevant to solving our day-to-day problems, permeating every aspect of our lives. As these technologies have much to offer to people with disabilities, potentially improving their independence and connections to the community, they are also often considered AT [1]. However, unlike the traditional AT, these MSHT are designed for people whose independence is not compromised and are u

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mostly for convenience and entertainment. Mainstream technologies generally do not consider the abilities and needs of people with disabilities concerning access and use, nor the integration and/or compatibility with their existing AT. Research has shown that a key element to assure that people with disabilities obtain the most appropriate AT that meets their needs and benefit from the solution(s) is the quality of AT itself and a quality service delivery process. Therefore, for people with disabilities with complex needs, simply purchasing off-the-shelf MSHT may not be an effective solution [2]. Unfortunately, there has been a substantial lack of empirical research on delivering MSHT as AT and establishing the clinical role of such technologies in improving the performance and/or quality of life of people with disabilities [3].

Methodology

The Autonomy, Safety, and Social Integration via Smart Technologies (ASSIST) Project was initiated to develop an evidence-based, best-practice service delivery model for MSHT. The ASSIST service delivery model includes up to 12 treatment sessions with an occupational therapist and a technology specialist over a 3-month period [2]. The model includes a comprehensive assessment, technology selection, implementation, training, and follow-up. The assessment includes an occupational profile interview, functional skill assessment (motor, cognitive, sensory, and mobile device screening), ASSIST Functional Performance Index (AFPI) that helps identify needs, environment assessment, and goal setting [4]. Technology selection involves trialing devices and ecosystem interfaces and compatibility considerations regarding integrating AT and mainstream devices. Given the large amount of customizable MSHT available, selection can be overwhelming and lead to under-utilization or abandonment of devices if not implemented to meet the user's needs. Implementation involves device installation, device setup and configuration, and customization.

Central to the premise of ASSIST is to prioritize the needs of the participants and work towards client-centered goals. The intervention involves several sessions over a 3month period. The actual session number (no more than 12 sessions) depends on the number of goals identified by the participant and their progress towards achieving their goals. In general, the sessions in the first month focused on personal assessment, goal identification, home assessment, technology exploration and selection, plan of implementation, and technology installation and configuration. We set a budget cap of \$5,000 USD per participant to cover costs needed for devices and services (e.g., for installation such as an automatic door and home internet). However, depending on the number of goals participants could realistically achieve within a 3-month intervention period, the costs could be less. The sessions in the second month focused on user training to operate and configure home automation technologies.

The sessions in the final phase, or the third month, focus on exploring and learning apps for smartphones and smart speakers. Sessions during the last two months will be spaced so that participants can practice the activities with the professionals and then on their own. The provision of training is a critical aspect of the service delivery process for the majority of persons. In the ASSIST Service Delivery Model, training is guided by the Cognitive Orientation to Daily Occupational Performance (CO-OP) model. CO-OPTM is a clientcentered approach designed to enable performance in a goaldirected manner. The therapist works with the client using cognitive strategies to achieve the following objectives: 1) skill acquisition, 2) strategy use, 3) generalization, and transfer [5].

Discussion

This presentation will further engage participants by describing four unique case studies that have applied the ASSIST Service Delivery Model and the CO-OP ApproachTM to training. These case studies have been carefully chosen to demonstrate a range of client needs and MSHT applications. Session participants will also be provided time to generalize the content to their own practice and the opportunity for discussion and questions.

Acknowledgments

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Theories, models and frameworks to understand barriers to the provision of mobility assistive technologies: A scoping review

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Abstract

There is good evidence that Mobility Assistive Technologies (MATs) improve occupational performance, social participation, educational and employment access, and overall Quality of Life (QoL) in people with disabilities. However, people with disabilities still face barriers to accessing MATs. The aims of this scoping review were to summarise and synthesise: 1) Theories, Models and Frameworks (TMFs) that have been used to understand MAT access; and 2) specific determinants of access. We used the 5-stage approach developed by Arksey and O'Malley. We searched MEDLINE, Embase and CINAHL. We included 14 articles, using 6 TMFs which were synthesised into nine interconnected propositions The synthesised theory emphasises that mobility is essential for human flourishing and certain health conditions may impose restrictions on mobility. This impact can be ameliorated by two direct determinants: the provision of suitable services and their comprehensive provision. These services are influenced indirectly by policy and cost. Socio-cultural factors and personal factors also affect access to these services. Ineffectively addressing these determinants could limit access to MAT and subsequent disability. Our synthetic model describes the logic of providing evidence-based MATs, and we identify determinants of access which can act as targets for future work to improve MAT service provision.

Keywords

Assistive technology, Mobility, Barriers, Theories, Scoping review

Background

Many studies have proven the benefits of mobility assistive technologies (MATs) in improving occupational performance, social participation, educational and employment access, and overall quality of life in people with disabilities [1]. However, people with disabilities still face barriers to accessing affordable and available MATs [2]. While several studies have identified the reasons why the need for MATs remains unmet, no efforts have been made to identify and synthesise theories, models and frameworks (TMF), and barriers to the provision of MATs. Therefore, the aims of this scoping review were to 1) summarise and synthesise TMFs that have been used to understand the barriers to the provision of MATs to overcome the limitations of individual TMFs and provide greater insight into the barriers and 2) synthesise the barriers

identified in these studies using the consolidated framework for implementation research (CFIR) [6] to highlight knowledge gaps and research priorities.

Methodology

A scoping review was conducted using the 5-stage methodological approach developed by Arksey and O'Malley [3]. The BeHEMoTh (behaviour of interest, health context, exclusions, models or theories) was used to formulate the review question and search terms [4]. Literature searches were performed on MEDLINE (Ovid), EMBASE (Ovid), and Cl-NAHL (EBSCO). A theoretical synthesis based on the work of Pound and Campbell [5] was performed. The CFIR [6] was used to analyse and categorise the barriers indicated in the identified articles.

Results and Discussion

The synthesis included 14 articles, including studies from South Africa, Mongolia, Canada and India, Australia, Malaysia, New Zealand, Uganda, Brazil, the United States, Sweden, and Canada and the United States. Six TMFs representing varied perspectives were identified: the International Classification of Functioning, Disability, and Health

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Framework, the Human Activity Assistive Technology model, the Integrated Multi Intervention Paradigm for Assessment and Application of Concurrent Treatments, Levesque's theoretical framework, Gibson's affordances theory, and the systematic development model.

These TMFs were synthesised into nine interconnected propositions. The synthesised theory emphasises that mobility is essential for human flourishing and certain health conditions may impose restrictions on mobility. This impact can be ameliorated by two direct determinants: the provision of suitable services and their comprehensive provision. These services are influenced indirectly by policy and cost. Furthermore, an individual's accessibility to these services is determined by their socio-cultural environment and personal factors. If these direct and indirect determinants are not effectively addressed, it could result in limited access to MATs and subsequent disability.

Categorising the barriers to the provision of MATs, according to the CFIR, showed that the following constructs were the most important for describing barriers: cost, complexity, patient needs and resources, external policy, readiness for implementation, knowledge and engaging.

Conclusion

The findings of this scoping study provide a clear understanding of the factors that influence MATs provision. Addressing these determinants is crucial for ensuring appropriate and comprehensive service delivery to enhance mobility and participation. This knowledge can be used to develop focused strategies to enhance provision.

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Insights from Integration of Vision Screening and Provision of Glasses into Liberia's National Community Health Assistant and School Health Programs – A Novel, Sustainable, Government-led Approach to Increasing Access to AT

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Abstract

Leveraging proven models, the Government of Liberia, in partnership with EYElliance, is integrating vision screening and eyeglass provision in school and community health programs. Over 295,000 students, 8,300 teachers, and 6,300 community members have received vision screenings and eyeglasses if needed. Learnings include prioritization, integration feasibility, scale-up strategies, healthcare worker motivation, and sustainability. These insights have broader implications for integrating assistive technology in government programs.

Keywords

Refractive error, eyeglasses, community eye health, school eye health, systems change

Context

Vision impairment is a major public health problem worldwide, impacting health, quality of life, economic productivity, and safety. Without good vision, both children and adults are excluded from a world of economic opportunity. It is estimated that the global economy loses \$414 billion in productivity each year because of uncorrected poor vision [1]. The public and private sectors have traditionally allocated little attention and resources to addressing the market for eyeglasses in less developed countries. This has not only led to over billion people in need of glasses, [2] but also a lack of distribution channels with which to reach them. Like other models for AT delivery, existing delivery streams function almost exclusively outside of government health systems and consequently struggle to reach and sustain scale. [3] Recognizing this opportunity, Liberia, with the support of EYElliance, sought to pilot the integration of vision screening and provision of glasses within its school health programs and national CHW program.

Methodology

Adapting Proven Models for Government Delivery: School Eye Health

Access to eyeglasses prevents children from growing into

adulthood with poor vision and delivers lifelong benefits, improving education outcomes and increasing personal earnings [1]. Despite this positive impact, few LMICs have successfully tackled this issue within their education and health systems. To help fill these gaps, NGOs across diverse contexts have introduced school eye health programs. Initiatives from East and South-East Asia to Latin America and Sub-Saharan Africa have proven school eye health to be a simple, cost-effective approach for identifying children with vision problems and providing them with prescription eyeglasses [4].

In 2017 EYElliance established an Evidence Lab in Liberia at the request of the then president, Madame Ellen Johnson Sirleaf. Recognizing both the wealth of evidence from NGO-led efforts and the president's political will to endorse a national program, the Ministry of Education and Ministry of Health set out to design and test a government-led approach to school eye health as a core component of the national plan. EYElliance has supported the Ministries to operationalize their phased national school eye health plan by: 1) convening organizations or businesses with the relevant expertise to fill capacity gaps; 2) leveraging the existing infrastructure to minimize costs; 3) systematizing training and data collection; and 4) providing an exit for philanthropy.

Since this inception, Liberia has made great strides in establishing an enabling environment for students and teachers to receive services through its National School Eye Health program. As an initial step, the government appointed a School Eye Health Technical Working Group, convened on a regular basis by the Assistant Minister for Student Personnel Services. With guidance from the Technical Working Group, the government designed the national program based on best practices laid out in the broadly endorsed Standard

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Guidelines for Comprehensive School Eye Health Programmes.[5] Further, in 2018 the Government integrated the National School Eye Health Program into its School Health Policy and Essential Package for School Health.[6] Subsequent successes in program delivery led the Ministry of Education to spotlight School Eye Health as a "key result" in its 2020 Joint Education Sector Review.

Adapting Proven Models for Government Delivery: Community Health Workers (CHW)

Achieving equitable access to reading glasses is a solvable problem. Community-based models for basic eye health screening and provision of reading glasses have proven effective across diverse contexts. To-date, over 35,000 community-level workers have been trained in Bangladesh, China, Kenya, Rwanda, Uganda, and Pakistan, creating a new eye health workforce to reach those previously without access. However, these models have operated almost exclusively outside of government health systems. To address this challenge, EYElliance's strategy leverages existing, governmentled CHW programs to bring basic vision screening and reading glasses to the nearly 1 billion people who need them.

To test this strategy, EYElliance partnered Liberia's Ministry of Health to integrate these lifechanging services into its National Community Health Assistant (NCHA) Program. To achieve this integration, the Ministry of Health is embedding community eye health components across the program's existing systems,—starting with a pilot in Margibi County. To begin, the MOH incorporated vision screening and provision of reading glasses into existing CHW program materials and SOPs for training, supervision, reporting, monitoring, and supply chain. Training content was adapted from WHO's Training in Assistive Products [7] and LV Prasad's "Basic Eye Screening Test" protocol. [8]

Results and Discussion

To date, 217 community health assistants have been trained in basic vision screening and delivery of reading glasses and over 5,300 pairs of reading glasses have been dispensed to community members. Given the NCHA program's traditional focus on maternal, and child health, the Ministry's introduction of eye health services has expanded services to all adults. The Ministry has reported that this expansion has enhanced CHAs' motivation and augmented community perceptions of the NCHA Program overall. Building on these findings, the Ministry has now formally embedded basic vision screening and provision of reading glasses into the recent revision of its community health policy and training curriculum.

Furthermore, 3,893 teachers have been trained to conduct screenings, more than 295,000 students and 8,300 teachers across 7 of Liberia's 15 counties have received vision screening through the National School Eye Health Program, and 1,424 students and 1,901 teachers have received glasses. With support from EYElliance and the Liberia Consortium, the Ministries of Education and Health are on track to provide vision screening and eyeglasses, when needed, to approximately 85% of children enrolled in public and community schools at the primary and secondary levels by the end of 2023. Plans for securing the short-, medium-, and longterm financing to reach and sustain full national scale are under discussion as part of the Ministry of Education's current education sector planning and budgeting process.

EYElliance is currently conducting evaluations on the cost, level, and impact of integration of eyeglasses into government-led school eye health program and the community health program. Results will be shared at AAATE 2023. Liberia's experiences have generated valuable insights and resources to aid countries as they integrate vision screening and provision of reading glasses into their CHW and school health programs. Key areas include: rationales for prioritization; feasibility and effectiveness of integration; pathways for scale-up and sustainability; positive impacts on CHW program foundations; and strategies to leverage key enablers and manage common challenges. We believe that many of these findings will be applicable for the integration of other AT services by government programs beyond eyeglasses.

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Hearing loss and access to hearing aids and services in low- and middle-income countries

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Abstract

WHO reports that nearly 80% of persons with disabling hearing loss live in low- and middle-income countries (LMICs), and it is estimated that 34 million children have a hearing loss. Furthermore, 60% of hearing loss in children is due to avoidable causes that can be prevented. The aim of this study is to explore the prevalence and cause of hearing loss among children in primary schools in Tanzania and their access to hearing aids.

A cross-sectional study including 1081 primary school children in class II and III was conducted to determine the prevalence of hearing loss, using both self-reporting questions and pure-tone audiometry (PTA).

Assessment using PTA documents the prevalence of hearing loss to be between 11,5% and 23% depending on the selected hearing threshold. Self-reported hearing loss was reported to be 1%. None of the children with hearing loss had access to hearing aids.

The study documents that access to hearing aids and hearing services is limited in semirural area of Tanzania.

Keywords

Hearing impairment, hearing services, prevalence, low-and middle-income countries, hearing aids

Context

Hearing loss is often invisible and can be difficult to recognize, thus making it challenging to provide early interventions, appropriate hearing services and appropriate hearing devices. Hearing loss in children has been shown to have an impact on all aspects of life at individual level including communication and speech, cognition, language, employment, and academic performance [1,2]. WHO World Report on Hearing further indicated that hearing loss may also lead to increased risk of school dropouts, social isolation, and exposure to violence [2]. Nearly 60% of hearing loss in children is due to avoidable causes that can be prevented through implementation of public health measures [1].

About 80% of people with disabling hearing loss live in low- and middle-income countries (LMICs), where human resources, services and hearing devices needed to address hearing loss are not commonly accessible [1].

The WHO rATA survey [3] is documenting that 4,8% of the study participants had "some difficulty" in hearing when

asked to self-report. Only 9,1% of those in need for hearing aids reported to have access to hearing aids. A recent study from Gambia reports that 25,5% of the study population needed hearing aids, and the study concluded that it is high prevalence and low coverage for hearing aids [4].

There are also previous studies from Tanzania documenting the prevalence of hearing loss among children in school to be between 7 - 17%, but there are few studies available on access to hearing services and devices in local communities [5].

Our vision is to contribute to "Leave No One Behind" by including children with hearing loss in school. The aim of this study is to explore the prevalence and cause of hearing loss among children in primary schools in Tanzania and their access to hearing aids. Furthermore, to identify the gap between self-reported hearing loss and measured hearing loss.

Methodology

This study was conducted using a descriptive quantitative cross-sectional design. The data collection was conducted during end of 2022. 1081 children were included in the study from seven different governmental primary schools in semi-rural areas of Tanzania. All children in class II and III were screened for hearing loss. The total sample include 45,5 % boys (n = 491) and 54,5 % girls (n = 589), average age of 8 years.

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Hearing capacity was measured in school, using puretone audiometry (PTA) and classified based on the audiometric hearing thresholds. WHO defines normal hearing below 20 dB [2]. A study conducted in South Africa [6] refers that it is appropriate to set the threshold level for hearing screening slightly higher, due to challenging test conditions with reference to background noise when screening in schools. A systematic review including 28 studies, with the aim of identifying the prevalence of hearing impairment in Africa, indicated the most common hearing threshold for hearing loss to be 25 and 30 dB [7]. For this study the threshold was set to be 25 dB, due to the background noise in the classrooms.

For self-reporting of hearing, we used the question on functional difficulty asking: Do you have difficulty hearing, without using any products? This is based on the Washington Group Short Set on Functioning (WG-SS) and like the rATA Questionnaire [9].

Informed consent for the screening was obtained from the District Educational Officer, the headmasters of the selected schools and the parents. Special teachers asked the questions and conducted the hearing assessment using audiometry. Ear-Nose and Throat (ENT) specialists conducted otoscopy and inspection of the ear. The research study is approved by the National Institute of Medical Research in Tanzania and the Regional Committees for Medical and Health Research Ethics (REK) in Norway.

Results and Discussion

We are currently analysing the data using SPSS. The preliminary results from the hearing screening indicates that prevalence of hearing loss below hearing threshold of 25dB is 23% and below 30 dB is 11,5%. The prevalence of hearing loss decreases by changing hearing impairment cut-off from 25 dB hearing loss to 30 dB. This corresponds well with previous studies in Africa and Tanzania [4, 5].

In our study self-reported hearing loss indicating "some difficulty" in hearing was reported by 1% of the participants. This is in line with a large self-reporting survey carried out in Tanzania where the head of the family reported that 1% had some difficulties in hearing [8]. While the WHO rATA survey reported that 4,8% of their study participants had some difficulties in hearing [3].

Our study indicates that there is a gap between self-reported hearing loss of 1% and hearing loss reported from assessment of screening for hearing loss to be between 11,5 and 23% depending on the selected hearing threshold.

The data also include the cause of hearing loss, and the preliminary analysis indicates that impacted ear wax blocking the ear canal may cause hearing loss. When the ENT specialists removed the earwax the child's hearing was screened again and the hearing was normal. This finding is in line with previous studies in Tanzania [5]. We are currently analysing this data and will provide more detailed results. Ear infections is also causing hearing loss and may be prevented locally with appropriate interventions.

Conclusion

The study generated knowledge about the prevalence of hearing loss among children in semirural primary schools in Tanzania. Prevalence of hearing loss based on hearing assessment in local governmental primary schools is high, while self-reported prevalence of hearing loss is low. There is a need for conducting hearing screening at local primary schools to identify hearing loss in children and take preventive measures. Access to hearing aids for children in primary school is limited, and there is a need for available hearing services in school.

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Implementation of Tele-assessment and Delivery of Wheelchairs in Low/Middle-Income Countries

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Abstract

According to WHO, 1.3 billion people (16% of the world's population) are living with some form of disability. Of this population, about 80% are from developing countries. The challenges of delivering wheelchairs to persons with disabilities (PwDs) in these countries, many of whom are from the lower socioeconomic group include affordability, multiple trips required for both measurements and delivery of Assistive Technology (AT) products, non-availability of care-givers, lack of integration of neuro-rehabilitation in AT services, lack of awareness and lack of healthcare professionals working in this field. Most of the wheelchair donated in the past and still is through government agencies and other NGOs is through mass camps where standard-size wheelchair are given to all beneficiaries. In our experience, most of our beneficiaries have received multiple such wheelchairs but did not use them because of reasons like ill-fitting of wheelchairs and lack of mechanisms to address trouble-shooting. It is with this background, that our NGO explored the possibility of conducting a pilot study to see if telehealth is an option for assessing beneficiaries for customizing wheelchairs and to check the satisfaction level using the Functioning Every Day with a Wheelchair (FEW) instruments.

Keywords

Teleassessment of wheelchairs, Low/Middle Income Countries, Distribution of wheelchair through teleassessment

Context

The India Census 2011 indicates that there are 26.8 million persons with disabilities in India, comprising 2.21% of the population, with 69% living in rural areas and 31% in urban areas. Uttar Pradesh, Maharashtra, Bihar, Andhra Pradesh, and West Bengal are the states with the highest number of persons with disability (PwD), comprising almost half of the total disabled population.^[1] Bihar has one of the highest disabled populations, with 23,31,009 PwDs, representing 8.69% of the state's population.^[2] Many PwDs in remote rural areas of Bihar lack access to neuro-rehabilitation and assistive products such as wheelchairs, walkers, crutches, etc.

Problem Statement

The PwDs living in remote rural areas of Bihar face difficulties in making repeated trips for wheelchair assessments, deliveries, and training, as most of them belong to the below poverty line (BPL) category and lack the resources to travel or have caregivers to accompany them. Those without proper wheelchairs rely on their caregivers and are often Bed-ridden. Up till now, wheelchairs were given in mass camps where one size fits all model was used which resulted in the non-use of the wheelchairs. Moreover, the complexity of wheeled mobility and seating interventions is exacerbated by various factors, such as intricate seating and positioning needs, environmental factors, and a broad range of product interventions. The limited availability of qualified practitioners with specialty expertise in this area further exacerbates the problem, particularly in non-urban areas, causing people to be isolated from rehabilitation services. Therefore the customization of wheelchairs has a wider acceptance.

Objectives

The provision of the appropriate wheelchair can enable PwDs to lead more independent lives with dignity, and confidence, and enable them to seek employment or continue with their education. Customized wheelchairs are designed and built to meet individual requirements, providing optimal comfort, balance, and posture for the user, as well as increasing the wheelchair's efficiency to maximize the user's abilities given that each person has a different neurological impairment. This paper aims to present our pilot project of conducting a need assessment of PwDs through teleassessment for appropriate size, type of wheelchair, and subsequent follow-up.

Methodology

Four members of our medical team have been trained under WHO TAP (Training in Assistive Products for Mobility) guidelines, wheelchair customization workshops, and other virtual courses on Telehealth and Assessment of Function and Mobility. Our team has adapted these guidelines to suit

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the socioeconomic factors of the rural landscape and modified the assessment to conduct it virtually on PwDs with the following Criteria;

The **inclusion criteria** are beneficiaries who were referred for wheelchairs, and beneficiaries/ caregiver who have smartphones, beneficiaries with good upper limb function, beneficiaries who can come to the AT centre to collect wheelchairs.

The **exclusion criteria** are beneficiaries/caregivers who don't have a smartphone, beneficiaries who have severe spasticity or are bedridden, and beneficiaries who couldn't come for getting the wheelchair from the center.

<u>Arrangement for teleassessment:</u> This is conducted by making 2-3 calls depending on the availability of the beneficiaries and the caregivers. The call is to understand the socioeconomic and environmental factors in considering the appropriate wheelchair type. The Socioeconomic and environmental factor call consists of asking questions such as the beneficiaries' financial situation, their primary caregivers, previous wheelchair experience, primary living environment, and work environment. After the socioeconomic call, a thorough neurological assessment is conducted which consists of questions such as their type of disability, neurological diagnosis, duration and details of the injury, and upper/lower limb functionality. The third call is for a comprehensive assessment regarding seat width, foot and backrest, and cushion type for accurate customization of wheelchair provision.

<u>After the provision of the wheelchair</u>, the outcome was assessed using Functioning Every Day with a Wheelchair Beta Version 2.0 (FEW) as our Teleassessment tool for outcome measure^{[3][4]} with an interval of 3 months as some of the participants were new users and learned wheelchair functioning with the provided wheelchair It consists of 10 items that were developed based on input and validation from wheelchair users.

The FEW can be self-administered, administered as an interview, or administered by telephone. Items 2-10 of the FEW measure the perceived functional independence of individuals who use a wheelchair or scooter as their primary mobility and seating device and have progressive or non-progressive conditions.

Results

In this study sample, the total participants were n=43: 41 Males & 2 Females. The preponderance of males in this population who were mainly spinal cord injuries (SCI) which was 32 out of 43 has been documented that in countries like India, the majority of the road traffic injuries occur in males between the age group of 18-40. The average age is 31.19 years old. The majority of the participants 83.7 % come from low socioeconomic backgrounds and belongs to BPL family while 16.3 % of participants were above the

poverty line. 6 beneficiaries need it for outdoor mobility having to facilitate access to the work area with a maximum of 2-3 km of daily Wheelchair mobility while 8 SCI- beneficiaries belong to the para-athlete category with higher mobility, stability, and dependability need and minimum score on the item1 of FEW is between 3.5 \pm 1 on the scale of 6.

Conclusion

To conclude, teleassessment is a reliable method in assessing mobility AT needs for the provision of a wheelchair using valid and reliable measures of assessment at all levels from need assessment to provision and satisfaction of user thereafter. It overcomes the geographical barrier and facilitates the provision of Mobility AT to remote and rural areas in low and middle-income countries. It also ensures maximal utilization of the wheelchair and independent mobility to PwDs. Some important additional findings of the pilot study include:

- Just donating the wheelchairs isn't enough, our study also says that proper training and peer mentoring are also important.
- Satisfaction of the beneficiaries FEW scores were higher for those, within the district who did not have to travel and those beneficiaries who received foldable wheelchairs.
- There were no professional caregivers as the primary caregivers of all the beneficiaries are family members who did not receive any type of training on how to care for a person with disabilities.

A larger randomized controlled trial (RCT) would be necessary to confirm that teleassessment is at least equal if not more acceptable to beneficiaries in remote and rural areas study that confirms the benefits of teleassessment would have a significant impact on the way that AT services delivered in LMIC all over the world. It would help to ensure that people with disabilities have access to the AT they need, regardless of where they live.

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Strengthening the Inclusiveness in Citizen Science to improve the Participation of People with Disabilities.

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Abstract

At AAATE participants are introduced to the project "IncluScience". They will learn about the basic methodological approach, which is essentially based on inclusive Citizen Science. Together with the participants, this approach will be discussed. Furthermore, the example of the Wheelmap will be presented with the addition of accessibility criteria of specific types of places. The participants will get an exemplary overview of how people with disabilities experience participation. As in the part about the methodological approach, this will also be discussed with the participants. The following questions are conceivable:

- What visions (concerning educational settings) do you see through "IncluScience" with regard to the inclusion of people with disabilities?
- What benefits do you see concerning the consequently consideration of people with disabilities in Citizen Science projects regarding the inclusiveness? Do you also see risks?

Keywords

Inclusiveness, Citizen Science, Methodology, Inclusive Research

Context

People with disabilities often encounter barriers in everyday life. Such barriers, which are caused by a non-inclusive design of human-made environments, make access to the workplace, carrying out tasks at the workplace or the work itself more difficult. The same applies to the educational environment or public spaces. While not being limited to the workplace or educational institutions, a support service with information on the accessibility of places is offered by the free online street map "Wheelmap" (www.wheelmap.org), where accessibility information is uploaded by a community of volunteer people facing barriers. So far, Wheelmap has mainly been aimed at people with wheelchairs. In a Citizen Science approach, work is now being done to expand the target group to other barriers. But what is Citizen Science?

Citizen Science is characterised by the participation of citizens in science [2, 3]. Nevertheless, not all citizens are always equally involved. For instance, elderly, people with migration background, youth, people with disability and other (marginalised) groups. Therefore, Citizen Science needs to be inclusive and independent of factors of diversity as gender, origin or disability. Another important point is the elimination of barriers that hinder people with disabilities' participation. This therefore requires an inclusive approach, which is pursued in the Citizens Science project "IncluScience – Disability Mainstreaming in science and practice" [4].

The project "IncluScience" expands on the one hand the "Wheelmap.org" [5] - online map to evaluate places concerning the wheelchair-accessibility - by integrating accessibility criteria of specific types of places ("verticals") for places like cinemas, cafés, restaurants, medical practices etc. in the map. The citizens themselves decide which types of places are particularly relevant, which leads to the following main question of the project: "Which type of places are of particular interest for the scientific expansion of the Wheelmap and what information do people with disabilities need in order to have inclusive access to the places"? The citizens themselves decide which types of places are particularly relevant and were involved in developing and selecting those. The process is therefore co-created from the beginning with researchers, citizens and other stakeholders with and without disabilities at eye-level through workshops, surveys, mapping events or other forms of participation. "Participation" is finally aware of different steps on a "ladder of participation" [1] that should reach a state, where people with disabilities are participating in all stages of a project beginning by setting up research topics over methods to budgets.

Methodological Framework

IncluScience grounds on a four-phase research process – needs assessment, selection, prototyping and implementation – in which the Wheelmap is expanded through a Citizen Science approach as well as through the target group of people with disabilities themselves. These four phases are repeated three times, whereby each loop aims at a new prototype of

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another place description, e.g. public authority, pub, schools or universities.

In the first phase step (needs assessment), possible place types were listed and discussed with people with different disabilities, their stakeholders and representatives in qualitatively oriented workshops. The results of the workshop led to a list with concrete types of places, which need to be prioritised through an online survey in the second phase. Through the survey, the first type of place could be identified. With this result, also information that is relevant for this type of place is determined. Then, in a third phase, a prototype is tested on Wheelmap in order to improve it and finally make it publicly available as a new type of place on the map (fourth phase).

Results so far

Over 500 persons participated in the first online survey and voted for "doctors' surgeries" (22.8%) as the first vertical. Thereby, it turned out that people with cognitive disabilities are still underrepresented, whereas people with limited mobility and wheelchair users are in a majority. So far, doctors' surgeries are tested as a prototype on the Wheelmap by exclusively chosen citizens with and without disability. At the same time, the second iteration loop started, whereby the online survey showed that most of the over 500 persons participated in it voted for "public toilets" (27.2%; status from 12.05.23) as the second vertical.

At AAATE

The above described process will be presented at AAATE. Therefore, we will focus on the Wheelmap as a "digital technology" to support people with disabilities in different settings. It will be presented how the first two verticals were integrated into the Wheelmap and how this supports the participation of people with disabilities. Moreover, also the mapping process will be displayed. This so called "Mapping" is a process, in which Wheelmap users (largely people with disabilities) collect accessibility data on a specific place and integrate it into Wheelmap. This is done individually or through "mapping events". These events are also organized for a specific type of place, for example cafes, doctors' surgeries or schools.

At AAATE participants are thus introduced to the project "IncluScience". They will learn about the basic methodological approach, which is essentially based on inclusive citizen science. Together with the participants, this approach will be discussed. Furthermore, the example of the Wheelmap will be presented with the addition of the verticals. The participants will get an exemplary overview of how people with disabilities experience participation. As in the part about the methodological approach, this will also be discussed with the participants. The following questions are conceivable:

- What visions (concerning educational settings) do you see through "IncluScience" with regard to the inclusion of people with disabilities?
- What benefits do you see concerning the consequently consideration of people with disabilities in Citizen Science projects regarding the inclusiveness? Do you also see risks?

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Cross-cultural evaluation of a web application to support communication and collaboration among stakeholders of the school inclusion of children with ASD

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Abstract

The schooling of children with autism spectrum disorder is a challenge that relies on all stakeholders (families, schools, and medical-social professionals). In many countries, the Individualized Education Plan (IEP) is a monitoring tool of the schooling process, implemented by the aforementioned stakeholders, but they face several barriers to the co-education process. The CoEd web app was designed using participatory methods in France, with interactive services for the children's follow-up and the three-way collaboration. CoEd applicability was assessed in Belgian cultural context (Walloon territory), as they experiences similar issues. The results showed comparable results between the two countries. The Belgian audience appreciated CoEd and would be ready to use it in real conditions, as is currently the case in France. Thus, this participatory design work developed a tool that meets the needs expressed by the French participants and those of stakeholders beyond French borders.

Keywords

cross-cultural assessment, collaboration, coeducation, inclusive education, participatory design, autism spectrum disorder

Context

The schooling of children with autism spectrum disorder (ASD) is a challenge that relies on all stakeholders, mainly: families, schools, and professionals in the medical-social sector. Whole-school approaches and the international classification of functioning, disability, and health (ICF) [1] place collaboration and communication among actors as an essential ingredient in the co-education process to foster the success of the school inclusion of children with ASD.

Due the heterogeneity and severity of ASD symptoms, stakeholders have to deal with various educative adaptations, aids and strategies to meet the children's specific needs in their school life [2,3]. In many countries, the Individualized Education Plan (IEP) paper document is a monitoring tool of the schooling process, notably gathering aids and adaptations. The IEP implementation and follow-up is ensured by the IEP team (parents, teachers, out-of-school professionals), but these stakeholders face several barriers to the coeducation process [4–6], e.g., information transmission and three-way communication, collaborative monitoring of chil-

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It is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0), which permits copy and reproduction of the material in any medium or format, provided the original author and source are credited. dren's evolution, sharing of support practices (aids, adaptations). In this context, digital tools to support school inclusion are seen as promising solutions. However, existing tools focus either on the student or on the relationships between two parties, always including parents, who are responsible for sharing information to ensure good coordination.

Figure 1: CoEd interface sample *Left*: profile tab, *right*: skills tab.



The CoEd web application (Fig. 1) was designed using participatory methods based on the needs identified in a French context [7]. CoEd offers features directed toward the children's follow-up and the three-way collaboration of their caregivers through interactive services. Parents, teachers and out-of-school professionals can access to a child folder whose content can be updated at any time to reflect the evolution of the child and daily practices. Since collaboration and communication issues are partly common with the needs of Belgian stakeholders, we conducted a study to assess the applicability of the CoEd web application and determine the transferability of this tool to another cultural context in the Walloon territory.

Methodology

Forty-two participants (21 French and 21 Belgian) were recruited among parents, teachers and medical-social professionals. A common evaluation protocol was used to conduct an ergonomic evaluation of the CoEd tool in France and Wallonia. Based on realistic fictitious cases (persona method), we created usage scenarios to test the envisaged features on a high-fidelity interactive mock-up. These scenarios were adapted to the role of the targeted user, namely parents, teachers, and extracurricular stakeholders. We used objective measures and subjective measures to evaluate usability, user experience, mental workload, and self-determination elicited by the tool. To objectively assess the usability of CoEd, screen-recorded sessions were annotated to extract navigation performance measures, that is, time to complete each scenario and average number of active interactions, as well as verbal comments made by the participants. At the end of the session, participants answered to several standardized questionnaires to assess usability (System Usability scale [8]), user experience (User Experience Questionnaire [9]), cognitive load (NASA-TLX, [10]), as well as custombuilt questionnaire to assess elicited self-determination (inspired from [11]), perceived difficulty (0-10 scale) and questions related to their perceptions and intention to use the CoEd application.

Results and Discussion

The analysis of the results shows comparable results between the two countries: usability and user experience were excellent, with low mental workload and a strong sense of selfdetermination elicited by the application. Few differences were observed between the French and Belgian studies, suggesting that the CoEd web application is transferable to a similar sociocultural context. The Belgian audience appreciated the application prototype and would be ready to use it in real conditions, as it is currently the case in France (ongoing field study). Thus, this participatory design work made it possible to develop a tool that not only meets the needs expressed by the French participants but also meets the needs of an educational community beyond French borders.

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Digital inclusion for persons with intellectual disabilities: A comprehensive literature review from "Right to Connect"

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Abstract

This paper draws on work carried out in the framework of the Erasmus+ co-funded project "Right to Connect: digital inclusion for persons with intellectual disabilities". The aim of the comprehensive literature review described herein was to record the state-of-the art knowledge in terms of challenges of digital literacy and social media usage by adults with intellectual disabilities and followed a comprehensive literature review approach.

Keywords

digital literacy, social media, intellectual disabilities

Context

The digital revolution has altered the way we live, learn, stay connected, and work in society. Digital skills are a necessity for all to participate in different areas of life. However, a digital divide exists that impacts persons with disabilities.

The ENTELIS White Paper on digital inclusion [1] identified barriers to full digital inclusion. These were classified at different levels (societal, community and personal). Lack of education, lack of skilled trainers and lack of self-confidence among the persons with disabilities themselves were the most common.

Not all persons with disabilities meet the same barriers in interacting with digital environments, but for persons with intellectual disabilities, digital participation can be really challenging. Reasons for this digital disparity include inaccessibility of digital environments, fear for personal safety, negative previous experiences, lack of digital skills development in formal and informal education, and overall lack of awareness of accessibility options in Information and Communication Technologies (ICT) tools. Digital exclusion leads to individuals lacking tools for self-management and self-representation, thus preventing them from contributing to society. In addition, the onset of the COVID-19 pandemic abruptly forced many sectors in Europe and beyond to move operations entirely online for certain periods of time, thus, restricted access was a great barrier for persons with intellectual disabilities. In 2020, the European Commission launched

the Digital Education Action Plan 2021-2027 [2]. During the preparation for the open public consultation, the main areas of concern for respondents were how to ensure access, equity and inclusion, a concern which was enhanced by the pandemic and the emergence of digital divides.

In the framework of the EU co-funded project RTCN (Right to Connect: digital inclusion for persons with intellectual disabilities), a comprehensive literature review was conducted to build further on earlier work and developments, by focusing on the learning element and inclusion themes, to create a competence framework for persons with intellectual disabilities and their supporters, in the context of a co-design methodology for the creation of an online learning platform.

Methodology

The aim of this literature review was to record the state-ofthe art knowledge in terms of challenges of digital literacy and social media usage by adults with intellectual disabilities. The stages of the methodology for this comprehensive literature review were the following seven:

 Formulation of six research questions: i) Definition of the field (digital literacy in relation to digital competences and digital divide) and the target group (adult persons with intellectual disabilities), identifying the areas of digital literacy based on the US Educational Testing Service report (access, manage, integrate, evaluate, create – also applying to questions 2-3). ii) Existing good practices and prospects. iii) Challenges, barriers, and accessibility issues. iv) Existing competence development for users and educators/trainers of persons with intellectual disabilities. v) Relations of persons with intellectual disabilities and social media, through an intersectional approach. vi) Elements

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of co-design research methodology when including people as participants.

- Definition of eligibility criteria: year of publication (2015-2022), in English language, relevant with questions 1-6, age of participants in the studies: adults of any age and adolescents, excluding studies that included only children younger than 16 years of age.
- Definition of keywords: adult, good practices, barriers, intellectual disability, digital accessibility, internet, digital competences, internet use, digital divide, MOOCs, digital inclusion, online courses, digital literacy, online learning, educators, social media use, elearning, teacher, adult, website.
- 4. The databases used in the first query, were: ACM, Google Scholar, IEEE Xplore, SCOPUS, Science Direct, Web of Science, Eric, Jstor, EBSCO, Research Gate, and Springer. The second query was run in EB-SCO Discovery Service, according to an adjusted PICO framework.
- The two queries were performed with keywords combined with truncation symbols and Boolean operators (OR, AND), resulting to the identification of in total 244 publications.
- 6. The findings were codified in tables, according to the defined research questions.
- Findings were analysed using basic descriptive quantitative analysis, and qualitative methodology (thematic analysis), to inform the methodological framework of the project.

Results and Discussion

This comprehensive literature review has led to several valuable conclusions. Regarding the first question, persons with intellectual disabilities have less access to ICT, as well as fewer opportunities to learn how to use it. The research identified was associated mostly with access issues, leaving aside components of managing, integrating, evaluating, and creating. Perceptions and practices of persons with intellectual disabilities, carers, trainers, and staff were frequently investigated, whereas designers and self-advocates were included less frequently. With regards to gender representation, when information about the gender of persons with intellectual disabilities participants was recorded, men and women were usually equally included. Relevant research was found to be conducted mostly in Australia, the USA, the United Kingdom, and Spain. Also, issues of ICT use by persons with severe and profound intellectual disabilities were less often investigated.

Concerning the second question, areas of good practices identified included the use of technology and accessibility requirements, communication, social media, social inclusion, searching and evaluation of information, transportation, everyday living, safety in everyday life, gamification, and employment practices. With regard to the third question, the governments and other stakeholders have a responsibility regarding barriers and challenges to the use of ICT by persons with intellectual disabilities. These include the cost of devices and the absence of accessibility policies and programmes. General societal and attitudinal barriers include lack of full accessibility (digital, physical, social), less services available when transitioning to adulthood and workplace, and lack of community integration. Barriers regarding the opportunity of persons with intellectual disabilities and their carers to access relevant services such as assessment, training and support have became more acute during the COVID-19 pandemic. Technical parameters of the system are also significant.

With respect to the fourth question, it is reported that both persons with intellectual disabilities and their carers or trainers should have the digital competences to use ICT. In addition, performing web searches and emailing, use of social media and YouTube, as well as safety concerns were recurring issues. It is also reported that the use of forums supports parents technically and emotionally.

Regarding the fifth question, persons with intellectual disabilities are reported to use digital technology to a great extent for social media and social networking. The use of social media is considered an arena for formation of identity, and an opportunity for the person to remain anonymous. Nevertheless, this entails dangers, such as bullying or sexual exploitation.

Ultimately, regarding the sixth question and co-design methodology, the literature reviewed acknowledged the importance of participatory research, observation and discussion, workshops, interviews, focus groups, the use of storyboards in the design process, and the integration of an advisory board, in an iterative process.

Conclusion

These conclusions have constituted the main pillars on which the methodological framework of the project is based.

Acknowledgements

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Building capacity of early childhood educators for the use of ICT and Assistive Technology in inclusive education: The SKATE Competency Framework

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Abstract

The paper presents the development of a competency framework for educators on the use of ICT and Assistive Technology for Inclusive Early Childhood Education and Care, under the SKATE project. A co-design approach was followed involving various stakeholders though which the structure and the content of the framework was decided. **Keywords**

digital competencies, digital literacy, inclusive education, ICT-AT, early childhood education

Introduction

Research of the last decade on digital inclusion and the challenges of digital transformation for various populations, shifted interest towards the development of digital competences of multiple stakeholders [1]. Acknowledging the impact of limited digital literacy and lack of awareness on the digital divide, several frameworks have been developed to support capacity building for digital inclusion, starting from the field of education. This endeavour has been proven challenging in terms of addressing the needs of a variety of stakeholders in education, at different education levels. In Early Childhood Education and Care (ECEC), this task has been even more difficult, as the use of technology in early years has always been a topic of debate.

Considering the need outlined above, one of the aims of the SKATE project (https://skateerasmus.be/), co-funded by the European Commission, was to create a competency framework that will bring together competencies considered essential for capacity development of ECEC educators in implementing (assistive) technology for promoting early inclusive education.

In the following the methodology of the development of the SKATE Competency Framework is briefly presented.

Methodology

The development of the SKATE Competency Framework for educators followed a co-design and consultation process methodology on the ground of three premises. First, it refers to ICT-AT, as it is acknowledged that nowadays the distinction between ICT and AT is rather blurred. As a consequence of the convergence between mainstream and assistive technologies, educators are now required to be aware of the potentials and usefulness of both ICT and AT to ensure inclusion of their students [2]. Second, the target population is educators in a broader sense, recognising that there are a number of professionals in the field of education (e.g., classroom teachers, special educators, teacher assistants, occupational therapists and speech and language therapists) who are involved in ECEC taking into consideration that they may be at any point be working with all ranges of young children of 0-6 years [3]. Third, it is acknowledged that existing frameworks and other work (e.g. [4] [5]) cannot be disregarded in developing new and customized frameworks, and hence they have been used in this work.

Upon the above premises in order to develop the framework a first step was to analyse existing frameworks and identify possible gaps and links to the scope of the SKATE projects. Then a Delphi study [6] methodology was followed to consult and encourage the participation of various stakeholders. Thirty-two stakeholders were involved in the Delphi study, who undergone different stages for providing opinions and feedback that facilitated the identification of the main themes and areas of interest for the framework. Based on those pillars a set of guidelines for educators was developed as a product of consultation and consensus between participants. These were used as the starting point for developing the SKATE Competency Framework. Specifically, the areas

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of competences were formulated in thematic connection with a set of guidelines for educators.

In the next stage, during a four-day joint learning activity involving the 32 stakeholders, representing most of the possible groups of educators, the areas of the framework were finalized, and the competence statements suggested initially by the core team where refined.

This approach overall facilitated the validation for the framework in various stages during its design, development and implementation, as well as its formative and summative evaluation with the involvement of the target population and its expected users.

Findings as final Output

Following the methodological approach described above the SKATE Competency Framework was developed including the following elements:

Areas of competences: The SKATE Competency Framework includes four areas of competencies, as a result of the Delphi study, and identified guidelines pillars, taking into consideration pedagogical, technological and administration aspects in educators' professional development. Areas 1 and 2 are about pedagogy, learning and instruction (i.e. designing and implementing appropriate pedagogies for ECEC and inclusive education). Area 3 focuses on the digital competencies relevant to technology resources (i.e. be familiar, selecting and using ICT/AT) and Area 4 refers to the leadership aspect of the educators' role (i.e. management, administration and collaborations at classroom and school level).

Levels of proficiency: In order to respond to the heterogeneity of previous and existing knowledge and skills of educators, the SKATE Competency Framework holds three levels of proficiency: beginner, intermediate and advanced. Following the co-creation jigsaw collaborative approach, competence statements at each level, have been developed into learning outcomes during a four-day joint learning activity.

Links to educational practice: The SKATE Competency Framework, together with the Guidelines, was used as the foundation for building professional development learning programmes for educators. Each learning module is connected to particular competences and learning outcomes, selection of which are localized in different educational settings and countries.

Concluding remarks

The SKATE Competency Framework is anticipated to be an open document that will be further developed, exploited and sustained beyond the SKATE project. As a first step, and on the basis of a co-design approach, following the validation of the framework through pilot implementation an additional structural element of the SKATE Competency Framework would be added. This refers to a set of examples of scenarios. Specifically, during piloting and validation participating educators will map their practices as examples and scenarios to the framework, as evidence from practice. As follow-up steps the framework was already recommended, adopted and adapted in other endeavours of developing guidance, training, or capacity building initiatives for integrating mainstream and assistive technology in inclusive learning design.

Acknowledgements

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Assessing impact of including People with Intellectual Disabilities as our DigiAcademy Teachers

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Abstract

There are around 8 million people in Europe with an intellectual disability. They face disproportionate health, well-being and inclusion difficulties, significant barriers to use and interact with technology in comparison to neuro-typical peers. Exacerbating existing health, well-being and inclusion vulnerabilities. Research about people with intellectual disabilities' digital access experience demonstrated a lack of prior support and training for people with intellectual disabilities, support, and health care staff. Digi-ID PLUS, an EIT Health funded multidisciplinary European collaborative partnership with people with intellectual disability and autism from Ireland, France, Sweden, Spain, and Croatia, is developing a digital skills education platform to address these challenges: DigiAcademy. Embedded within the project team is our Citizen Advisory Panel, individuals with intellectual disabilities and accessibility needs who are paid experts by experience recruited to co-design our programme and train as our DigiAcademy teachers. The focus of this presentation is introducing the role of our European Citizen Advisory Panels in our co-design process, exploring the DigiAcademy teacher role by listening to Irish and Croatian teachers' experiences directly and demonstrating the impact membership had on them, the community and the DigiAcademy app we are co-creating together.

Keywords

Intellectual Disability, Technology, Inclusion

Context

For the 8 million people with intellectual disabilities, (ID) across Europe who face disproportionate health, well-being and inclusion difficulties, given research showing over 50% having communication difficulties and 1 in 3 reporting difficulties communicating with health and education professionals, and educational and employment barriers [1], the pandemic has had a disproportion impact on themselves their families and the services that support them. Additionally, at a time of unprecedented dependency on technology in all our daily lives European citizens with ID encounter significant barriers to use and interaction with technology in comparison to neuro-typical peers, exacerbating existing health, well-being and inclusion vulnerabilities.

A recent international review [2] of people with intellectual disabilities' digital access experience during COVID-19 demonstrates a lack of prior support and training for both people with intellectual disabilities, support, and health care staff was both a barrier and a challenge to pivot to support online meetings and loss of autonomy and an in-creased reliance on support for many blocked digital opportunities. Digi-ID PLUS is an EIT Health funded multidisciplinary European collaborative partnership with people with intellectual disability and autism, disability service user organizations, and advocacy groups, which brings together expertise in the fields of intellectual disability, social science, assistive technology, accessibility, healthcare technologies, public health, inclusive education, speech and language and mental health from Ireland, France, Sweden, Spain, and Croatia.

At the heart of Digi-ID PLUS is an authentic user centered and led design process to co-design accessible digital skills training platform with and for people with intellectual disabilities and advocating for digital accessibility to enable and empower better health, well-being and social inclusion. Engaging 500+ EU citizens with disabilities, families/carers and professionals to co-design our digital skills learning platform DigiAcademy and advocate for digital accessibility.

DigiAcademy is promoting a peer-to-peer learning environment to support the acquisition of new skills. Several studies have examined the effectiveness and value of peer support especially when the existing knowledge and skills within the community are acknowledged, harnessed, and rewarded, and how it can also support employment opportunities [3-7].

Embedded within the project team is our Citizen Advisory Panel (CAP), individuals with Intellectual Disabilities and accessibility needs who are paid experts by experience recruited to co-design our programme and training as our DigiAcademy teachers with passion about teaching and us-

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ing technology to enhance their quality of life. CAPs comprise citizens with ID/autism, with diverse ages, gender, so-cioeconomic backgrounds and digital skills levels.

Methodology

Co-creation interviews and focus groups in our EU partners, shaped our understanding and preliminary analysis identified priority topics for the education programme which were validated with our CAP. In particular, the needs of focusing on getting people started and building up skills from an introductory basis were frequently emerged and also validated with CAP members.

With embedding our Citizen Advisory Panels within our programme we pushed our co-creation process to an optimum level, supporting and training Panel members to become our teachers. Therefore, the course content is presented by people with intellectual disabilities themselves, who act both as ideal tutors as well as motivational role models. Our DigiAcademy teachers' teams (e.g. 8 trained teachers in Ireland; 2 teachers in Croatia;) are guiding and inspiring others to follow the same journey, demonstrating the power and potential of people with intellectual disabilities to be the 'face' and the 'voice' of our accessible education program and the effectiveness of the peer-to-peer support. The digital educators expanded their own digital skills knowledge in particular, related to accessibility and enhanced confidence working as paid team members, enabling them to showcase their own digital experiences to support their peers' digital engagement

The Irish team designed the script co-creation sessions and the recordings activities as fun and flexible activities, where our teachers can enhance their communication, presentation and digital skills, showcase the best of their abilities and learn new tech skills in a fun, creative environment to inspire other people to have the confidence to give technology a go to enhance their own lives. The same approach was replicated successfully by our Croatian partners.

Results and Discussion

Direct benefits for our DigiAcademy teachers were rooted in providing opportunities to voice their personal experiences of digital inclusion and being recognized for their work and their expertise, and that their voiced lived experiences with technology were listened by their colleagues, their peers, and our community through their teaching experiences. Discussing their experiences in a collaborative peer support setting facilitated the opportunity to share and learn from the experiences of others in the group.

We have heard from our Irish teachers and strengthen by their supporters feedback, how becoming a DigiAcademy teacher has enhanced: (1) their communication skills, four reported how their communication skills highly improved during this experience and the other four how they noticed an improvement in their communication skills; (2) their confidence, four reported an high improvement on their confidence and the other four an improvement in their confidence, (3) their presentation skills, one teacher already had a lot of experience with presentations and talks so wasn't able to report a significative change in presentation skills, other five teacher demonstrated an improvement of their presentation skills and two of them reported how the teacher experience highly impacted and enhanced their presentation skills. Being part of the teachers' team also presents them with new strategies and ideas for themselves, new digital skills, fostering new friendships and increasing self-esteem.



Figure 1: Irish DigiAcademy Teachers' Team

Our Croatian partners obtained similar results with the collection of preliminary findings with the first two Croatian teachers. Both the teachers recognized the positive impacts of being trained and supported to become a DigiAcademy teacher. In particular, both reported an improvement in their communication skills, presentation skills and digital skills and one also a high improvement in his/her confidence. Other four Croatian CAP members have been hired and two of them are already in the process of being trained to become teachers.



Figure 2: Croatian DigiAcademy Teachers' Team

Conclusion

Following the positive impact of first CAP established in Ireland, our EU partners are also establishing their own national CAP. To date, eight members from our Irish CAP and two from our Croatian CAP have successfully trained to become teachers, all reporting positive feedback and actively engaging with: education content choice based on their own areas of interest and expertise; script co-creation; practice sessions; course co-design; professional video production company recordings.

During recent DigiAcademy focus group and user testing with collaborating intellectual disability services, our tutorials are receiving positive feedback from people with intellectual disability and their supporters, reporting that the tutorials' content, design, structure of the step-by-step guide and our digital educators' presentation is clear, accessible and fun to engage with. Peer-to-peer learning has been recognized as an enabling factor in the acquisition of new digital skills.

The focus of this presentation is to introduce the role of our Irish and Croatian teachers' teams in our co-design process, explore the DigiAcademy teacher role by listening to teachers' experiences directly and demonstrate the impact membership had on them, the community and the DigiAcademy app we are co-creating together.

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Digital transition in vocational education for all: Lessons from DIG-i-READY

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Abstract

This paper draws on work carried out in the framework of the Erasmus+ co-funded project DIG-i-READY: *Digital Readiness of Vocational Educational Institutions in an Inclusive Environment* which aims to examine how the vocational sector in education may better respond to the inclusion of students with disabilities during extreme circumstances. The project studied good practices on inclusion in the vocational sector producing a Catalogue of Good Practices on the basis of which a digital competence framework will be developed. This presentation focuses on sharing the results from the lessons learned from looking at good practices, with a particular emphasis on how these were used to develop the digital competence framework for users with disabilities in the vocational sector.

Keywords

Digital inclusion, vocational education, digital competences

Context

The onset of the COVID19 pandemic abruptly forced the educational sector (and many others) in Europe and beyond to move its operations entirely online for certain periods of time, during lockdowns, as well as apply a hybrid form of teaching and learning in some form of combination of offline and online mode for even longer periods of time during the duration of the pandemic. As it turned out, this transition to online education was not experienced in the same way across social groups and strata. In fact, we now know that it exacerbated educational inequalities among social groups who have traditionally experienced the impact of the digital gap, such as students and their families from lower socioeconomic backgrounds, immigrant background, and students with disabilities [1].

Recognizing the difficulties of educational systems in Europe to cope with these inequalities and to promote equal access to education for all during the pandemic, DIG-i-READY: *Digital Readiness of Vocational Educational Institutions in an Inclusive Environment*, an Erasmus+ co-funded project, aims to shift its attention to how the vocational sector in education may better respond to the inclusion of students with disabilities during extreme circumstances. It seeks to develop guidelines for vocational schools and institutions

on how to better support digital inclusion for all during periods of crises, such as ones brought by a new pandemic or a natural disaster, or during periods of substantial educational change such as that brought by an educational reform. Guidelines for vocational institutions will be accompanied also by a digital competence framework for the enhancement of users' digital competences that addresses the users themselves.

Methodology

To achieve its aims, the DIG-i-READY project through a desk research and consultation sessions first delved into the collection and study [2,3] of good practices on digital inclusion for all applied by vocational schools and institutions during the time of the pandemic in the partner countries (Austria, Belgium, Bulgaria, Cyprus, Germany, Italy, and Latvia). Based on the lessons learned from the study of such good practices a Catalogue of Good Practices was formed and the development of the digital competence framework has ensued. This presentation focuses on sharing the results from the lessons learned with a particular emphasis on how these were used to develop the digital competence framework for users with disabilities in the vocational sector.

Results and Discussion

Findings of the desk research showed the need to better support the digital competences for students with disabilities in vocational education, revealed the absence of related state policies or initiatives across partner countries and highlighted how efforts to promote policies of digital inclusion often relied on private initiatives or even EU funding. The need for

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developing targeted guidelines and indicators promoting inclusive digital practices in VET was also highlighted. 'Going digital' and reducing the digital divide for persons with disabilities needs to be systemic within the VET setting, as well as tuned with the broader ecosystem at global, regional and local level. In this contribution we discuss how the digital competence framework for people with disabilities in the vocational sector has developed highlighting the learner's perspective. Many digital competence frameworks [4,5] focus on the empowerment of educators and professionals rather than on the actual competences of people with disabilities towards reducing the digital divide.

Conclusion

Starting from the evidence that emerged from findings, the lessons learnt point out the fact that generally digital competence frameworks of vocational education/training programs aim mostly on the empowerment of educators and professionals, rather than of the persons with disabilities. While there are some existing frameworks that provide a basis for the project's next steps, the development of sets of competences specific to VET and people with disabilities is an important aspect of the DIG-i-READY project.

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Digi-ID PLUS: sharing digital inclusion experiences of people with intellectual disabilities in Ireland, Sweden and the Netherlands

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Abstract

Research conducted during the Covid-19 Pandemic has highlighted the widening problem of digital exclusion among people with intellectual disabilities. To address these challenges, Digi-ID PLUS, a multidisciplinary European research programme, was designed with the aim to address issue of digital access and inclusion and increase empowerment among people with an intellectual disability. Co-creation focus groups were structured and designed as social activities within the collaborating service community. Participants in France, Ireland and the Netherlands provided quantitative data in relation to technology use in their daily lives. Qualitative data from focus groups and interviews in Ireland, Sweden and the Netherlands, identified two main themes, (1) Technology for Health and (2) Online Activity for Social Inclusion. Thematic analysis was conducted on data that emerged from focus groups. 3 sub-themes were identified arising from Theme 1 and 2. Key findings from co-creation focus groups were collated and connected to new sub-themes. An overview of the results of two core themes will be presented and discussed.

Keywords

Digital Inclusion, Intellectual Disability, Experience

Context

Progress in digital technologies has changed the way that people interact with the world around them. Access to the digital world opens opportunities to entertainment, education, communication, and employment [1]. While there are many benefits that can be caused by interacting with digital content online, not everyone can easily access these materials [2, 3]. This is in spite of the fact that internet access has been enshrined into the United Nations' Conventions on the Rights of Persons with Disabilities (UNCRPD) as a human right [4]. Social inclusion for marginalised people, such as people with intellectual disabilities, has become increasingly important. Social Inclusion has been recognised as a complex topic encompassing many different attributes [5].

Research conducted during the Covid-19 Pandemic has highlighted the widening problem of digital exclusion among people with intellectual disabilities. People with intellectual disabilities were being left behind in a time which required more than ever their full participation in digital society. Digi-ID PLUS, a European EIT-Health project, was founded with the aim to increase digital knowledge and skills and contribute to increased empowerment, as well as self-efficacy, among people with intellectual disabilities in taking care of their own health and well-being.

To address these challenges, Digi-ID PLUS, a multidisciplinary European research programme, was designed with the aim to address digital literacy and increase empowerment among people with an intellectual disability. Digi-ID PLUS is a project led by Trinity College Dublin in Ireland and the first phase was in collaboration with the Netherlands and Sweden. In this phase, the focus of the project was to understand how people with ID were interacting with digital technology to guide the future development of the project. Due to this primary focus, the study has adopted a usercentred design methodology and an iterative co-creation and co-design process to outline the priorities to development. The benefit of the co-designing process is that it focuses on the user's whole experience and needs to optimise the final product.

At the heart of Digi-ID PLUS are the Citizen Advisory Panel (CAP), a group of 14 individuals with intellectual disabilities who have diverse ages, gender, and digital competencies and are paid experts by experience in the lead partner country, Ireland. With each Partner country now replicating this model and establishing their own national Citizen Advisory Panels. To evaluate and validate findings, CAP meetings were held monthly to engage with all members in meaningful ways. The results of these meetings were analysed to

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pinpoint areas of focus for app development across the European partner countries involved in the first phase, France, The Netherlands, Spain, and Sweden. The Digi-ID PLUS study adopted a user-centred design methodology and iterative co-creation and co-design process to inform, shape and determine the priorities within the development of DigiAcademy.

Methodology

The first phase of the Digi-ID PLUS study was content codevelopment and app design. This phase comprised of focus groups. These groups were consulted for app development and for co-creating Digi-Academy education content. Focus groups were made up of approximately 6-8 individuals with an intellectual disability. These groups were facilitated both online and in person. Due to covid-19 restrictions, in Ireland, Sweden and the Netherlands all focus groups were arranged online. Focus group discussion centred on health and social needs, how technology is currently used to support these goals, and what helped or hindered the participant's use of technology.

To guide the focus groups and interviews, and to ensure that core digital literacy skills were addressed, the Trinity College Dublin team developed a framework for data collection as a guide for co-creation activities. By developing these tools, the lead-team aimed to promote a systematic and consistent approach to running focus groups and recording data from all groups in each partner country. In this way, these tools were integral to the ongoing Digi-ID PLUS project. The data collected using these tools helped to establish the direction and focus of the content included in DigiAcademy educational programmes and has shaped the content and design of the app.

Results and Discussion

Participants in Ireland provided insight into their daily interactions with digital technology. The majority of responders to questionnaires noted good overall physical and mental health. While some participants noted difficulties and concerns with their vision, hearing, and communication skills, most participants experienced good vision, hearing, and communication skills. Most participants in Ireland reported that they found specific tasks within digital technology difficult to complete without additional support, such as using passwords or accessing search engines to look up topics of interest. Most of the respondents reported that they lived in their family home, which may have influenced their reported levels of loneliness and isolation. French participants reported that they felt more isolated in comparison to their Irish peers, and Irish peers reported that they experienced more loneliness when compared to their French peers.

Focus groups were structured and designed as social activities in cooperation with the collaborating intellectual disability service and training community. These groups were shaped following engagement with collaborators in Ireland, and so were trialled and validated during meetings with the first Citizen Advisory Panel. Considering this, co-creation focus groups were intentionally designed within the context of the outbreak of the covid-19 pandemic as a community engagement social activity. Thus, focus group activities aligned with frontline collaborators in Intellectual Disability services to meet the needs of people with intellectual disabilities during lockdown. These activities enabled social interactions as well as discussions around technology tips and fostered connections with peers who had the potential to reconnect or make new friends.

The pandemic accelerated research into the effectiveness of conducting online focus groups with positive preliminary findings. In [6] the researchers collected success strategies also validated within the current programme, such as good advertising and incentives, electronic calendar invitation, limited duration of meetings, how to manage technical difficulties, low participant engagement, and suboptimal data collection. A time limit of maximum 1 hour was suggested, but within the Digi-ID PLUS programme a 2 hour meeting has also been effective. This was especially the case if these meetings were arranged for the late morning. Additional measures were also adopted, such as the implementation of a comfort break at the hour point as well as regular check ins. In addition to this, researchers adopted a flexible approach to shorten meetings if energies or interests were noted to. Further, participants were also invites and supported to use the chat feature to describe or share thoughts with the group or with the researchers. These measures supported the research team to create an effective method, especially for more reserved participants and those who had more significant communication needs.

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Public transportation training: A low-tech approach to facilitate using the bus for people with disabilities

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Abstract

People with disabilities face physical and societal barriers to accessing public transportation, such as using the bus. Public transportation training represents a low-tech approach to improve how people with disabilities use public transportation services (the bus) and the associated technology (using apps for route planning). A multi-methods study was conducted in partnership with a local public transit service provider. Public transit training was completed by all participants, which integrated didactic information with practical experiences. Self-efficacy, satisfaction and community mobility were evaluated and semi-structured interviews were conducted. Data were analyzed descriptively, statistically and thematically. 12 people with disabilities experienced improvements in self-efficacy, skills and autonomy for using the bus, which in turn enhanced community mobility and social participation. Low tech training programs may enhance adoption and sustained use of technologies.

Keywords

Mobility, Accessibility, Participation

Community mobility, defined as 'moving in the community and using public or private transportation' facilitates community engagement, social connectedness, and social participation [1, 2]. Loss of community mobility is associated with adverse outcomes, including worsening disability and morbidity, increased healthcare utilization, and low quality of life [3, 4, 5, 6]. Public transportation provides an affordable and convenient method of community mobility [7]. Moreover, for people with no other means of transportation, public transportation is essential for obtaining goods and services and for participating in meaningful social activities [8].

People with disabilities face significant physical and societal barriers to accessing public transportation. For example, people with disability have difficulty getting on and off the bus, lack knowledge and experience, and perceive or experience safety concerns [9, 10, 11]. While people with disabilities are often eligible for paratransit (ie. adapted public transportation), this service requires more planning (*e.g.*, 24-hour reservations), offers less flexibility (*e.g.*, limited hours, longer waits, does not permit multiple stops), and does not provide the same environmental benefits as regular public transportation. The result is often missed appointments, cancelled plans or activities, and reduced overall social participation.

Modifications to the physical environment and educational opportunities are needed to improve access to public transportation for people with disabilities [11, 12, 13]. Public transportation training represents a low-tech approach to improve how people with disabilities use public transportation services (i.e., using the bus) and the associated technology (*e.g.*, using apps for route planning). Improving knowledge and skills through didactic and handon experiences may enhance self-efficacy for using public transportation, which may in turn increase the quality and frequency of public transportation use by people with disabilities. In fact, self-efficacy is an important predictor of using the bus[14].

In their 2018-2027 strategic plan, the Réseau de transport de la Capitale (RTC), the public transportation company serving Quebec City, prioritized improved accessibility of public transportation services for people with disabilities. In 2021, the Service d'accompagnement en mobilité intégrée (SAMI) training program was launched with goals to improve utilisation of regular bus services.

Objectives

The objectives of this pilot study were to explore the influence of SAMI on self-efficacy for using public transportation, life-space mobility, and satisfaction with public transportation use among people with disabilities. Experiences with and perceptions of the SAMI program were also explored.

Method

Design. A mixed-methods (qualitative and quantitative) pre-post design was conducted in partnership with the RTC. **Participants**. A larger study is currently recruiting forty people 18 years of age and over living in the Quebec City with a disability. To be included, participants must be able to use public transportation services independently or with the help of an attendant. **Intervention:** The SAMI program integrates didactic information with

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practical and accompaniment experiences for using public transportation. Customized 1.5-2h programs include theoretical and practical support, such that people can choose among five training modules (i.e., Demystifying public transit; Planning a trip, Getting a ticket, Getting around; Discovering our information tools) and then use life-size models (*e.g.*, board a bus with a kneeling ramp) to practice. Data collection: Self-efficacy (100-point visual analog scale [14]), satisfaction with transportation goals (Canadian Occupational Performance Measure; COPM)[15] and life-space mobility (Life-Space Assessment; LSA) were evaluated before and after SAMI.[16] Semi-structured interviews were conducted immediately after SAMI. Data Analysis. Descriptive statistics were summarized. Changes in self-efficacy, COPM, and LSA were evaluated using a non-Parametric Longitudinal analysis (r software). Qualitative interviews were transcribed, coded, and thematically analyzed using NVivo.

Preliminary results

Twelve participants included females (58.7 %), mean (SD) age of 53.6 (14.4) years, who live alone (83.3 %) with a gross income between \$15-\$29,999 (33 %). All had reduced mobility due to traumatic brain injury (n=5), neurological (n=5) or musculoskeletal (n=2) conditions, and used mobility devices (n=10), including wheelchairs (n=6).

Two preliminary themes are presented, and some suggestions to consider for improving the SAMI program.

Theme 1: Training enhances self-efficacy, skills and perceived autonomy for the bus

SAMI enhanced personal factors that facilitated using the bus, revealing that self-efficacy, perceived autonomy and skills were acquired by participants. Self-efficacy for using the bus increased from 57.1 (35.1) to 69.2 (26.9) but was not statistically significant (p=0.18). Qualitatively, participants expressed that SAMI helped to maintain or increase self-efficacy for using the bus. For example, a woman (35y) who used a manual wheelchair stated, "I felt like I had more confidence last week after taking [SAMI]." Participants described how SAMI improved skills for using the bus, as a man (71y) with reduced mobility conveyed; "what I learned was to read the instructions well. So, the signs, how the bus shelters are made, that it is safe [...]. I know which way to go out, which way to go in, to sit as close as possible to the driver. How to read the routes. That spoke to me a lot." Finally, participants described feeling more autonomous in their decision to use public transportation after SAMI and explained how their stress and anxiety was reduced. One man (50y) with a traumatic brain injury described his experience with two of his friends who had also taken the SAMI training. He said, "Instead of using paratransit, we had taken two buses without having to wait for an hour and a half for paratransit." His friend, a 45-year-old man with a traumatic brain injury explained how "Before SAMI, the unknown was stressful [...] there was an anxiety bubble. After my meeting with SAMI, I was very motivated to take public transportation."

Theme 2: Training enhances community mobility and may facilitate socialization

Although there were no statistically significant differences in satisfaction with public transportation goals or life-space mobility, participants perceived that SAMI facilitated using public transportation to participate in meaningful activities and to mobilize in their community. Various goals identified by the participants included participation in activities of daily living (work, school, medical appointments, salon), community and leisure activities (visits friends, church, choir, movies and concerts) and physical activities (swimming, basketball). Participants described how SAMI influenced the how often they used the bus to travel within the community. For example, a woman who used a wheelchair (46y) told us, "I'm learning more, I take the bus more often." Some participants perceived that SAMI facilitated socialization, with one man (71y) saying "I feel like going for coffee in town, I feel like going to the library, I feel like doing things, I feel like going out."

Some suggestions for improving SAMI included, creating video of the theoretical component of SAMI, adding a component where the learner can be accompanied during their first outings (customized according to need), having the presence of an attendant, and to provide disability specific training for the SAMI staff and bus drivers

Discussion

Preliminary results of this study suggest that proving public transit training for people with disabilities improves their self-efficacy and skills for using the bus and autonomy in making choices about mobilizing in the community. According to Deci and Ryan, interventions that target perceived competence (ie. skill and self-efficacy) and autonomy influence motivation and behaviour change [17, 18]. Moreover, completing the SAMI program with friends who share similar life experiences (i.e., peers) may target belonginess, which is another important construct in creating an autonomy supportive environment.17 Moreover, interventions that can facilitate community mobility and social participation may have impacts on overall health and quality of life for people with disabilities.

Evidence from this study will inform best public transit training practices for adults with disabilities. The results will be used to modify and improve the SAMI program for various populations (*e.g.*, considerations for manual and power WC training). Future research will include development and evaluation of training programs to support community partners to improve their service delivery for people with various disabilities who use various technologies (*e.g.*, wheelchair users, people with visual impairments).

All technologies require learning by potential users. Low tech training programs may enhance how targeted users can better adopt and sustain use of technologies. While the importance of learning applies to using the bus (and the associated steps to completing a transit), the need for training programs is present for all new technologies. Training programs that consider the important theoretical and psychosocial constructs of behavior change (*e.g.*, skills, self-efficacy and belonginess), may influence adoption and sustained used of technologies

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Are manual wheelchair users free to visit natural landscapes?

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Abstract

EU's Statistics Office Eurostat suggests an estimate of 5 million wheelchair users in Europe. Among this population, this paper focuses on users able to self-propelled the wheelchair by using push-rims fitted on rear wheels and in particular the ones who are travelling around the world. Self-propelled wheelchairs are difficult to drive in off-road paths or in situation of slope greater than 8%. Electric wheelchairs are difficult to transport, and front-wheel drive kits are not suitable because of wheel slippage due to the rearward-shifted barycentre. From these problems, the idea has been the realization of an innovative kit that is plug-and-play and affects rear wheels. The kit is composed of a mechanical support, motors, control unit and a human-machine interface. The kit makes use of two motors which are pushed towards the rear wheels through a spring. Once the motors turn, rotation is transmitted to the wheels by friction. A prototype has been realized and tested.

Keywords

Wheelchair, Plug-and-Play kit, AT for Turism

Context

EU's Statistics Office Eurostat [1] suggests an estimate of 5 million wheelchair users in Europe. This number is continuously growing due to the aging of the population. Among this population, this paper focuses on users able to self-propelled the wheelchair by using push-rims fitted on rear wheels and in particular the ones who are travelling around the world.

Self-propelled wheelchairs are difficult to drive in offroad like in Figure 1 or in situation of slope greater than 8% like in Figure 2. For most people, these situations are too tiring and so unfeasible. Of course, to deal with these scenarios, the user could rely on electric-powered wheelchairs (EPW) or to upgrade the manual wheelchair by using wheel motorization kit (such as MAX-E [2], triride, etc.). Both solutions have pro and contra especially for people willing to travel around the world. In particular, very often the EPW weighs a lot, so it can be a problem in all those situations where there is a weight constraint, such as internal lifts to overcome obstacles limited to 150/200 kg. Other problems such as space and battery constrain may arise if travelling with plains. In addition, in case the EPW's battery runs out, it can be challenging as well to push an EPW due to its weight. On the other side, the usage of transformation kit can overcome the abovementioned issues but depending on the kit, others may arise. In case of tri-ride and similar, they are not



Figure 1. White road with pebbles.

Figure 2. Steep slope path.

suitable for unpaved roads because they add a motorized wheel in front of the wheelchair whereas the barycentre is shifted backwards toward rear wheels. This configuration results in slipping of the motorized wheel. Some solutions are available that motorise the rear wheels, such as MAX-E, but require the rear wheels to be replaced with others specifically compatible with the kit. More generally, they need some sort of adaptation that prevents them from being truly plug-and-play, namely easy to install, on any type of wheelchair.

Proposed Solution

Starting from this ascertainment, the idea has been the realization of an innovative kit that is truly plug-and-play, to allow the transformation of a manual wheelchair into a motorized one such that the motorization affects rear wheels. The project was founded within the initiative "Itinera Romanica+" [3], an international agreement between Italy and France to enhance the cultural heritage of Romanesque in both countries. In particular, the kit is composed of a mechanical support, motors, control unit and a human-machine interface. The key point that allows the kit to be effective is how the wheelchair gets motorized. In particular, it makes use of two motors which are pushed towards the rear wheels through a spring as

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Figure 3. Motor support with spring to increase friction between motor and rear wheel to transfer motor rotation to the wheel.



Figure 4. Mechanical support with tube collars for extendibility.

depicted in Figure 3. Once the motors turn, rotation is transmitted to the wheels by friction. The mechanical support in Figure 4 has been designed to adapt to different wheelchair dimensions thanks to tube collars which can extend or reduce the width of the support. The motors are of the out-runner type, which means that the rotating part is the outer frame. The control unit comprises the electronics responsible for managing the movement of the wheelchair according to the user's will and in a safe manner. The human-computer interface is a joystick with a screen to show telemetry information but, thanks to control unit modularity design, any system that implements the required interface can be used. A block diagram of the system is in Figure 5. The control unit receives input from a joystick. Depending on the stability condition of the wheelchair, the control unit elaborates reference command for motors and monitor their operation. Meanwhile, it is also responsible for logging of telemetry information to the screen such as battery level, current speed, current selected speed mode, wheelchair inclination for stability assessment.



Figure 5. Block diagram of the electro-mechanical system.

Results and Discussion

A prototype has been realized and presented to the conclusion event of "Itinera Romanica+" as depicted in Fig.6. The entire system has been tested in "Villa Reale di Marlia" [4], a turistic point of interest in which several scenarios can be found such as white off-road path, namely paths where different size of pebbles are distributed along the track, green ones, steep slopes to access beautiful courtyard with amazing view of Tuscan landscape and indoor scenarios for visiting the 19th-century frescoes distributed throughout the various buildings. On such occasion, we gave the possibility to try out the solution to people coming with their own wheelchair and to elderly. Then, we collected their feedbacks via a questionnaire. Interesting answers were provided. Among people with



Figure 6. Prototype of discussed plug-and-play kit for transforming manual wheelchair into automated one.

wheelchairs, they expressed a positive opinion regarding the seamless integration with their own wheelchair and the smooth movement experience. Overall, they did not notice a difference with electric wheelchairs regarding usability. Satisfaction was expressed also from elderly people who underlined how often they cannot fully enjoy places like these because too vast for their physical fitness but with such kind of solution they could visit every corner without too much stress.

Conclusion

The surrounding environment is not user friendly and very often is the user who needs to overcome this issue with all related burdens completely on user's side, such as carrying the equipment, cost, maintenance, etc. Our proposal wants to shift the paradigm: instead of making the user adapting to the surrounding environment, why do not we make the surrounding environment adapt to the users? From this consideration, the idea is to equip local authorities with such kind of plug-and-play system to transform on request a manual wheelchair into an automated one for the duration of the tour. In this case, we give everyone back the freedom to visit beautiful places in a natural landscape very often reserved for those lucky enough to be able to move their legs.

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Co-design of an Interactive Wellness Park: Ideating Designs for a Multimodal Outdoor Physical Web Installation

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Abstract

Existing research and physical activity guidelines highlight the benefits of outdoor physical activities for ageing populations. We propose that smart and interactive systems in open public spaces specifically designed to engage older adults hold great potential to support physical activities and motivate rehabilitation. Older adults and other stakeholders will participate in co-design workshops to iteratively design an interactive system using the physical web. In this present study, we aim to explore the perceptions and experiences of older adults in relation to their physical activity routines and to ideate some initial design ideas for the proposed novel physical web interface.

Keywords

Physical web, older adults, Participatory design, Co-design, Physical activities, Design thinking

Introduction

Outdoor physical activities improve older adults' physical and mental health [1]. Physical inactivity is a significant concern for public health; globally, it has been estimated that sedentary lifestyles will result in healthcare costs of \$53.8 billion annually [2]. World Health Organization (WHO) research revealed that around 1.4 billion adults are not physically active enough to stay healthy; these groups of people have a 20% to 30% risk of death compared to those who engage in at least 30 minutes of moderate-intensity physical activity most days of the week [3]. Various research on physical activities for older populations has suggested that given the importance of physical activities, it should be one of the highest priorities for preventing and treating non-communicable diseases in older adults [4]. The WHO Global Network for Agefriendly Cities and Communities illustrates that creating agefriendly environments is a key strategy to encourage older adults to participate in outdoor activities. We propose that smart and interactive systems in open public spaces specifically designed to engage older adults hold great potential to support physical activities and rehabilitation. To ensure an inclusive and accessible solution, we will invite older adults and other stakeholders to participate in the proposed application's design through co-design workshops.

Literature Review

The importance for older adults to experience independence in 'natural' public space is significant, and neighbourhood environments that encourage outdoor activity like walking improve older people's quality of life [5]. Older adults who access the park for physical activities meet the WHO-recommended physical activity levels [6]. Similarly, wellness Parks in green public open spaces have been known to provide opportunities for physical activity, recovery from stress and attention fatigue, and facilitate social contact [7]. On the benefit of outdoor physical activities, Smyth et al., 2013 [8] argued that outdoor environments offer many opportunities to be physically active, experience nature, and improve social interaction. Other research also highlights that engaging in physical activities outdoors is more beneficial to mental health than indoor exercise because apart from the improved physical fitness gained from outdoor activities, people can also benefit from an increased feeling of connectivity, social networking, and increased appreciation of nature, improve the feeling of revitalisation, and promote positive engagement [9].

Co-design is a participatory approach to developing solutions in which community members are treated as equal collaborators in the development process [10]. A systematic review of the literature by [11] discovered that older users and other stakeholders are vital in the participatory design process to ensure empathy and improve the acceptance of new technologies. Involving older adults in parts of the co-design process can empower them and provide a sense of ownership in the decision-making of application development [12]. Codesign frameworks such as experience-based co-design have shown the value of utilising people's lived experiences in creating and designing new devices [13]. The co-design process will help explore and identify how the physical web applications interface could be better designed and tailored to meet the users' needs.

Aim

In this present study, we aim to explore the perceptions and experiences of older adults in relation to their physical activity routines and to ideate some initial design ideas for the proposed physical web interface.

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Method

Twenty older adults have been recruited from an older adults' organisation in Ireland to take part in a co-design workshop. The co-design workshop will involve older adults and other stakeholders: activities coordinators and physiotherapists. The workshop will use the design thinking methodology to gather enough resources to develop an interactive prototype. Before the workshop, the participants will be given two questionnaires to measure their physical activity intensity and mobile device proficiency. During the workshop, activities will be tailored toward eliciting participants, perceptions, stories, and experiences of their engagement in physical activities outdoors on the following themes:

- What are the challenges and obstacles/barriers preventing you from engaging in outdoor physical exercise?
- 2. How might we solve these problems with technology?
- 3. Can you tell a story of the last time you participated in outdoor physical activities?
- 4. Do you walk outdoors alone or with friends?

Through the above questions, we hope to understand the optimal processes, technologies, and interactions needed to develop a physical web application in a public open space for rehabilitation and physical activities for older adults.

Result

Following the co-design workshop, the data will be analysed using thematic analysis. This data will help us to make design decisions, interactively explore the themes that arise from the workshop and utilise them to find direction to move forward in the next stage of the co-design process.

Conclusion

Outdoor physical activities benefit older adults in many ways; it improves physical and mental abilities and provides an opportunity for social contact and physical rehabilitation. A conducive, age-friendly, interactive environment may encourage older adults to participate in outdoor activities. However, they must be part of the design process when developing an outdoor physical web interface that will encourage them to engage in outdoor physical activities. The co-design method allows and empowers older adults to be part of an inclusive application design process. With this co-design ideation workshop, we aim to generate ideas and promote a nonhierarchical atmosphere for older adults and other stakeholders, in which their concepts, lived experience and tacit knowledge can be applied towards designing an inclusive outdoor physical web interface that supports and motivates outdoor physical activity for older adults.

Acknowledgements

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Don't Hold Back: Removing the Braking Component in Wheelchair Propulsion with a Novel Steering-By-Leaning System

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Abstract

Manual Wheelchairs do not steer but are turned by braking unilaterally. Changes or adjustments of the direction of travel slow down the movement and force users to re-accelerate. The resulting energy loss contributes substantially to the inefficiency of wheelchair propulsion, is possibly hazardous to users' health and can be frustrating. Our steering-by-leaning system allows wheelchair users to control the direction of travel through a laterally tiltable backrest that functions as a steering wheel. We tested the system in an adapted Illinois Agility test course with 16 experienced wheelchair users as well as 15 able-bodied novices and compared it against conventional wheelchair usage. The system was able to remove the need for braking for directional control which drastically reduced the energy requirement for completion of the course. We therefore believe that steering-by-leaning systems can make a meaningful contribution to the mobility of manual wheelchair users.

Keywords

wheelchair, propulsion, steering, leaning, agility, turning, cross-slope, tilted

Introduction

Manual wheelchair propulsion is widely regarded as inefficient, with only a small fraction of the energy exerted during a propelling push being translated into wheelchair movement. This drawback directly contributes to the high risk for shoulder pain and injuries among users has led to a series of studies investigating optimal propelling techniques or therapeutic interventions to reduce the strain on the upper extremities. A critical source of energy loss, however, has gained little attention in wheelchair propulsion research: The conventional design framework of manual wheelchairs based on 4 independent wheels and "differential steering" frequently forces users to work against themselves when they are required to brake on the curve-inner side to achieve a change in direction [1] or on the uphill side to maintain straightforward movement on tilted surfaces such as pavements [2]. Here, we hypothesised that any steering mechanism like known on other wheeled vehicles would allow users to change or adjust direction without braking and therefore better utilise kinetic energy.



Figure 1. Agility Test trial using the steering-by-leaning wheelchair prototype

Methods and Materials

Our steering-by-leaning system uses a laterally tiltable backrest to actuate two front wheel steering devices via Bowden cables. With the system engaged, these steering devices control the orientation of the front castor wheels, and hence of the direction of travel. The system was implemented on a research prototype wheelchair which further could be adapted to match the sizes and geometries of study participants' personal wheelchairs.

For evaluation, the chair was equipped with instrumented wheelchair wheels to track bilateral power output of study participants at a sample frequency of 140 Hz [3]. We invited 16 experienced active wheelchair users across a broad functional spectrum (ranging from amputation to complete cervical spinal cord injury) as well as 15 able-bodied novices to each complete 12 repetitions

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of an adapted Illinois Agility Test course, alternating between the conventional and the steering-by-leaning mode. Effects of the steering-by-leaning mode on wheelchair propulsion were assessed by comparing positive and negative work done (J) as well as elapsed time (s) for completion of the task using repeated measures ANOVA.

Results

The steering-by-leaning mode had significant effects on the assessed parameters, whereby the results differed between the two groups. Wheelchair users did a mean 1580 J of positive work for completing the test course. This amount was reduced by 29 With a mean of 760 J of active braking in the wheelchair user group, the negative work component made up almost 1/3 of the total energy spent for the task. This amount was halved in the steeringby-leaning mode. Able-bodied subjects, however, almost completely avoided braking, reducing their mean 704 J of negative work in the conventional mode by a striking 84 Among wheelchair users, the steering-by-leaning system did not yield a significant difference in time for completion of the agility test course whereby the able-bodied novices completed the task 23

Discussion

Steering-by-leaning can make a meaningful contribution to the mobility and independence of manual wheelchair users by removing the need for braking for directional control. Few studies have reported on the component of active braking required to change or adjust direction in wheelchair propulsion. Using the prototype wheelchair conventionally in our trials, the negative work made up almost 1/3 of the total due to frequent turning and sideways tilting sections. The steering-by-leaning system rendered active braking obsolete leading to a significant reduction of negative work done. This effect, however, was accompanied by simultaneous reduction of the positive work done, since subjects no longer needed to compensate for the energy lost while braking for directional control. The differences between the groups are likely the result of established routines in wheelchair propulsion. The wheelchair users were more efficient with the conventional system than the able-bodied subjects who didn't have any prior experience. Simultaneously, the latter appeared to intuitively better exploit the steering-system

compared to the experienced wheelchair users who still deployed their habitual propelling pattern, simply at a lower intensity. For able-bodied novices, the system seemed to be more intuitive and made completing the course much faster. Experienced wheelchair users adopted the system well, despite their established routines in conventional wheelchair use. This talk presents the novel steering-byleaning system for manual wheelchairs, evaluates related effects on wheelchair propulsion in laboratory settings and discusses implications for and the potential of using a steerable wheelchair in daily life.

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A case study of social robotics addressed to students with autism in upper secondary school

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Abstract

This paper presents a case study on the use of social robotics for students with autism in upper secondary school. The methodology used was described and results discussed.

Keywords

Social robotics, students with autism, upper secondary school, case study

Context

This paper presents a case study on the use of social robotics for students with autism in upper secondary school.

The intervention was aimed at promoting an inclusive educational-school context using this kind of assistive technology [1]. It was decided to use the social robot NAO to respond the needs expressed by the actors involved in the intervention¹. Also, as emerged by literature analysed [2, 3, 4, 5] this robot showed positive results for improving communication and social behaviours skills.

The specific objectives of the intervention were the improvement of the level of attention, communication, imitation, and social behaviors of students with autism [4, 5]. Furthermore, the use of the robot was investigated trying to answer three research questions:

- 1. What are the requirements for a correct introduction of social robots in educational contexts?
- 2. What modality could be adopted for introducing social robots within individualized teaching proposals?
- 3. Which learning and socialization needs of students can be addressed using social robots?

Methodology

The method used to carry out this study was based on a qualitative approach that through naturalistic observations allowed to collect information on the changes emerged following the intervention [6].

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The adoption of this methodology allowed to carry out thematic analysis of the experiences of students with autism and support teachers involved.

Also, the compilation of logbooks and feedback collected through focus groups allowed to analyze qualitative data from participants to understand the level of acceptability and replicability of the intervention [7].

Considering the method adopted for using the robot, it was based on the A-RAT methodology (Autonomous Robot Assisted Teaching), which consists in allowing students to interact with the robot through tablet for responding to robot's instructions.

For the implementation of the intervention, a multidisciplinary support team was organized, and it consisted of computer technician, pedagogist, neuropsychiatrist, as well as researcher and support teacher coordinator. The purposes of the team were:

- provide guidance to support teachers (n. 10) of schools involved through consultancy activities and training sessions on the characteristics of the NAO robot,
- identification of significant tasks from a didactic-educational point of view,
- definition of exercises consistent with student's educational objectives,
- training on programming and maintenance of robot,
- support in updating the Individualized Education Plan (IEP) of students involved.

The profiling of participants (students with Autism Spectrum Disorder, ASD), was carried out to identify a set of initial skills that could change over time and contribute to the definition of objectives and learning activities.

Participants' selection criteria included:

diagnosis of ASD,

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¹ The intervention was carried out by the Verona Autism Helpdesk in collaboration with the University of Verona (Department of Human Sciences), the Hospital of Verona, and 6 upper secondary schools located in the province of Verona (Italy).

- possibility of representing the different classes of the secondary school cycle,
- participation of students with different levels of severity of ASD.

Results and Discussion

Considering the initial questions, this case study allowed to identify the main requirement for a correct introduction of social robots in education contexts. It is represented by the possibility to settle a collaborative context with a team of experts that collaborate to design individualized learning activities for the acquisition of skills such as attention, communication, imitation as well as social behaviours.

Other results achieved allowed to understand:

- The importance to enhance the adoption of social robots within individualized teaching proposals strongly correlated to student's needs.
- The usefulness to define the functioning profile of students before choosing the activities mediated by the robots.
- The opportunity to anchor the activities carried out with the robots to what is outlined in the Individualized Education Plan (IEP) in order to find coherence in the identification of objectives for the development of functional skills.
- The fundamental role of support teacher as mediator between school, family, and support services in order to strengthen the synergies of different education agency.

Conclusion

The collaboration of different institutions and experts (support team), including families and classmates allowed to facilitate the introduction of social robots in the education environment.

The use of this robot confirmed that attention, communication, and social behaviors skills are needs that can be effectively addressed using social robots.

Finally, some evidence emerged in the results allowed to focus on some interesting aspects, such as the usefulness to define the functioning profile of participants or to anchor the activities delivered by the robots to what is outlined in the IEP. Topics that deserve to be further investigated as new trajectories of research.

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A role-based investigation of Socially Assistive Robots in a Paediatric Rehabilitation Clinic

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Abstract

There are many benefits to be found in the use of socially assistive robots in rehabilitative efforts, although much of the research focuses on testing specific functionality and observing the effects. Another outlook that can be taken is from a role-based perspective, understanding what roles a robot can take and the outcomes generated from taking on those roles. To broaden our understanding, we propose an in-situ study partnered with a major hospital focusing on the roles of socially assistive robots and how these roles can change or improve our use of robots and our design process. **Keywords**

Socially assistive robots, paediatric rehabilitation, rehabilitation robotics, hospitals

Context

In the area of health care, Socially Assistive Robots (SARs) are a quickly evolving technology offering a wide variety of use cases, augmenting and advancing health care delivery. A common focus of SAR research is looking into what can be done with them [1] and what benefits can be observed from their use.

SARs are capable of taking on a diverse set of roles. However, often these roles are set because of pre-determined requirements. For example, in social interaction contexts, SARs generally take on a role of companionship [2]. In contrast, in rehabilitation or physical exercise contexts, SARs take up coaching/demonstrating roles, giving motivation or providing corrective feedback [3, 4]. There is a clear importance in deciding on SAR roles to support specific desired patient outcomes.

This brings to the fore the question of appropriateness and choice of roles to be taken by SARs. Previous work has extensively explored roles supporting paediatric rehabilitation, such as providing guidance and encouragement - coaching [4], verbally providing directions - instructing [3], physically acting out specific actions - demonstrating [5], among others. Despite encouraging results exploring these roles for SARs, to date there has been little focus on the choice of role and the implications of these choices. We thus propose an in-situ field study within a busy paediatric rehabilitation clinic to address the question of SAR role choice.

In-situ Study

This research aims to uncover new insights into the rolebased utilisation of SARs. Extending from understanding what roles can be fulfilled to what roles are most appropriate and offer the greatest benefit in specific health care contexts. As SARs inherently possess limited capabilities, appropriate role choices are vital. Currently, trading autonomy for more human-guided use cases and more selective role choices offer the potential for greater benefit realisable in shorter time frames than more ambitious and ambiguous use cases. We argue that such efforts will serve to better focus future research on the key requirements of SARs, as identified through in-situ testing and evaluation.

In partnership with a major hospital, working with their paediatric rehabilitation clinic, we can analyse various scenarios. Included are those of SAR-guided interactions, human-guided interactions featuring SARs as well as other more niche designs. Through addition and subtraction of these roles in experiments and seeing the resulting effects, it is expected that a deeper understanding of how best to use SARs in the field can be gained.

Our study builds on previous work completed with the same partnered hospital. Specifically, Martí Carrillo et al. [5], employed SARs to guide paediatric rehabilitation sessions with over 50 patients from 3 to 16 years of age. Shown in Figure 1, a NAO robot interacted with children as part of their rehabilitation. While establishing the feasibility of SARs in the role of facilitating paediatric rehabilitation sessions, this research also identified several technical, social and clinical challenges. Limited availability of therapists, the focus of the patient wandering, and SAR unresponsiveness are all among these challenges. This previous work also considered SAR roles and so displayed the usefulness of further understanding role choice and appropriateness.

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Figure 1: NAO leads a patient during a therapy session [Guardian consent provided]

Evaluating SAR benefit represents another key component of our research. Specifically, judging how effective a specific integration of an SAR is while it is in use. Commonly, questionnaires and interviews are completed to judge patient and related parties' satisfaction towards SARs. While useful, this would be difficult to produce meaningful measurable data. Occasionally studies have implemented external cameras or additional physical sensors to measure physical status (e.g. heart rate) [6]. We propose the inclusion of additional external sensors to track movement during paediatric rehabilitation to allow for data gathering for quantifiable comparison and further analysis of the care delivery.

Conclusion

By deepening the understanding of the roles of SARs and their characteristics in a paediatric rehabilitation context, we expect to better the design and utilisation of SARs in paediatric rehabilitation, as well as provide useful information for wider health care contexts.

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An intervention model for inclusive educational pathways with Assistive Technologies: some experiences from southern Italy

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Abstract

This article presents the model of operation of the support desk for the introduction of assistive technologies in inclusive educational paths provided by the non-profit social cooperative Ausilioteca Mediterranea Onlus. The desk, active since 2010 in the province of Naples and since 2016 in that of Salerno, is aimed at curricular and support teachers of Italian public schools of all levels. The introduction of assistive technologies in educational paths can provide valuable support to students with disabilities, helping them access educational content and fully participate in activities in an inclusive way.

Keywords

Assistive technologies, disabilities, education, enabling environments.

Context

This article presents the model of operation of the support desk for the introduction of assistive technologies in inclusive educational paths provided by the non-profit social cooperative Ausilioteca Mediterranea Onlus. The desk, active since 2010 in the province of Naples and since 2016 in that of Salerno, is aimed at curricular and support teachers of Italian public schools of all levels. The introduction of assistive technologies in educational paths can provide valuable support to students with disabilities, helping them access educational content and fully participate in activities in an inclusive way.

In the years before the activation of the desk, Ausilioteca Mediterranea had activated numerous training courses for curricular and support teachers on the topic of introducing assistive technologies in the educational field. The training courses aimed to enable teachers to identify suitable educational technologies for students and classroom contexts and to integrate them into educational contexts. Field evidence showed partial effectiveness of the training interventions. In fact, the vast majority of trained teachers did not develop educational paths that integrated the use of AT^[1].

This condition led to the formation of a multidisciplinary team made up of experts in AT, bioengineers, psychologists, and educators to support teachers in identifying appropriate AT. Following the identification of $AT^{[2]}$, the team started

supporting teachers and conducting follow-ups to ensure the success of the interventions themselves.

The team works in synergy with the material and human resources already present in the field, trying to generate mechanisms of change in relation to the reference contexts. The article provides an overview of the most representative interventions carried out by Ausilioteca in different contexts. The cases examined involve students from primary to upper secondary school, and the classroom contexts examined involve students with disabilities who are very different from each other and often have multiple disabilities. Over the years, cases of motor, cognitive, and/or sensory disabilities have been addressed.

The interventions carried out from 2010 to 2017 were aimed at identifying the most appropriate assistive technologies, taking into account the difficulties in sourcing them. The interventions carried out in these years tried to use the technologies available to schools or students in a logic of frugal innovation^[3].

Starting from the 2017-2018 school year, the Italian Ministry of Education launched an experimental program, still active, for the provision of assistive technologies to schools that request them. From this date, the team's work focused on identifying the most appropriate ATs that could be provided by the ministry. The working group started a field training activity dedicated to teachers to support them in preparing requests for aids.

Conclusion

What emerges from a downstream qualitative analysis of the interventions is that the team's intervention is decisive for the introduction of assistive technologies in educational contexts and for the creation of enabling environments^[4]

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within which teachers can implement inclusive teaching strategies. Unlike training interventions according to the cascade model, the team's approach has proved to be effective.

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Will this book fit my reading needs?

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Abstract

Publishers are producing more and more born accessible eBooks, but to reach their publics those books must be identified as fitting the reader's needs. What sentences must be displayed by online book selling or landing platforms? To find answers we had to dive into the diversity of books features as well as print disable readers practices. The project leads us to advocate for redefinition of metadata sets, build a feature dictionary and publish reading use cases. **Keywords**

Publishing, Ebook, Metadata, Reading, Digital Accessibility, Inclusion

Context

Books are playing a major role in spreading ideas, enriching the culture and turning our democracies into flourishing debated places. No matter whether they are used to escape from our reality or to dive into it, access to books remains a fundamental human right. This right reinforces by the application of the European Accessibility Act [1] that urges the eBooks ecosystem to comply with accessibility obligations for products and services. This directive creates an inclusive society by ensuring access to eBooks for all European citizens, regardless of their disabilities.

However, paying attention to accessibility issues is raising the question of the diversity of eBooks and the plurality of editorial offers. It means that each book is likely to have different features than another and therefore, informing readers about accessibility features of eBooks is not an easy question to solve. In practice, it means that the access determines by specific reading systems, assistive technologies and reader competencies.

Readers with disabilities can choose the book they need as long as transparency on eBook features is fostered. This is a condition to allow people with disabilities to be fully independent. It is important as well to help teachers to choose the best book to recommend for their pupils or students to get access at their university.

This issue is well known by accessibility experts for a long but it is still a burning issue that is tackled by a large set of organisations in the four corners of the world. Beyond expertises, the subject is transversal and addresses all the actors of the book value chain.

The European Digital Reading Laboratory (EDRLab) is an international, non-profit development laboratory, working on the deployment of open, interoperable and accessible digital publishing ecosystems. 65 members are part of the EDRLab adventure that shaped a professional network composed of publishers, distributors, booksellers, public libraries, companies specialised in accessibility services, developers of reading applications and, obviously, readers and e-readers.

Methodology

Since 2021, EDRLab leads a project focused on informing users properly of eBook accessibility features. To do so, we identify state-of-art accessibility technologies and we work with the eBook ecosystem as a whole.

Our goal was to provide online booksellers and national lending websites with tools that could help them to improve the quality of services to people with disabilities. Eventually, we could help those people to get a similar experience to everyone and so, get closer to an inclusive society. We paid attention to two main stakes:

- usability defines as information put online to help the reader choose the book that fits their needs;
- feasibility defines as the level of transparency and intelligibility of provided information.

In practice, we created prototypes of book information pages as fully accessible HTML webpages. We based those prototypes on the existing guide, proposed by the World Wide Web Consortium (W3C) [2].

An invitation was sent to 70 selected persons all actors of the eBook ecosystem, including organisations representing peoples with disabilities (blind, visually impaired and dys), libraries serving persons with print disabilities and public libraries. 51 persons responded. They were asked to manipulate the prototypes and participate in two workshops to discuss and respond to the two following questions:

- is the provided information of use to help me choose a book that fits my needs?
- is this information present and reachable to be provided to users?

We used participants responses to make iterations on the prototypes until we reached a consensus. A restitution of this work was given to the participants in February 2022. The next step is practical implementation by bookselling platforms providers, expected by the end of 2023.

As participants of the workshops enlightened difficulties with the vocabulary translated from English, we opted for an

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extension of the project through a national survey. A working group was constituted to establish a survey limited to 6 identified informations. For each of them, 3 sentences where proposed. A use case description page with examples was built to help respondent understand the feature to describe.

The survey was submitted to users in different ways depending on the target audience:

- a general public survey distributed by *epagine.fr* and *leslibraires.fr* to which 221 people responded;
- a survey targeted at the pilot readers of the *Éole* multimedia library (Valentin Haüy association) to which 56 people responded;
- an interview with a panel of 4 persons from the Fédération Française des Dys (FFDYS).

The results are publicly available since September 2022 on the project dedicated webpage [3].

Results and Discussion

From the initial phase, a synthesis of participants reactions was established. It can be resumed as follows:

- the proposed wording is overspecialized and generates misunderstandings;
- 2. the user experience should be more inclusive;
- recommendations about the filtering user experience should be detailed;
- 4. important books characteristics are missing;
- 5. no mapping from MARC available.

Point 1 was addressed by an extension of the project to propose a localized wording as described in the Methodology. Point 2 to 5 were detailed and used to trigger actions to the relevant actors:

- a feedback paper sent to the W3C Publishing Working Group that led to an ongoing complete rewriting of the User Experience Guide;
- recommendations to ÉDItEUR, responsible of ONIX metadata standards, and to the MARC committee that are considered for next releases;

We've also seen a side effect on persons in charge of adding accessibility informations. Because describing possibilities to access the content of a book means describing features of this book, the redefinition as use cases allowed a much better understanding not only of accessibility metadata but also of the book as a digital object and real impacts of care provided and attentions taken in it's conception and production. To consolidate this effect, we reused reading use cases to build a Dictionary of Accessibility metadata [4].

Because the project triggered actions from third party actors, we are monitoring the evolutions and will adjust our recommendations in consequence.

Still, access to knowledge and culture in a digital world implies moving an entire ecosystem, never forgetting that the reader is part of it and needs understanding to take advantage of the features made accessible. Reading and manipulating born accessible eBooks still require strong competencies for peoples with print disabilities. Some of the participants to the vocabulary study discovered possibilities of visual adjustments or navigation at different levels including print page related position.

Use cases and localized vocabulary are a great step but they are still not sufficient to make reader's practices easier to learn. Because assistive technologies are often the main mean of access for peoples with print disabilities, they might be a wonderful vehicle to promote state of the art in industry standards and order to empower users in the use of born accessible materials.

Conclusion

This ambitious study drives us to redefine not only accessibility metadata but also the eBook itself as a social and cultural object. Improving eBook information to make them visible to people with specific needs is a challenge that can only be lived up to whether each actor gets fully involved in paying attention to the quantity and the quality of eBook metadata.

Searching for the best sentences to be displayed by book distribution systems we landed with recommendations that aim to inform all readers about eBooks features including related accessibility counterparts and also spread good practice into the eBook ecosystem, including authors, publishers, distributors and booksellers, about how to describe eBook contents and features in general.

This work opens doors for a better independence of persons with print disabilities if they have sufficient tools and competencies to fully access born accessible features.

Acknowledgements

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Designing for Accessibility in Cultural Heritage – Exploring Tangible Technologies for Enhancing the Museum Visit Experience for Blind Visitors

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Abstract

The development of 3D scanning and printing technologies opened new opportunities for improving the engagement of visually impaired people in general and blind people specifically, when experiencing cultural heritage. However, in spite of numerous recent studies, developing cultural heritage experiences for visually impaired visitors is not straightforward, and multiple factors, including knowledge about the available opportunities, desires, barriers, and abilities affect their participation. In this short paper, we present an approach for exploring techniques for designing and developing such experiences in the framework of a graduate multidisciplinary course with the active involvement of museum staff, and visually impaired visitors with the aim of making the cultural heritage accessible according to the universal design principles to enhance the museum visit experience of blind people.

Keywords

Human-centered computing, Accessibility, Accessibility systems and tools

Context

Museum exhibitions are mainly visual, which makes visiting museums challenging for visually impaired people in terms of engagement and participation. In general, exhibitions contain and are composed of numerous glass boxes where various items are displayed and not allowed to be touched. This is the first and major challenge for visually impaired visitors. Current technological development and especially 3D scanning and 3D printing open new opportunities for making the museum accessible for visually impaired visitors. Over the years, considerable research effort was invested in making museums accessible for such visitors. [1] and [2] surveyed state of the art of the use of assistive technology for enhancing the museum visit for visually impaired visitors. They describe in details the challenges that visually impaired visitors face. They then discuss how assistive technologies can enhance visually impaired visitors' experiences in museum exhibitions.

With similar ideas in mind, our aim was to train the students-developers – to work together in teams of graduate students, in a multidisciplinary course on making the archaeological heritage in the museum accessible to blind visitors, inspired by the work of [3].

Methodology

After an introductory lesson, the students were split into four groups of four students. The museum staff selected four topics and several artefacts related to each topic, including ancient warfare, writing, mythology and religion, and lastly the story of late Bronze Age anthropomorphic sarcophagi. Each subject was to be presented as a cohesive narrative represented by three to four artifacts from the museum.

To ensure that the suggested concepts meet the needs of the blind users, the development process include all stages of Design Thinking:

1. Empathy: The students generate empathy and familiarity with the field of development by talking with the museum staff, experiencing the museum blindfolded, and accompanying blind visitors during a visit in the museum, and finally, reviewing relevant literature. In the second lesson, the students met with two blind people – to understand and evaluate their needs.

2. Define & Ideate: The teams were asked to present their concepts based on literature reviews and user interviews while producing quick prototypes (such as video prototype and cardboard prototype) to better communicate and refine their concepts.

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Prototype	3D printing	System activa-	Pre-recorded	Object arrange-	Audio control
	technology	tion	audio player	ment	features
Ancient warfare	FDM	NFC	Mobile app	No order	Volume
Writing	FDM	N/O Pushbuttons	Local Mp3 player	separated in different boxes	None
Mythology and religion	SLA	N/C pushbuttons	Local Mp3 player	located in designated shape-matching sockets	None
Late Bronze age anthropo- morphic sarcophagi	FDM + SLA	NFC	Mobile app	linear order	Volume and speed

Table 1. Interact design: The technologies that been chosen for producing the four concepts.

3. Prototyping: the teams were asked to produce semi-working prototypes that could be tested with actual users. For that matter replicas were produce using 3D scanning and 3D printing, audio files were recorded, and primary code was written. All groups faced the same questions regarding interaction design and each of them chose to solve them in a different way

4. Testing Evaluating: For the first usability test the students used the Wizard of Oz testing technique – a method of testing a system that does not yet exist and yet found to be a very efficient tool for evaluating interactions and performance [4]. The 3D artifacts and audio files were produced but the activation of the interactive artifacts was controled by "a hidden wizard". The students could test the concepts with the two blind users although it wasn't fully working and improvements would be implemented in the final projects.

5. The final prototypes were developed and refined according to the observations of the intermediate tests. The interactive sets were presented at the end of the course but had not yet undergone additional testing with blind users.

6. Finally, all of these new affordable technologies have the potential to improve accessibility by providing blind individuals with more control over their environment, making it easier for them to interact with tangible technology and access information and resources.

Results and Discussion

Four different interact design were developed with different technologies (See **table** 1).

Conclusion

The course was highly appreciated by the museum and the representatives of the intended audience. The group work yielded diverse suggestions for enhancing museum accessibility for blind visitors.

The end user evaluated the final project positively, highlighting their potential to enhance participation and engagement while visiting the accessible museum. In addition, the students gained a sense of self-efficacy and satisfaction with the opportunity to use of 3D scanning and printing technologies for creating an inclusive museum for blind people. The course provided them with new challenges, which were completely different from traditional frontal teaching. Learning with multidisciplinary students and lectures demonstrates an innovative, different and creative way of learning and added to their experience.

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Online art therapy-based self-help intervention for emotional betterment

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Abstract

ELTE EMIND Research Group conducted a series of studies on the investigation of effectiveness and characteristics of the art therapy-based online self-help tasks (ATB-SHOT) to support university students during stressful times. This digital, individual method was easily accessible for all students via structured instructions given in google forms via email. Art tasks required no artistic skills. According to qualitative and quantitative analysis of 54 participants, students were able to enhance mood, lower anxiety, gain more self-awareness, control, and feelings of safety and competence. Correlation analysis revealed that emotional betterment can be enhanced even with higher trait anxiety, and somatic complaints due to ATB-SHOT. Some tasks' texts and images were uniquely investigated from different view-points: "Squiggle tasks" was observed to seek an understanding of how a simple creative task fosters coherent self-consciousness; "Object task" was investigated to see how instructions modify the experience of a self-help intervention.

Keywords

art therapy-based online self-help, digital mental health service

Introduction

In recent years, there has been a growing need for accessible and convenient mental health support. The COVID-19 pandemic has only heightened this need, as many individuals have experienced increased stress, anxiety, and other emotional challenges. Online self-help forms, such as self-guided therapy offer individuals a flexible and personalized approach to emotional well-being^[1]. These solutions can be accessed anytime and anywhere, making them a convenient and costeffective option for individuals seeking support.

We designed^[2,3] a new initiative combining the advantages of digital self-help in complex art therapy-based self-help tasks (ATB-SHOT) and investigated its effectiveness and mechanisms. Often, individuals may struggle to express their feelings and experiences through words alone, and art therapy provides a creative outlet for expressing and exploring these emotions. Using art materials, individuals can tap into their creativity and engage in a process of self-reflection and discovery ^[4]. Online group art therapy was studied during the pandemic ^[5] but the self-help format is a new initiative. The mixed method using cognitive-focused expressive writing^[6] and emotional, sensory-focused artmaking in easily accessible Google forms provided users with a unique approach to emotional support.

Methodology

Research Design: Effectiveness measures consisted of a pre-and post-test design with standardized measures, and the qualitative analysis acquired reductive content analysis based on post-test written feedback and image coding.

Participants

The study involved 54 (7m,50fm, Mean age: 24.66 SD:2,4) participants who were university students during the pandemic. Data collection happened in two semesters (1+2). As inclusion criteria, we recruited participants from a course where they could have first-time self-experience in art therapy, exclusion was active psychiatric or neurological treatment.

Procedure

All tasks were given on google forms in emails. Visual imagemaking based on instructions, designed by the first author, an art therapist, and a clinical psychologist. A list of tasks is introduced in Table 1. Participants could choose any art medium.

Table 1. ATB-SHOT Art themes

Color: matching individual colors and emotions

Squigglle: expressing emotions by squiggles and creating forms and narrative

Object: Meditative drawing of a personally relevant object

Avatar: using body focusing and imagination to relate to the present and wished emotional state

Safety: creating an image of the personal meaning of safety

Transformation: a visual overview of recent times

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The structure of tasks was identical as visualized with grey in Table 2.

Table 2. Structure of ATB-SHOT					
Preliminary tests	Pre-test	ART TASKS	Post-test		

Trait anxiety (STAI-T) and somatic complaints (PHS-15) were preliminary tests. Pre/Post tests investigating the emotional state with a verbal scale (PANAS), a nonverbal scale (SAM: self-assessment manikin on mood, arousal, control), structured questions about feelings of safety (SQ), and Feedback of the process.

Data analysis

I. Quantitative analysis[3]

1. To prove the effectiveness of ATB-SHOT pre-post comparison was made in PANAS, SAM scales of 57 participants in four tasks (indicated grey in table1); because of non-normal distribution, we used the Wilcoxon Signed-Ranks Test.

2. We also correlated the PANAS with personality traits measured in the preliminary tests.

II. Qualitative analysis^[2]

1. In the case of 22 participants (from semester 1) we also did a reductive qualitative analysis of texts to see coping mechanisms used by conducting the art tasks.

 To investigate the working processes of ATB-SHOT we made a reductive qualitative analysis of the participants' Squiggle task.

3. To investigate the effects of instructions, - in the case of the Object task where the two semester groups (S1, S2) received slightly different instruction for the same task,- we compared the pre-post PANAS changes of S1 and S2 with the Wilcoxon test. We also made a qualitative analysis of the feedback texts related to the images.

Results and Discussion

I.1. In all four tasks there was a significant (p<0,01) decrease between pre- and post-measures on PANAS negative score as visible in Figure 1.



Figure 1: Pre-Post PANAS Negative in ATB-SHOT tasks.

PANAS positive only increased in the Safety task (p:0.045) and Transformation task (p<0.001). On the SAM Scale mood (p<0.001) and arousal (p=0.005) only increased significantly in the Transformation task. SAM Feelings of Control increased significantly in the Safety task (p<0.049) and Transformation task (p<0.001).

I.2. Correlation matrix showed a negative correlation between diff PANAS negative and trait anxiety (STAI-T) R: -,467**, and somatic complaints (PHQ-15) -,450**, and susceptibility (STAI-T+PHQ15) -,488**. With medium effect size, all these results showed a g power between 0.98-0.99.

We concluded that ATB-SHOT effectively reduces stress in crucial times even if personality traits show greater susceptibility.

II.1. Qualitative data analysis showed three emerging themes in the overall images and texts throughout the seven tasks: calming natural scenes, memories of positive experiences with attachment figures and loved ones, and transpersonal content.

These themes might be further utilized to facilitate coping.

II.2. The analysis of squiggle tasks showed that arousal and valence of the affective states were expressed in the squiggles. Reflective questions aid cognitive work, and introspection resulting in emerging themes connected to coherent self-concept: self-reflection, acceptance and compassion, feelings of competence and control, and integrated coherent self-consciousness.

Semi-directed free artmaking and associative writing helped to gain awareness and link the spontaneous vibe marks with more coherent and complex experiences of life changes, memories, and self-narratives.

II.3. In the analysis of the Object task we found significant differences between the two groups. The most significant result is the negative effect increase in the S2 group (p:0,00) as visualized in Figure 2. The analysis of the texts revealed that the suggestive effect of the instruction unconsciously elevated anxiety in the second group.



Figure 2: Panas changes in Squiggle task in the two groups

This mixed study proved that instructions have a suggestive component and therefore it is necessary to carefully design such a method.

Conclusion

As the need for accessible and convenient mental health support continues to grow, ATB-SHOT may offer a promising solution for individuals seeking a creative and personalized approach to emotional well-being. Non-verbal self-expression supports engagement with embodied emotional experiences and helps to identify, express and understand life situations even for individuals who might struggle with verbal fluency (because of cognitive, linguistic, or mental states). The artistic, symbolic approach helps to mitigate defense mechanisms, and opposition and increase self-care and self-acceptance. The digital format lowers social anxiety, time management, and engagement problems which often cause setbacks in face-to-face therapies. Limitations are lack of social support, dropouts, and scarce access to computers, especially in marginalized populations.

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Developing an Android-based game for children with blindness or low vision

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Abstract

The purpose of our research was to create a skill-based game running on the Android platform that is primarily intended for children around the age of 7-12 years. The game is designed to improve the dexterity and hand coordination of the children and can be played by users with blindness or low vision. It can be also applicable in instances where a variety of disabilities caused by neurological differences, such as autism, may result in blindness.

Keywords

Skill-based game, smartphone, Android, Unity, blind and low vision

Introduction

The game is a specially designed activity that aims to improve the dexterity and hand coordination of children. Its unique features and design make it accessible to individuals with blindness or low vision, allowing them to participate and enjoy the benefits of the game like other children. [1]

Moreover, the game's accessibility makes it useful in instances where various neurological differences, such as autism, can result in blindness or low vision. The game's design allows for users with different abilities to play and enjoy the game, promoting inclusivity and accessibility. In this way, the game serves as an excellent tool to promote physical activity, social interaction, and cognitive development in children of diverse abilities. It can provide an engaging and stimulating experience for children with disabilities, allowing them to improve their hand coordination and dexterity while having fun.

Furthermore, the game's accessibility can also increase awareness and understanding of individuals with disabilities, promoting a more inclusive and accepting society.

Methodology

We have created the "Sleepy Kitten" skill game on Android with two game modes, with the goal of getting as many kids of school age as possible to enjoy the game. The story of the game is to get a tired kitten home by collecting plush animals on the way and avoiding obstacle boxes. The task is to collect as many points as you can by guiding the kitten through the level.

For implementation Unity development environment and C # programming language were chosen. We have used free

online tools for producing graphic and audio materials (opengameart.org, bearaudiotool.com).

For testing, we have used the Unity 5 app available on Google Play Marketplace to try the game on a physical device during development. Until the final game had been made, we have tested the game on several physical devices. While the developing process of the game our families, colleagues, and friends have helped us in testing. In order to test it with the help of elementary school-aged children, we have asked for the help their teachers. Based on their feedback, the current version was ready after some minor changes. [2-3]

Functions

The game has two game modes currently, there are four different difficulty levels, two modes of control. The Hungarian and English languages are implemented in the game, also the sound files of both languages too for helping those players who have visual problems (Fig. 1).

- Game user will be taken to the level selection menu, depending on whether Dark Mode is on or not the player can choose from Dark Mode levels or Normal ones.
- Settings access the Settings menu where you can adjust the game settings. Such as turning background music on / off, turning effect sounds on / off, muting or unmuting every sound, turning Dark Mode on / off, changing the language or selecting controls.
- Highscores you will be taken to the Highscores menu, where you can see the best results so far by level. Help access the Help menu for information about the game.

There is a mute button in the top right corner of the level selection menu. Clicking on the title of the screen which here is Levels or Dark Levels - if read out loud option is enabled - the game will read the entire screen again. Each level is indicated by numbered boxes, a higher number indicates a heavier level. If read out loud option is enabled, the first click will only read the level number and only the second click will start the selected level. At the bottom of the screen

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Figure 2: Figure game

the user can return to the Main Menu by pressing the button labelled Main Menu.

After the user has selected a level in the level selection menu, the game begins. In the upper right corner is the mute button. In the top left corner are the kitten's lives / enthusiasm and the score in the middle of the top of the screen. The kitten is shown at the bottom of the screen, you can move it left or right in the direction you select, the kitten can't leave the screen (Fig. 2). As the game moves forward, the kitten will encounter plushes and obstacles (boxes) and bowls full of refreshing milk. If the kitten reaches the end of the level, he will be welcomed by a litter and will receive ten bonus points for successfully completing it.

In the dark game mode (Fig. 3), the user can only rely on hearing and memory. The kitten is trying to get home in complete darkness. At times the kitten stops to listen to the sounds of the night and knows pretty much where he/she is.

Touching the screen with multiple fingers pauses the game. While it is stopped, users can sweep the screen with one finger to scan it and realize where they can go. Which character is touched by the player's finger, it gives a clear voice and the object identifies itself. Other than that, the dark mode rules are no different from the rules of regular play.

As you reach the end of the level or run out of kitten lives / enthusiasm a summary window pops up. If the kitten has returned and the points he has earned are displayed. Clicking the OK button will load the Highscores menu, where the highest scores are displayed by level.

The game has two modes: Normal and Dark. Normal mode offers the player more setting options, greater freedom





Figure 3: Dark mode game

Figure 4: Game over game

of movement, and a higher level of visibility. The player can move the cat in different directions, collect plush animals for points, and must avoid colliding with boxes that cost the cat a life. On the other hand, Dark mode has limited settings due to its mechanics. The game screen is dark, and the player must navigate the cat home using their ears and memory. The player can explore the terrain by touching the screen with at least two fingers to scan the area, and the cat changes lanes by touching the side of the screen corresponding to the direction of movement. The player must avoid boxes and collect stuffed animals to earn points. Both game modes have separate score records, and the player can set a new record by achieving a higher score at the end of a level.

- The player can make the cat move in right and left directions using the selected control (by touching the appropriate side of the screen or tilting the phone in the appropriate direction).
- Boxes are placed on the field that the cat collides with, which costs one of its lives/enthusiasms for returning home and resting.
- The cat starts every level with 3 lives/enthusiasm, and if it loses them, the level ends.
- Plush animals mouse, penguin, bear can be collected on the field, earning points for the player. Different types of plush animals have different point values.
- If the cat reaches the end of the level, its achieved score plus the homecoming bonus will be its total score.
- If the cat loses all its lives/enthusiasm before reaching the end of the level, it will not receive the homecoming bonus.

Results

The game was tested with the help of 8 small children and their parents and their teachers. During the testing, we sought answers to three things. These are:

- How enjoyable was the game?
- Playability of Dark Mode
- . Controls

Everyone was satisfied with the game, and even suggested further development ideas. The enjoyability of the game was only slightly affected by the Dark Mode, which appeared as a weak point due to its lack of refinement. More than half of the children tried it out, but their responses were almost unanimously indicating that there is still room for improvement and refinement for this concept. Based on the testing, both the controls and the Dark Mode have been improved. During development, we eliminated the over-sensitivity issue when tilting the phone, and the Dark Mode has also been designed to be more user-friendly.

Conclusion

The "Sleepy Kitten" game is a very user friend game, it is easy to control for children with low vision or blindness. During the testing process, children have always enjoyed the game. Parents' and teachers' opinion were also very positive about the game.

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https://www.cost.eu/actions/CA19104/.

- https://www.spectrumnews.org/opinion/viewpoint/seeing-connections-between-autism-and-blindness/
- [2] https://store.unity.com/products/unity-personal Official Unity products
- [3] https://www.unrealengine.com/en-US/what-is-unrealengine-4 Unreal engine Site

A Pilot Study on the Relationship between Hand Load and Gait during Walking while Holding on to Furniture in Patients with Hemiplegia Stroke

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Abstract

Focusing on the hand load is essential in analyzing walking while holding onto furniture. However, installing sensors inside a house to measure pressure is difficult. Therefore, this study investigated the relationship between gait and hand load, aiming to estimate the hand load from the gait. Two stroke paraplegic patients participated and walked across a parallel support stand instead of furniture. Each evaluation indicator was calculated based on the data acquired by the 3D motion capture system and pressure sensors. In common with all hand load evaluation indicators, strong positive correlations were observed with maximum trunk lateral flexion angle, maximum pelvis depression angle, stride length, and vertical range of movement of the center of gravity, which showed walking characteristics while holding on to something. Therefore, the above four indicators are likely to be useful reference indicators for estimating hand load from the gait.

Keywords

Maintenance Rehabilitation, Stroke, Gait Analysis, Marker-less Sensing, Non-contact Sensor

Context

In the living environment for hemiplegic stroke patients in maintenance rehabilitation, furniture such as desks and shelves are selected and arranged based on the fact that they can support walking behavior. However, conventional methods for gait evaluation and selecting and arranging furniture based on such evaluation are trial-and-error and qualitative, and a quantitative evaluation method is required here.

In analyzing handrail walking, it is important to focus on the hand contact area in addition to conventional gait analysis indices [1,2]. Still, measuring the hand load by installing pressure sensors in an actual house is difficult. Therefore, it is necessary to estimate the hand load. Therefore, this study aims to investigate the relationship between hand load and gait to estimate hand load from gait as the first step of quantitative gait evaluation.

Methodology

2.1. Experimental setup

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It is distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0), which permits copy and reproduction of the material in any medium or format, provided the original author and source are credited. Two Azure Kinect DK (Microsoft, Redmond, WA, USA) and a full-body version of the SR SoftVision surface pressure distribution sensor (Sumitomo Science and Technology Corporation, Nagoya, Aichi, Japan) were used to acquire joint position coordinates and surface pressure data.

2.2. Calculation of indicators

2.2.1. Gait evaluation indicators

Five indicators were calculated as spatiotemporal parameters: period, speed, paralyzed side duty ratio, cadence, and stride length on the paralysis side. In addition, two indicators were calculated as assessment items in the physical therapist's observation: moving distance of the center of gravity and joint angles focused on paralyzed side lower limb motion. The center of gravity was calculated by combining the center of gravity of each body segment obtained from each joint position. The vertical range of movement during the entire gait cycle and the lateral range of movement during the stance phase on the paralyzed side were calculated. For each joint angle, a basic axis and a moving axis were set respectively (Table 1), and the angle between the two axes was calculated.

2.2.2. Hand load evaluation indicators

Four indicators were calculated to evaluate the hand load: (1) maximum local load: maximum value of maximum surface pressure per contact, (2) maximum total load: maximum total load per contact, (3) impulse: product of total load and contact time, (4) maximum contact area: maximum contact area per contact.

Table 1. Definition of Joint Angles

Name	Plane	Definition of two axes						
			(B:Basic axes, M:Moving axes)					
Trunk flexion	sag	B:	the vertical line passing through					
Trunk lateral bending	cor	M:	SPINE_CHEST SPINE_CHEST SPINE_NAVAL					
Pelvis anteversion	sag	B: M:	the vertical line passing through PELVIS PELVIS SPINE_NAVAL					
Pelvis depression	cor	B:	the horizontal line passing through HIP					
Pelvis rotation	hor	M:	the line connecting both sides of HIP					
Hip flexion /extension	sag	B: M:	SPINE_CHEST SPINE_NAVAL HIP KNEE					
Hip external/internal rotation	cor	B: M:	the line perpendicular to the line connecting both sides of HIP $$\rm HIP \ \ KNEE$$					
Hip abduction /adduction	cor	B: M:	the vertical line passing through KNEE KNEE ANKLE					
Knee flexion	sag	B: M:	KNEE HIP : KNEE ANKLE					

Table 1	2.	Subject	Characteristics
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	Subject			
	А	В		
Gender	М	М		
Age	70	60		
Height [m]	1.63	1.72		
Weight [kg]	57.8	80.3		
Affected side	L	L		
BRS*	V	V		
FIM(movment)	7	5		
*BRS:Brunnstrom Stage of lower limbs[3]				



Figure 1: Reproduction of the Measurement

2.3. Experimental protocol and data analysis

Two stroke left hemiplegic patients with general hemiplegic gait characteristics participated in this study. The measurement reproduction by a physical therapist is shown in Figure 1. In hospital rehabilitation, gait practice is performed using a parallel support stand. Therefore, a parallel support stand was used as a substitute for furniture, and the motion of walking while moving across the parallel support stand with the right hand was measured. The subjects were allowed to choose the way of contact with the parallel support and the walking speed during walking.

A bivariate analysis was applied, and Spearman's correlation coefficient was calculated to investigate the correlation of each hand load evaluation indicator with that of gait.

Results and Discussion

In common with all hand load evaluation indicators, strong positive correlations were observed with maximum trunk lateral flexion angle, maximum pelvis depression angle, stride length, and vertical range of movement of the center of gravity. The following mechanisms are discussed with regard to the results.

- i. Since walking is stabilized by external support, the pat
- ii. ient actively tries to apply load to the external environment by tilting the trunk. At this time, pelvic descent occurs along with lateral trunk bending because

of the integration of the trunk and pelvis, one of the characteristics of hemiplegic patients.

- iii. The stride length increases as contact with the external environment, stabilizes the gait, and reduces the fear of falling.
- However, since the defective rocker function is not fundamentally improved, the range of vertical movement of the center of gravity increases with increased stride length.

Considering the above, it can be inferred that the above four indicators show walking characteristics while holding on to something. Therefore, they are regarded as helpful reference indices for estimating the hand load from the gait evaluation indicators.

Conclusion

This study focused on the gait of patients with hemiplegia stroke and attempted to elucidate the relationship between hand load and gait. We suggested that four indicators, i.e., maximum trunk lateral bending angle, maximum pelvis depression angle, stride length, and vertical range of movement of the center of gravity, are useful in estimating the hand load.

Furthermore, this study is a pilot study on walking while holding onto furniture. Future prospects are to revalidate the trends revealed in this study as the number of subjects increases through continuous experimentation.

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Proposal and prototype of an esophageal speech training device using myoelectric signals

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Abstract

Patients who undergo a laryngectomy, for treatment of laryngeal cancer, lose their vocal source function and therefore lose their voice. Esophageal speech is used to help these patients regain their voices. Although this method can be used hands-free and has high speech intelligibility, it is difficult to learn, requiring more than six months of practice, and the percentage of patients who learn it is as low as 60-70%. This is thought to be because an objective practice method has not been established.

Therefore, we have been developing a device to analyze and visualize the muscles' activity in esophageal speech, which will enable efficient practice. In this report, we describe the results of our study of signal processing methods for measuring the myoelectric potential signals of the hyoid muscle and diaphragm, which are active during esophageal speech. In addition, we have developed a prototype myoelectric measurement device using an Arduino and tested its operation.

Keywords

Esophageal speech, Myoelectric signal, Training device, Speech production substitutes

Background

Laryngectomy patients for treatment of laryngeal cancer or other diseases lose their vocal cords, the source of the human voice. This makes it impossible for them to produce a voice and to speak[1]. However, such patients have only lost their vocal cords, which are the sound source, and their articulators, such as the oral cavity, lips, and tongue, are still intact. Therefore, it is often possible to regain voice by reconstructing the sound source mechanism.

Various speech production substitutes have been proposed and put into practical use to reconstruct the sound source for such patients[2,3], and esophageal speech is a representative example. While this method has the advantage of high intelligibility and requires no equipment, it has the disadvantage that it is extremely difficult to master and may not be acquired even after a long period of training[4]. This is because the practice of esophageal vocalization is mainly based on the experience of skilled practitioners, and no objective practice method has been established.

We have focused on the muscles that are active during esophageal speech and have researched to develop a device that supports training by detecting and visualizing muscle activity during esophageal vocalization by measuring myoelectric signals. This report describes our signal processing and device prototyping findings when applying EMG signals to training devices.

Esophageal speech

Esophageal speech is a method in which air is drawn into the esophagus through the mouth or nose and then backflowed into the mucosal layer of the upper esophagus, called the false vocal cords, which vibrates to produce the original sound, from which the voice is produced. This speech method is the first method to be tried as a substitute for vocalization because the sound source is a mucous membrane similar to the vocal cords, so it is similar to vocalization by vocal cord vibration and has good sound quality. On the other hand, however, it is quite difficult to learn, with 60-70% of the population being able to hold a simple daily conversation, and it takes more than half a year to master the technique. This is said to be because, in the process of esophageal vocalization practice, the method is mainly based on subjective practice methods obtained from the experience of skilled practitioners, with little intervention by medical professionals. Therefore, this study aims to find an objective practice method based on the biological mechanism used during esophageal vocalization to improve practice efficiency and realize a device that enhances the learning rate.

Methods, Results, and Discussion

First, 173 esophageal speech users were asked to complete a questionnaire regarding the areas in which they exerted force

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and areas in which they relaxed force during vocalization. The results of the questionnaire revealed that the participants put a lot of effort into their mouth and abdominal muscles during vocalization. This tendency was particularly pronounced among the more advanced participants who were able to utter more than 10 sounds at a time. Based on these results, we speculated that esophageal speech users use tongue and diaphragm movements to draw air into the esophagus. There was also a significant difference in the use of abdominal muscles and muscles around the mouth and tongue between advanced and novice in terms of areas of relaxation during inhalation and areas of tension and weakness during exhalation. In this study, we measured the muscle activities in these two areas using surface EMG signals and proposed a device for training esophageal vocalization using the results. Our proposed training device uses two electrodes to measure tongue and diaphragm muscle activity, one attached to the mylohyoid muscle and the other to the lowest intercostal space on the median line of the right clavicle. By quantitatively evaluating muscle activity in esophageal speech, this device is expected to establish an objective practice method to improve the efficiency of the training. The procedure for training with this device is as follows.

- Identify which muscles are active during esophageal speech and at what timing, and based on this, create data on model muscle use.
- The muscle activity of the user of the training device is monitored to confirm whether the muscle movement is correct compared to the model data, and the user confirms correct muscle movement at the correct timing by visually presenting the timing of the model data using indicators, etc.
- 3. The instructor gives personalized, objective, and accurate advice.

Second, we fabricated a prototype training device using a PC and LabVIEW and investigated the temporal relationship between muscle activity and vocalization in an esophageal speech user. EMG electrodes were attached to the two locations mentioned above on the subject, and the muscle activity of the mylohyoid muscle and diaphragm was measured while simultaneously measuring the voice with a microphone. The subject was a male, in his 60s with, an advanced esophageal speech technique. The measurement results revealed that this advanced esophageal speech user moves their muscles in the following order.

- 1. Before speaking, open the mouth to let air into the mouth.
- 2. Lower the diaphragm and move the tongue backward.
- 3. The air in the oral cavity is sent into the esophagus.
- 4. Speech is produced.

In the measurement by a normal subject for comparison, there were some discrepancies, such as the absence of movement in 1) and the difference in the order of movement of the diaphragm and tongue in 2). These results suggest that this system is effective as a practice aid device.

Third, we determined a discrimination criterion for automating the threshold value determination for reading the onset of muscle activity from myoelectric signals. Since this device is designed for users to practice by themselves, it is necessary for the device to set the threshold value automatically and objectively, and to automatically determine the correctness or incorrectness of the timing of muscle activity based on the value and present it to the user. Therefore, in the process of signal processing of the measured myoelectric signals, the number of items for obtaining a moving average was changed, and 85 items were determined as the maximum value at which the characteristics of the waveform remained. A baseline with low amplitude was determined from the moving average obtained above, and a threshold value of 1.5 times that value was assumed. The respective values were 0.015 mV and 0.0225 mV for the diaphragm and 0.17 mV and 0.26 mV for the mylohyoid muscle. The temporal relationships between the diaphragm and mylohyoid muscle activity and vocalizations obtained using these values were the same as those obtained using conventional visual thresholds. Based on these results, we believe that 1.5 times the baseline assumed in this study is appropriate as a threshold value.

Finally, an Arduino-based system was constructed to realize this system at a lower cost. The system consists of a general-purpose microcontroller board Arduino and an inexpensive myoelectric signal measurement unit Myoware from Advancer Technologies. The prototype device is shown in Figure 1. The results of measuring the muscle activity of a healthy male subject in his 20s using this prototype device were similar to those obtained previously using a PC and LabVIEW. The results of measuring the muscle activity of a healthy male subject in his 20s using this prototype showed more noise components than the results using a PC and LabVIEW, and when moving average processing was used to remove these components, accuracy was lost. These are considered to be caused by the insufficient performance of Arduino and inadequate noise countermeasures, so it is necessary to use a high-performance microcontroller board such as Raspberry Pi and fabricate devices with noise countermeasures in the future.



Figure 1: Photo image of the prototype device

Conclusion

To realize an esophageal vocalization practice support device using myoelectric signals, we proposed and fabricated a practice device, discussed signal processing when applying myoelectric signals to the practice device, especially the determination of threshold values, and fabricated and tested an inexpensive device. The following are our findings.

- 1. The site and sequence of muscle activity during vocalization in esophageal speech users were clarified.
- The appropriate number of moving average terms for smoothing myoelectric signals measured in LabVIEW was determined to be 85 items.
- 3. The appropriate threshold for determining the onset of muscle activity was 1.5 times the baseline voltage estimated after the moving average was calculated.
- 4. A prototype of a device for simultaneous measurement of myoelectric signals at two locations using Arduino and Myoware was developed, but it was not possible to achieve highly accurate measurements.

Future works are below.

- 1. Create and implement a program to automatically determine thresholds and baselines.
- 2. Prototype devices using a high-speed microcontroller board such as Raspberry Pi.
- Confirm the effectiveness of this device by measuring data from esophageal speech users of different skill levels.

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Acoustic Properties of Hearing Aid Processed and Unprocessed Speech Sound: An Evaluation of Hearing Aid Performance

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Abstract

Hearing aids are expected to improve speech intelligibility for listeners with hearing impairment. An appropriate amplification fitting tuned for the listener's hearing impairment is critical for good performance. The modern DSP hearing aids, though restores the sensitivity or audibility, but failed to restore frequency selectivity in persons with hearing impairment. It has proven difficult to identify the poor performance of hearing aids to restore normal auditory perception through psychophysical examinations. Therefore, in this paper, an attempt is made to explore an alternative approach to study the alterations in the speech signal processing in hearing aid. So that future processing strategies in hearing aid can be improved to avoid tradeoff between input and output signal of the hearing aid.

Keywords

Hearing Aid, Acoustic Parameter, Pro-cessed Speech, Unprocessed speech

Context

The most common treatment to persons with sensorineural hearing loss (SNHL) is hearing aid fitting and cochlear implantation. However, only about 20% of populations acquire hearing aids. Among them, about 30% are not satisfied with hearing aid that can lead to undesirable consequences, such as discontinued hearing aid use, cognitive decline, and poor quality of life. Many factors can contribute to poor aided speech understanding, including hearing aid features and patient variables (e.g., age, attention, motivation, and biology). However, hearing aid feature as a large portion of the variance in outcomes remains unexplained. Souza and Tremblay (2006) suggested hearing aid feature & performance variability as a possible source of poor speech intelligibility in persons with hearing impairment and opined that acoustic content of the amplified signal and its relation to speech perception can be studied to quantify the hearing aid ability to mimic the natural speech. Therefore, it is intended to study the acoustic characteristics of unprocessed and hearing aid processed speech sound.

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Method

The speech units consisting of Hindi consonant-vowel (CV) syllables (voiceless |pa|, |ta|, |ka| and voiced |ba|, |da|, |ga|) of 100ms duration were used in this experiment. The syllables uttered by an adult female speaker at normal conversational level 60dB were digitally recorded and stored in a digital recorder with a sample rate of 20 kHz and 16-bit resolution. The acoustic parameter of the each of the above speech sound which include fundamental frequency (F₀) and Formants F₁ F₂ F₃ & F₄ were determined (see Table-1). This served as a reference for comparisons.

The recorded individual speech stimuli were processed through the microphone of the Dr. Speech (Tiger Electronics Inc, USA) and then into a Behind the Ear DSP hearing aid conforming to ANSI 3.22 (2014) with gain of 30dB at input of 50dB. This process was repeated for three times. The input to the acoustic signal entering the microphone and

Figure 1: Instrumental Set -Up for recording acoustic properties of unprocessed and hearing aid processed speech sounds



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hearing aid was kept constant at 58-65dB with reference to 20 μpa in both the conditions. The spectrographic analysis of these stimuli was performed and descriptive and inferential statistics were applied for comparisons. The Figure 2: depicts Instrumental Set-Up for evaluating acoustic properties of unprocessed and hearing aid processed speech sounds.

Results and Discussion

The acoustic properties of reference stimuli used in study are presented in Table 1. The overall findings suggest the acoustic parameters of unprocessed and hearing aid processed speech differ significantly in comparison with reference stimuli for unvoiced CV syllables. The unvoiced CV syllable |ka| was most affected (Table 2). Statistical analysis using repeated measure $2\times3\times3$ ANOVA showed significant main effect of speech stimuli (F _{6.44}, p<0.030) the higher mean scores were obtained with reference parameter. There was main effect of processed and unprocessed test condition (F=37.07, p<.003) and speech sound (voiced & unvoiced) category (F= 66.54, p<.042).

Table-1: Acoustic parameter of speech stimuli used in this experiment

Speech Token	F₀ Hz	F_1 Hz	$F_2 Hz$	F₃ Hz	F4 Hz
p α	179 (±31)	790 (±93)	1470 (±134)	$2570 (\pm 231)$	3900 (±317)
ba	171 (±24)	760 (±76)	$1540 (\pm 111)$	2780 (±201)	3800 (±335)
tα	187 (±37)	816 (±64)	$1400 (\pm 200)$	2800 (± 331)	3700 (± 316)
da	154 (±49)	740 (±70)	1350 (± 176)	2450 (±300)	3600 (±383)
ka	169 (±41)	810 (±63)	$1600 (\pm 153)$	2400 (±270)	3780 (±347)
ga	156 (±44)	756 (±61)	1280 (±109)	2280 (± 260)	3650 (± 434)

The F₀, F₂& F₄ found to be affected parameters mainly for voiceless CV in hearing aid processed speech. These findings are in consensus with behavioral findings in literature. The studies reported that hearing impairment results in reduced audibility, broadened frequency tuning curve (Moore, 2007) and impaired temporal processing (Henry Heinz, 2013; Lorenzi et al., 2006) affecting the clarity and pleasantness of the natural as well as amplified sound specially complex signal like speech. Thus, Speech perception is affected by the acoustic stimuli and how it is altered by hearing aids.

It has been reported that hearing aids may restore speech audibility/spectral sensitivity but not temporal aspects of acoustic signal necessary for consonant identification and comprehension. The current study used the hearing aid with compression and adaptive circuit which is known to decrease the spectral and temporal contrast of incoming sounds, and amplification. Therefore, it is likely that the lack of frequency processing in compression hearing aid might have altered the higher formants of unvoiced CV syllable which is considered as critical for speech intelligibility and speech perception in listeners.

 Table 2. Repeated 2x3x3 ANVOA values of effect of speech stimuli, effect of presentation condition & speech sound category

Speech Stimuli	Unv	voiced mean	(SD)	Voiced mean (SD)			
	F₀ Hz	F_2 Hz	F ₄ Hz	F₀ Hz	F_2 Hz	F4 Hz	
Reference	171 (±30)	1756 (±114)	3850 (±348)	171 (±25)	1570 (±243)	3800 (±383)	
Unprocessed	214 (±24)	1817 (±213)	4100 (± 482)	177 (±32)	1747 (±367)	3970 (±445)	
Processed	289 (±31)	1877 (± 209)	4390 (±534)	189 (±30)	1780 (±343)	4100 (±416)	
Effect of speech stimuli (F = 6.44, p<0.030) Effect of processed and unprocessed test condition (F=37.07, p<.003) Effect (voiced & unvoiced) category (F= 66.54, p<.042).							

Hence, it can be inferred that hearing aids still fails to mimics the temporal aspects of acoustic signal necessary for consonant perception.

Conclusion

The overall results indicate sound processed through HA, fall short to mimics the temporal aspects of acoustic signal necessary for consonant identification resulting in poor speech perception. Probably because of this reason, only small fraction of people with hearing loss use hearing aid (McCormack and Fortnum, 2013; Orji et al., 2020). The study supplies experimental evidence of altered speech parameters of speech through hearing aid. This possibly can help hearing aid manufactures to improve hearing aid circuitry and quality to prevent the changes in hearing aid processed speech for better speech intelligibility to hearing aid users.

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Measuring Accessibility of Higher Educational Institution's Websites for Digital Inclusion

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Abstract

Websites are today the face of an organization in the virtual space, with a global reach. The Universities are organizations (in India) offering higher education. They use their websites and social media platforms for education and the dissemination of information. Accessibility of these websites and social media platforms will be the test of their global reach to their students in terms of digital inclusion. This study is based on the Uses and Gratification theory (Blumer & Katz) that states viewers decide what they choose to see and hear. The Information and Technology (IT) Act 2000 of India and its amendment in 2022, is silent on the subject of accessibility for persons with disabilities. During the times of the Covid-19 pandemic, where human interaction has become, limited and is often not even a possibility, the failure of technology resulted in increasing isolation and marginalization, and in a few cases, even a breakdown of the system for persons with disabilities in terms of education. However, the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) guidelines, which have been ratified by the Govt. of India, in 2007 of which Article 9.2 (g) & (h) lay down that, states should facilitate access for persons with disabilities for education, for new information and communication technologies, especially the Internet. In fact the Rights of Persons with Disabilities (RPwD) Act 2016, did insist that accessibility compliance is mandatory and applicable to both the public as well as private sectors in India. One of the aims of the National Assessment and Accreditation Council (NAAC) is to assess and accredit institutions of higher education in the country and lay special emphasis on upholding the quality of higher education in India. The websites of 211 Central and State Universities with 3.01 Cumulative Grade Point Average (CGPA) and above grade for NAAC accreditation were used for the present study. The study was undertaken on 3rd December 2022 to analyze the quality of the websites designed by these Universities (in India), both of the central as well as the state government.

Keywords

Accessibility, Websites, Universities, Higher Education, Communication Technology, Digital Inclusion.

Introduction

Websites are today the face of an organization, with global reach. Website reflects true face of an organization as never before [1]. The Web creates a direct link between the organization and the customer. Websites are used by Universities in India as an Information and Communication Technology (ICT) medium. They use their websites for education and dissemination of information.

'A website is increasingly the place where customers get that vital first impression' [1]. Accessibility of these websites to students with disabilities will be the test of its global reach. All the Universities in India are guided and monitored by the University Grants Commission (UGC). The National Assessment and Accreditation Council (NAAC) is one of the autonomous bodies established by the UGC to assess and accredit institutions of higher education in the country. In the year 2010, the Government of India, Ministry of Social Justice & Empowerment made a provision of Rs.20 lakh for adopting websites to be accessible to PWDs under the Scheme of the Implementation of Persons with Disabilities Act (SIPDA) and requested all Central/State Universities recognized by the UGC to provide self-contained proposals. The Articles 8, 9 and 21 of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) 2006, guidelines, deal with awareness, accessibility and access to information. Article 9.2 (g) & (h) of UNCRPD (to which India is signatory since 1st October 2007), specially lay down that states should facilitate access to new information and communication technologies, especially the Internet for PWDs.

'Digital inclusion tends to be solely associated with technical accessibility issues' (Steyaert, 2005). 'A particular focus of attention has been the inaccessibility of virtual learning environments for disabled students' [2]. In a review of accessibility issues in higher education, [3] noted that, although disabled students may have access to computers and the Internet, they may not necessarily have access to access online learning resources and activities, and stated that in this sense, disabled students may still be 'have-nots', and experience what [4] described as the 'second digital divide'. Such moves have helped

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to expand our concept of accessibility, but on their own, they only partially contribute to the improved conceptualization and understanding of digital inclusion. NAAC accreditation of higher educational institutions in India. The NAAC was established in September 1994 in Bangalore for evaluating the performance of the universities and colleges in the country. NAAC's mandate includes the task of performance evaluation, assessment and accreditation of universities and colleges in the country. The philosophy of NAAC is based on objective and continuous improvement rather than being punitive or judgmental so that all institutions of higher learning are empowered to maximise their resources, opportunities and capabilities. Assessment is the performance evaluation of an institution and /or its units and is accomplished through a process based on self-study and peer review using defined criteria. Accreditation refers to the certification given by NAAC which is valid for five years. At present, the assessment and accreditation by NAAC are done voluntarily. However, it is mandatory for seeking financial assistance from UGC Assessment and accreditation is broadly used for understanding the "Quality Status" of an institution. In this study, 211 such universities with Universities accredited by NAAC with CGPA of 3.01 and above were selected for the study Accessibility of websites.

Hypertext mark-up language (HTML) is the nonprogrammable technology used to create most websites. It can be augmented with other features (e.g. IBM 2003) and it is these features that add complexity to WebPages and social media platforms that are often the causes of barriers to accessibility. In their study on the quest to make accessibility a corporate article of faith at Microsoft, [5] reiterate that, according to the United States Department of Justice and World Wide Web Consortium (W3C) it is important to include text equivalents to non- text elements (such as images and multimedia objects) so that these textual descriptions can be rendered as speech or Braille output by assistive technologies, enabling access to the content regardless of disability or device constraints. Uses and Gratification theory also determine the choice of the users of websites and social media platforms, even among persons with disabilities.

Aim & Objectives

The aim and objective of the present study was to assess the quality of websites designed by the Central and State Universities in India in terms of information, dissemination, accessibility, design and interactivity and participatory features. The study also aimed at measuring these features in all the websites selected for the study, using validation methods already available on the Internet.

Research Questions

Following research questions provided direction for the study:

- 1. Does the website follow the guidelines of UNCRPD with reference to access to information?
- 2. Are the websites designed to meet the functional requirements of the category of students with disabilities, such as availability of a screen reader, font size

increase, colour change, alternate texts and Indian Sign Language?

- 3. Do the websites of the Central and State Universities in India conform to the accessible design features such as, 'F' Pattern (does the website have the shape of letter 'F' in their design and lay out) for fast viewing of a website?
- 4. Are the websites of the Central and State Universities in India, more interactive or more participatory in nature for persons with disabilities?

Methodology

Since this study is essentially aimed at assessing the qualities of a website designed by NAAC accredited Central and State Universities in India in terms of design, format, functional and accessible features, care was taken to choose the websites available on the Internet using 'Google' as the primary search engine on 3rd December, 2022 to assess and measure these features. The specific day 3rd December, 2022, being 'World Disability Day' was selected for studying the accessibility features of these websites, considering the significance of the day in a year for persons with disabilities. On this particular day, 211 websites of various Central and State Universities were carefully studied. Screen shots of the websites were also used as part of the sample. In this study, the researchers have tested these websites for W3C compliance and assessed them. The assessment was based on the following parameters: information and dissemination, accessibility, design and interactive and participatory features.

Sampling

The present research is a survey with purposive sampling. Hence, only 211 websites belonging to Central (56), State Universities (95) and Private Universities (60) with NAAC accreditation were selected as sample for the study. Initially each selected website was browsed in search of various aspects in terms of design, formal, functional and accessible features. Later, they were classified into two groups i.e., features those belonged to websites of Central Universities, State Universities and those belonged to Private Universities. Thus, the data on each of the accessible feature of the website collected would fall into these two groups and a comparative study was done using Statistical Package for Social Sciences (SPSS) Version-16. The researchers have chosen only home page of those websites that appear on the first page of the 'Google' search. This is important, because if the meta tags of a website are not designed properly, the link does not appear on the first page of Google search, unless the website is extremely popular.

In **table 2**, it may be found that only 35.07% had NAAC Accreditation above CPGA 3.01grade. Majority (14.2%) of the higher educational institutions recognized by UGC belonged to the Central Universities demonstrating the standards of digital inclusion approach to higher education in India.

Sr. No	Type of University	Universities with NAAC Accreditation with CPGA Above 3.01	Universities with NAAC Accreditation without CPGA Above 3.01	Total Number of Universities
1.	Central Universities	51	05	56
2.	State Universities	58	404	462 (42.9%)
3.	Deemed to be Universities	25	102	127
4.	Private Universities	77	359	436
5.	Total Number of Universities	211 (19.5%)	870	1081

Table 1. Classification of Universities Recognized by UGC in as on 03.12.2022

Type of Universities	Above CGPA 3.01	Below CGPA 3.00	TOTAL
Central Univ.	30 (14.2%)	26	56
State Univ.	16	61	77
Private Univ.	28	50	78
TOTAL	74	137	211
	(35.07 %)		

Table 2. NAAC Accredited Universities in India

Limitations

The following are the limitations of the study:

- 1. Only 211 websites (56 Central Universities, 95 State Universities, 60 Private Universities) were studied in terms of their website accessibility.
- Websites selected for the study included those of both Central, State and Private Universities with NAAC Accreditation as on 3rd December 2022.
- 3. In this research study 211 such universities with Universities accredited by NAAC with CGPA 3.01 and above were selected
- The home page of websites were downloaded, assessed and analysed only on 3rd December 2022 i.e., World Disabled Day. No updates were studied.
- 5. The accessibility of electronic documents linked with web page is not included in the study.
- 6. Only websites in English were selected for the study.
- 7. The social media platform links also formed the part of study in terms of accessibility.

Results of Analysis and Conclusion

Two decades has passed since the IT Act has been passed in India. Even though it is silent about web accessibility features, NAAC accredited universities in India have made efforts to use this new medium with global and local reach. Very few of the websites have the links to new interactive and social communication tools like blogs, guest books, and RSS feeds. A majority of them (66.4 per cent) do not even have feedback or complaint form details. However, it is encouraging to note that on "World Disability Day" i.e., 3rd December 2022, some of the Websites of NAAC accredited universities had accessible features. The accessible features decrease the digital divide between the students with disabilities and these institutions offering higher education in India. The study aimed at evaluating the websites and social media platforms in terms of media tools for information, education, dissemination, acces-

sibility, design and interactive participatory features for students with disabilities for higher education. The study indicated that 24.8 per cent websites under study and 57.1 per cent Central Universities' websites offered information in the regional language. None of the Central University websites passed the Markup validation test, except three State Universities. Only 25.5 per cent of the websites of NAAC accredited Central and State Universities in India passed the cascading style sheet (CSS) validation and 8.8 per cent mobile phone validation test. Even though 67.2 per cent of them used videos, images and photographs in websites that had social media platforms, few (17%)of them provided alternative text or audio description for the visuals. The majority of the websites under study provided downloadable information, social media platform links and participatory features, but very few of them offered accessibility features that demonstrated digital inclusion.

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Sensitize and qualify teachers for digital accessibility

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Abstract

University teachers face new challenges, particularly in the context of digital teaching and learning. However, teachers often encounter obstacles in implementing digital accessibility in their teaching. One of the challenges is disproportionate additional time effort as well as technical and didactic compatibility issues. The SHUFFLE project aims to support teachers with their needs in designing accessible digital teaching concepts through a material package based on the concept of Universal Design for Learning. The package includes checklists, guides, and a knowledge database, which covers various aspects related to digital teaching – accessible to everyone. The checklists offer advice and assistance on technical and didactic requirements, and the guidelines provide detailed instructions for implementation. The knowledge database provides additional information on other aspects of making digital teaching accessible. The materials will be available in German and English under the Creative Commons license CCBY.

Keywords

digital accessibility, material packages, higher education, inclusion, universal design for learning

Context

University teachers are confronted with several new challenges - especially in the context of digitally supported teaching and learning. Digitization processes permeate university every day and open up both new potential and challenges. In view of the increasing heterogeneity of students at German universities, risks regarding comprehensive technical and didactic accessibility of teaching should be mentioned (cf. Berghoff et al. 2021; Podszus 2019). To ensure the right to equal participation, increasingly digitized university teaching must be accessible to all students.

Accessibility is prescribed by law at various levels. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) has been signed by nearly all nations. In the EU the Directive 2016/2102 and the corresponding EU standard apply, as well as the different laws implemented by the member states.

Current state

The legal requirements have rarely been implemented in everyday university life up to now. An empirical study of teachers at four German universities in spring 2022 provides detailed insights into the attitudes, experiences and needs of teachers regarding accessible digital teaching (Kuhlmann et al. in press). Although there is a fundamental willingness among teachers to implement digital accessibility in their teaching, they are confronted with several obstacles.

The main concerns of teachers are that accessible digital teaching involves disproportionate additional time effort, and that the technical and didactic additional efforts are not compatible with the resources available. The survey also showed that teachers are in need for a low-threshold access to topics around digital accessibility in order to cope with the challenges involved.

Material description

This is where the material package of the SHUFFLE project comes in. It addresses teachers and is intended to support them in designing accessible digital teaching. It bundles central information that is also intended to help raise awareness, in addition to offering concrete support measures. In this way, the material package directly addresses the needs of teachers.

Based on the concept of Universal Design for Learning (UDL), accessibility at the technical and didactic level is considered from the outset. The needs of as many people as possible are already taken into account during the development process of the materials, thus preventing major adjustments retrospectively or (the need of) individual solutions.

The material package is composed of various components. It contains:

- 1. Checklists for Word, PowerPoint, Excel and PDF
- 2. Guidelines for Word, PowerPoint and Excel
- 3. A topic-specific knowledge database

The checklists offer advice and assistance for preparing documents and teaching situations that are as accessible as possible. They enable teachers to independently check their teaching for a certain degree of accessibility. Important aspects for designing accessible teaching are broken down into individual, comprehensible points. In addition, the checklists indicate the student group for which consideration of the aspects is particularly helpful. This is intended to promote awareness of different needs. At the same time, it shows that, in terms of UDL, a large target group can benefit from small changes.

The checklists will be available in different forms of presentations and platforms. On the one hand, they will be available in the form of Word documents on websites and learning platforms. In addition, an Office Add-In for Word, PowerPoint and Excel has been developed, which can be integrated directly into the workflows of teachers and thus offers low-threshold access. The Add-In includes the information listed in the checklists as well as other information that instructors need to review documents.

In addition to the checklists, the material package includes guidelines for creating documents that are as accessible as possible. These contain detailed instructions for implementing the requirements listed in the checklists. Enriched with images as visual support as well as comprehensive explanations on the relevance of the individual criteria, the guidelines complete the checklists.

As a third element, a knowledge database completes the material package. This provides information on other aspects related to accessible digital teaching. In addition to recommendations on the use of methods and social forms, information is also provided on accessible (specialist) literature, accessible language, and on how to compensate for disadvantages. The knowledge database is provided as an H5P element that can be integrated into websites and learning platforms.

Legal categorisation

In order to create legally compliant barrier-free documents, many technical criteria, some of which are less relevant in practice, must be taken into account. To ensure the low-threshold nature of the checklists, some of these criteria, which are rarely used in practice, were not included in the lists. By reducing the checklists to criteria that are central in practice and adding didactically relevant checkpoints, checklists adapted to everyday teaching at universities were created. However, since these do not fully cover all legal criteria, the creation of additional so-called *extended checklists according to EN 301 549* is planned. The extended checklists will contain all legally relevant criteria that were

omitted from the normal checklists due to their infrequent use and, in some cases, complex implementation. With the help of clear assignment to EN criteria, it is possible to keep track of which criteria are fulfilled. In this way, fully legally-compliant documents can also be created.

Conclusion

In summary, the presented material package offers teachers a starting point on the topic of accessibility in digital teaching. In particular, it addresses the obstacles that teachers perceive when designing accessible digital teaching. It offers low-threshold materials that teachers with limited time resources can use to make their teaching as accessible as possible. The additional information also helps to raise awareness and expand knowledge about accessibility.

Trying the materials with teachers is planned for late summer of 2023. The entire package of materials will be made available in German and English under the Creative Commons license CCBY.

Acknowledgements

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Accessibility and Universal Design in higher education curricula: the ATHENA project

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Abstract

This contribution aims to present a research study (work in progress) conducted under the ATHENA project, examining if and how issues of accessibility are integrated in Higher Education curricula in various European Countries across disciplines of studies. Data collection includes publicly available curricula of higher education programmes in disciplines defined by the ISCED fields of education and training 2013 (ISCED-F 2013). A fixed number of 21 bachelor's master's curricula and syllabi are sampled in each participating country. Two methodological approaches are applied for collection and analysis of the data: corpus linguistics and thematic analysis. The findings of the study are anticipated to inform the development of a set of recommendations on how to incorporate accessibility and universal design into higher education curricula through focus groups with experts from the main areas of knowledge.

Keywords

Universal design, accessibility, higher education, university curricula, syllabi

Context

Notions of accessibility and universal design are increasingly required to be incorporated into the higher education curricula across all areas of knowledge in Europe. However, at present, only a few and often elective courses cover these topics. The Erasmus+ ATHENA project, led by the European Disability Forum and comprised of the Johannes Kepler Universität Linz, Masarykova Univerzita, European University Cyprus, Universitat Autònoma de Barcelona, EURASHE, AAATE and EIDD, aims to develop a set of recommendations on how to broadly integrate Accessibility and Design for All into higher education curricula.

The existing literature on the inclusion of accessibility and universal design notions across varied university curricula is scarce, with studies mostly focusing on specific experiments involving teaching universal design to university students [1, 2], with promising results, and the assessment of university lecturers' knowledge of these topics [3], deemed as rather insufficient.

The current project is structured into two main stages. The first one, which corresponds to the focus of this proposal, aims to a) identify higher education domains of particular relevance for inclusion and participation, and b) to compile a sample of curricula and syllabi within these domains to analyse whether accessibility and design for all are introduced and how. The second stage of the project, which builds on the results of the first stage, aims to develop a set of recommendations on how to incorporate accessibility and universal design into higher education curricula through focus groups with experts from the main areas of knowledge.

Methodology

Two methodological approaches are applied in the initial stage of the project: corpus linguistics and thematic analysis. The combination of both methods allows for a preliminary quantitative analysis of the patterns of appearance of terms which are relevant for universal design and accessibility in university curricula and syllabi, and, later, a qualitative enquiry into the topics, competences, learning objectives, disability models applied, etc. on these topics in the corpus texts. First, to select the sample of texts for analysis (higher education curricula and syllabi from the participating countries) for the *ad-hoc* corpus, a group of expert partners set the following sampling criteria via the Delphi method for consensus finding: 1) coverage of seven areas of knowledge from the ISCED fields of education and training 2013 (ISCED-F 2013): Education; Arts and Humanities; Social Sciences, Journalism and Information; Business, Administration and Law; Information and Communication Technologies; Engineering, Manufacturing and Construction; and Health and Welfare; 2) availability of the selected higher education programmes throughout all participating countries; 3) public availability of curricula and syllabi; and 4) relevance of ac-

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cessibility to the field and professional practice. A fixed number of 21 BA (Bachelor) and MA (Master) curricula and syllabi are sampled in each participating country.

Second, the expert partners agree on a set of keywords related to accessibility, design for all, disability and inclusion. These are retrieved and analysed in the corpus in terms of absolute frequency, relative frequency and dispersion. The analysis allows us to empirically discern which curricula and syllabi incorporate accessibility and universal design and to what extent. Furthermore, the corpus analysis tentatively informs where the keywords are to be found: in the learning outcomes, content, university policy, etc. This is explored further in the thematic analysis.

The thematic analysis will look deeper into how accessibility is articulated, what particular terminology is used that indicates accessibility issues in the curricula, how accessibility is conceptualised through terminology and context used and what the possible connections or differences across disciplines may be. In addition, possible links of accessibility references and constructions of disability and diversity would also be investigated. Further themes are anticipated to emerge from the corpus of the data/text to be analysed.

Anticipated Findings

At the time of the submission of this contribution an initial mapping of sample curricula is conducted that is expected to facilitate validation of inclusion criteria and final selection of curricula. By the time of the conference presentation, the present proposal will disseminate the results from both the corpus linguistics analysis and the thematic analysis.

Conclusion

The significance of this project relies on the ATHENA project providing the higher education sector with informed knowledge on accessibility and universal design to be taught both as transversal competences and specific skills for each field of knowledge. It is expected for the project to foster change in the curricula not only in the involved universities but beyond.

The societal impact of the project—and its aim of promoting a more inclusive society—is expected to materialise in tested guidelines and recommendations on how to integrate accessibility and universal design in higher education curricula. These will be targeted at higher education institutions and universities, national and international organisations of higher education curriculum development and accreditation bodies, education representatives and persons with disabilities and their umbrella organisations.

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Drivers and barriers for use of assistive technology among children with autism and/or intellectual disabilities: Parents perspective

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Abstract

The aim of this study was to detect drivers and barriers for use of assistive technology (AT) among children with autism spectrum disorder and/or intellectual disabilities. An online workshop with researchers and two parents produced the material. The main drivers for using AT are knowledge about its existence, its inherent possibilities, access and funding. Barriers are related to lack of information, accessibility, knowledge in schools, funding, poor user interface, and poor retail and maintenance service. The workshop co-created an online form which subsequently will be sent to other parents to address these issues further. The study highlights perspectives and aspects that are important to parents and encourages researchers and AT-designers to systematically include end-users in design and implementation. **Keywords**

Participatory design, inclusive design, assistive technology, autism spectrum disorder (ASD) and/or intellectual disabilities (ID), social inclusion

Introduction

Social inclusion can be facilitated through access to education and employment [1]. However, while the prevalence of people with autism spectrum disorder (ASD) and/or intellectual disabilities (ID) is growing [2], these groups are among the most disadvantaged and socially excluded in society [3]. Research suggests that the use of assistive technology (AT) can contribute to increased self-management and participation in education and work [4,5]. Despite the promising results of AT in research projects, the adoption of such technology in everyday living, education or work settings is slow [6]. So far, there is a lack of scientific knowledge about drivers and barriers for uptake and use of AT amongst persons with ASD and/or ID [6]. The body of knowledge on the use of AT by children with ASD/ID is even more scarce.

This paper presents results from a workshop with two parents of three children with ASD and/or ID, about their experiences and opinions regarding acquiring, learning and using AT for themselves and their children. One of the parents identified as living well with ASD.

Background

Persons living with ASD and ID face a range of challenges in everyday living. Some of these challenges include difficulties with communication, social interaction, concentration, time management and self-regulation. While the range of available AT for persons with ASD/ID is soaring, its implementation is slow, which suggests that there might be several challenges that hinder technology adoption or its continued usage [6]. While AT has potential to add value to everyday living for persons living with ASD/ID, it is essential to address both drivers and barriers to uptake. Known barriers are related to mismatch between design of the user-interface and the wider social and material contexts. To our knowledge, end-users with ASD/ID and other stakeholders are not systematically involved in research or technology design and implementation processes. Henceforth, drivers for uptake might be overseen or ignored.

Method

The authors hosted an online interactive workshop for parents to children with ASD and/or ID in early December 2021, under Covid-19 restrictions. Parents were invited to participate through peer support organizations for persons living with ASD/ID. Covid constraints, time-constraints in

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the Advent, and unpredictable everyday lives with a child with a disability, caused large drop out. The workshop had a total of two parents to three children. The small group format gave all participants (researchers and parents) an eminent opportunity for in-depth discussion [7].

The workshop had three main parts. The first part consisted of a joint discussion and conversation about what type of AT they had experience with, how they and or their children used it, which advantages and disadvantages they had discovered, as well as what needs and wishes they had for AT and digital tools. For the second part we presented an online form where participants could enter their experiences related to AT, as a summary of the previous discussion. The participants were invited to discuss and comment upon this form. Finally, we wanted to get feedback on their experiences and wishes for user participation in the development of AT.

The workshop was hosted on MS Teams and recorded using its built-in function. The recording was downloaded for secure storage. The participants consented to videorecording by confirming acceptance of the informed consent letter via email, and verbally in the beginning of the workshop. The transcribed workshop data were analysed using thematic analysis.

Preliminary results and discussion

The participants expressed that it was meaningful to participate in the workshop. They were able to convey their experiences to the researchers and each other. Some of the main themes from their experience with adoption and use of AT are:

- How to get advice on which technology might be usable and suitable.
- The process of acquiring AT including economic aspects, as well as trial and error to find aids that work for their children.
- That school personnel sometimes lack understanding of the need for AT and their function.
- Guidance, training, and support in relation to AT products for all relevant stakeholders.
- Time management is a feature in many ATs for pepersons with ASD/ID. Organizing and coordinating the task of adding and managing entries connected to time management, between caretakers and the kindergarten or the school can therefore be an issue.
- How to help the child become more independent by gradually transferring responsibility for handling the AT to the child.

The second part of the workshop was a co-creation session on the further development of an online form with questions for use in similar workshops. The participants made comments and suggestions for improvement to the online workshop arrangement so that it could be even better and more suitable for parents with ASD. The participant with ASD underscored that most people with ASD like to be well informed and prepared, and the advantage of being able to think through questions in advance, in peace and quiet. Therefore, they suggested that questions to be discussed should be distributed beforehand, possibly as an online form. The participants suggested reformulations and amendments to questions in the online form that were presented to them. For example, we received the following advice: "the questions could have been more focused on things such as how did you find out about the tool, did you get advice from someone about the tool and issues related to this". They also suggested a question about whether parents have encountered positive or negative attitudes when seeking help and advice about AT. This discussion shed light on topics that the participants were concerned about and where they believed there is a need for more knowledge. Both the need for easier access to information about AT and the need for involving stakeholders, including end-users, in the design of such systems, is in line with the views of AT professionals [8].

Conclusion

The workshop generated several insights on drivers and barriers related to uptake and use of AT for use in daily life and at school for their children with ASD/ID. Main drivers are systematic inclusion of end-users in design and sharing of knowledge about promising AT. Main barriers are lack of information about potentially useful technology, lack of training, high demand on cooperation and coordination of entering content to the technology, lack of interest, knowledge and support from schools and lack of funding. The parents were clear about the need to include them, young persons and others living with ASD/ID in design and implementation of AT. Additional research is needed to ascertain the degree to which others share similar experiences and to assess the applicability to different products and contexts.

Acknowledgements

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Development of an Educational System for Blind Children Using VR Haptic device

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Abstract

In education for the visually impaired, tactile perception education, which uses tactile sensation to learn shapes, etc., has become an important means of education. In this research, we propose tactile perception education using VR as a solution to these problems. By using virtual objects on VR as teaching materials for tactile perception education, we can solve the problems caused by using real objects, and a more flexible and wide-ranging education is possible. The purpose of this research is to construct a VR system that can be used in education for the visually impaired by creating an interface that enables tactile perception of virtual objects, which are necessary in tactile perception education.

Keywords

Visually impaired children, VR, Tactile education

Introduction

DDD In education for the visually impaired, tactile perception education, which uses tactile sensation to learn shapes, etc., has become an important means of education. Tactile perception education uses tactile sensation information to make images of objects that differ from person to person tangible using only linguistic information. However, there are problems such as the cost and location of teaching materials, as well as the difficulty of teaching dynamic information. In this research, we propose tactile perception education using VR as a solution to these problems. By using virtual objects on VR as teaching materials for tactile perception education, we can solve the problems caused by using real objects, and a more flexible and wide-ranging education is possible. The purpose of this research is to construct a VR system that can be used in education for the visually impaired by creating an interface that enables tactile perception of virtual objects, which are necessary in tactile perception education.

Components

The basic components of a VR system are an input system, an output system, and a simulation system. In this research, the equipment that manufactured the input system and the output system, and the simulation system are handled by Unity, the game engine of Unity Technologies. The basic components of a VR system

Copyright: \bigcirc AAATE and N. Asakawa *et al.* 2023. This is an openaccess extended abstract of a contribution (Oral contribution) given at the **AAATE 2023 Conference** in Paris. are an input system, an output system, and a simulation system. In this research, the equipment that manufactured the input system and the output system, and the simulation system are handled by Unity, the game engine of Unity Technologies.

Concept

As a device concept of an apparatus for presenting the shape of a virtual object, it was decided to enable a tracing operation for the virtual object. When information is obtained through the tactile sense, the movement of the hand is changed according to the information to be obtained. For the shape information, the movement of tracing the contour of the object is necessary. Therefore, it was thought that the shape of the virtual object can be presented by enabling the tracing operation for the virtual object, and this apparatus presents the information that enables the tracing of the contour of the virtual object.

Outline of the System

Figure 1 shows the overview of the device. In the tracing operation, a force is applied to the object to trace the



Figure 1: Device overview

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Figure 2: Presented shapes

contour. Therefore, the system needs to continuously present the absolute position of the contour of the virtual object. Therefore, instead of the device worn on the body, which is difficult to present the absolute position, the device is grounded to the environment where the absolute position can be presented. In addition to the position of the contour, the information to be presented is the orientation of the surface and the angle in the contour. In the presentation of the contour position of the virtual object, the distance information between the rotation axis of the arm of the device and the contour of the virtual object calculated on the Unity is presented using the linear motion mechanism. By this presentation, the position of the contour of the virtual object can be presented continuously without intruding the operation point of the user into the inside of the virtual object, so that the existence and position of the contour can be clearly presented. In the presentation of the surface orientation in the contour, the direction of the normal direction on the surface of the virtual object calculated in the Unity is presented using the mechanism by presentation mechanism 2 and 3. In the discrimination of the curvature such as the ruggedness, the change of the direction of the contact surface becomes more important than the change of the height direction. Therefore, the detailed contour information such as the curvature is presented by presenting the normal direction on the presentation surface of the virtual object in addition to the position information of the contour. By presenting these pieces of information as the information necessary for the user to trace the contour of the virtual object, the operation of tracing the side surface of the virtual object with a three dimensional shape is enabled, and the cross-sectional shape is presented to the user as a two dimensional shape. mechanism 2 and 3



Figure 3: Results of the experiment

Evaluation Experiments

An experiment was conducted to evaluate the presentation performance of the virtual object on the system. In the static information presentation performance evaluation in tactile sensing education, language information is added to tactile sense information by the equipment, and how much the shape of the virtual object can be recognized is measured. In actual tactile sensing education, the object information is presented in the language. The performance when it is used in such tactile sensing education is attempted.

In the experiment, information about the shape was conveyed in language in a way that the shape could not be specified only by language information, and the shape was specified and evaluated from tactile information using the device. Five persons with good eyesight cooperated in the experiment. The examinee operated the device while blindfolded, and the recognized shape was illustrated. Three types of static shapes shown in Fig. 2 were used as the presentation shapes. The language information for each shape was as follows: (a) a shape with three angular projections in a square, (b) a shape with four rounded projections in a circle, and (c) a shape in which three consecutive rounded projections and a different rounded projection are combined. The results of the illustration are shown in Fig. 3. The results of the experiment showed that the position of the projections and the position of the corners were correct, and the presented shape was generally recognized. Therefore, the shape could be presented by the device. However, the size of the projections varied among the examinees, and it was confirmed that the detailed angle and size of the projections were information that was difficult to present uniformly.

Conclusion

In this study, we proposed the shape presentation by the tracing operation for the virtual object, and produced the equipment which enables them. It was confirmed that the presentation of static shape and dynamic information of the virtual object was possible by the tracing operation. And, the VR teaching material which could be utilized in the visual handicap education was able to be produced by the VR system using this equipment. In the future, the improvement of the presentation resolution of the virtual object by correspondence to the three dimensional shape and by increasing the operation point is considered.

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Textbook's accessibility for children with dyspraxia and visual disability

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Abstract

This paper introduces the beginning of our work to design accessible textbook's for children with disabilities, first with the understanding of transcription processes then with tests with end-users.

Keywords

LATEX Accessibility, Special Education, Single Case Design, Disabilities

Context

In France, the 11th February 2005 law, "for equality of rights and opportunities, participation and civic rights" supports inclusion of children with disabilities in schools. However, the access to scholarship and to the compensation means, the materials and infrastructures remains low. Our work is part of the ANR project "MALIN" (MAnuels scoLaires INclusifs, ie. Inclusive Textbooks). Its purpose is to make digital textbooks more accessible. To this day, only few textbooks are adapted for children with disabilities and these process are still time- and moneyconsuming. The MALIN project seeks, on one hand, the automation of the process and, on the other hand, the conception of a platform allowing to choose for the most fitting adaptation depending on the user. The aim of the project is to allow for a better access of textbooks for the children with disabilities but the overall goal is to provide a way to adapt the textbooks to try to compensate the difficulties children can face at school during their learning process. The core of the project focuses first on two specific populations (dyspraxic people and visually disabled people), but once expanded with other type of targeted user profiles, the created basis will make all of the students able to use the same pedagogical material. First, our goal is to better comprehend the execution of the textbooks transcription process, including the issues and needs the experts face. In order to do that, we chose an expert-centered method. The activity of transcription will be analyzed through shadowing observations. We

will work with the two following experts. The first one is the "Institut National des Jeunes Aveugles" (ie. Young Blind People National Institute, in Paris, France). This institute aims to develop the autonomy of children and provide adapted individual project with constant followup care during the whole education time. Hence, it also deals with transcription of textbooks and learning materials for people with visual disabilities to make access to knowledge easier. The second one is the association "Le Cartable Fantastique" (ie. The Fantastic Schoolbag), which provides resources for teachers to facilitate the education of children with dyspraxia. Dyspraxia is a neuro-developmental disorder of the coordination which means that people struggle to automate gestures. One of the resource provided is an online platform allowing to recreate the exercises of a French language textbook on a web page. The exercises are then displayed on the computer and the dyspraxic children are able to do the same thing as their peers in class, without having to hand write. The expertise of both the association and the institute will allow us to better understand the process of creation of textbooks adapted for people with dyspraxia and with visual disabilities. We will then propose a modeling of the process, which will be integrated in the platform in the form of adaptive user profile. Then, we aim to understand how these experts take into consideration the drivers, constraints and needs of the population they work for and with. This expertise and knowledge will help to think about the conception and implementation of adaption and the various features of the user profile. This will be tested by end-users using the Single-Case Design (SCD) methodology.

Methodology

The main issue about disabilities is the important heterogeneity between profiles, hence the consequences on the reliability of the statistical evaluations of software,

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hardware and other solutions implemented. For instance, the tiredness and fine motor skills difficulties will vary a lot among people with dyspraxia. Added to this, the high comorbidity in these specific population is another problem researchers may face in randomized trials. For these reasons, it can be difficult to obtain significant results when using classical statistical analyses, as the large inter-individual variation is responsible for the excess of within variance inside the experimental group. To address this issue, there is a methodology called Single Case Design (SCD), as mentioned above. These types of design are not in opposition to classical randomized design, but rather complementary. To sum it up, each participant are at the same time the control "group" and the experimental "group". [1] define SCD as "experimental, rather than correlational or descriptive" and whose goal is to show "causal (...) relationships between independent and dependent variables". They are designs often used in special education, due to the suitability of the procedure to assess the effectiveness of the independent variable, in a participant centered manner. That is why dependent variables in SCD are mostly behaviors, for instance self-injuring behaviors. The independent variables, (i.e. what is evaluated), are called interventions and need to be actively manipulated in the experiment. To evaluate if an intervention is effective, the experimenter has to follow a precise procedure depending on the type of SCD, and meet standards set by experts of SCD [1, 2, 3, 4]. Even if some features may differ depending on the type of design, some other are to apply in every case. The basic procedure of a SCD consists in first a baseline phase (Phase A), where the experimenter measure the performance of each participant without the intervention, then apply the intervention and measure again the performance (Phase B). The phases are measured over time. This basic design is called the AB Design. Every other type of SCD requires a baseline phase and an intervention phase. The analysis of SCD is done in two steps: (1) with visual analysis and (2) with statistical analysis. According to [5], visual analysis can not be replace by any other type of analysis to represent changes in dependent variable in a comprehensive way, but "quantitative metrics can be helpful for summarizing data characteristics". The process of visual analysis have to be very well understood by SCD researchers and requires to follow correctly the guidelines and standards[6, 7], and not every data analysis techniques are appropriate depending on the data[8]. We plan to use a specific design of SCD, called Alternating Treatment Design. This design allows to compare two or more interventions in a rapidly alternated manner. We want to compare the different adaptations using SCD to see if we can find any trends in the results. In our case, we want to know which are more facilitating for dyspraxic children in terms of right answers, speed of response, but also to study their strategies when answering. We also want to assess their preferences about the different adaptations. The goal is to understand what are the abilities and the limitations of these children in order to better adapt all the various types of exercises of textbooks. In the long term, this work aims to provide resources and a "user'

template that could be re-used in other accessibility contexts, in particular in school contexts, and that could be overall applied not only to dyspraxic and visually deficient children, but to any that face difficulties at some time. At the time of the AAATE Conference, the two models from the analyze of the textbooks transcription activity as well as initial results from SCD about assessment of one of our exercise adaptations for dyspraxic people will be presented.

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Training Program for Children with Severe Speech and Motor Disabilities Using Eye Control

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Abstract

We present a methodology and a training program with a large set of interactive activities that allow the implementation of adapted and effective individual programs for developing basic cognitive and communication competences typically partially or completely missing in children with severe speech and motor disabilities. This target group presents particular challenges to professionals due to the combination of functional disabilities that make communication and learning almost impossible without the use of high-tech AT for augmentative and alternative communication (AAC) and for alternative computer access.

A very important factor for children with motor and speech impairments is the limited or missing interactions with peers and the environment, dramatically low involvement in communication, and sometimes (e.g., in less developed countries) life at a single place (sometimes an apartment). The training program aims to level up the general knowledge and respective passive and active vocabulary with the typical ones and thus provide a basis for further cognitive development. The program is in Bulgarian but is sufficiently general to be implemented in other languages. **Keywords**

Eye control, AAC, Educational program for children with CCN

Context

A very important factor for children with motor and speech impairments is the limited or missing interactions with peers and the environment, dramatically low involvement in communication, and sometimes (e.g., in less developed countries) life at a single place (sometimes an apartment).

This target group presents particular challenges to professionals due to the combination of functional disabilities that make communication and learning almost impossible without the use of high-tech AT for augmentative and alternative communication (AAC) and for alternative acomputer access [1, 2].

Eye-gaze computer control implements all the functions of a standard computer mouse and allows full use of a computer by just pointing and holding the gaze. This gives considerable opportunities for communication and development through specialized software for communication and learning and text-to-speech software, online learning opportunities, access to the Internet, social networks, professional realization, social inclusion and use of all other advantages of modern digital technologies.

The training program aims to level up the general knowledge and respective passive and active vocabulary with the typical ones and thus provide a basis for further cognitive development. The program is in Bulgarian but is sufficiently general to be implemented in other languages.

Methodology

The training program presented targets the primary education of children with speech and motor disability and provides a structured methodology for its implementation in practice. The creation of the methodology and training program is the result of an almost three-year development process, software implementation, application and validation in hundreds of working sessions with children and youth with speech and motor disabilities in residential centers in Bulgaria.

The activities in the training program are tailored to the functional capabilities of children and youth who, in addition to being unable to speak, are also unable to use their hands. This requires the use of assistive technologies for computer access that allow these fine motor impairments to be compensated for. The most effective modern and accessible AAC tool that allows full and fast access to a computer is the eyegaze computer control.

The training program includes various modules. Some of them use the capabilities of software that already exists and can be used without adaptation. The rest of the training modules are newly developed – many activities were developed for basic concepts and categories, relationships, quantitative and mathematical skills, basic literacy for reading and writing, and communication skills.

The interface is tailored to the specifics of the alternative computer access by eye-gaze control and uses larger buttons, feedback with synthesized voice, interactivity and possibility for repetition. This specificity of the developed activities does not limit their use only by eye-gaze control, on the contrary,

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it makes them easier for any other type of computer access, including the standard methods using a computer mouse and touch screen. The aim is the training program to be useful to all children and young people with expressive speech disorders.

Results and Discussion

All of the newly created modules are implemented using the specialized software for communication and training Communicator 5 (Tobii Dynavox), and some of the new activities are also implemented in the software for communication and training Grid 3 (Smartbox). In total, more than 700 activities are implemented in Communicator 5.

They are structured in several main modules – basic concepts, linguistic and conceptual development, quantitative concepts, basic literacy, and communication skills:

- Basic Concepts module contains activities for mastering colors, shapes, size, and spatial relations.
- Language and Conceptual Development module – contains training activities covering the main concepts in 19 categories. For each of these categories, there is a series of activities that introduce the concepts through pictures and synthesized speech, then there are activities to introduce the symbols. Concepts in each of the categories are selected based on empirical data about the most frequently generated representatives of that category. For each category, we start the training with the most frequently generated representatives for the Bulgarian language.
- Early Math Skills module trains skills related to quantity estimation, comparison, counting, and addition mastering.
- Communication Skills module contains many interactive activities through which children learn to express opinions, needs, and desires, ask questions, and communicate in social situations. Many of the activities in this module are integrated in the other modules.
- Basic Literacy Reading and Writing module contains activities that gradually introduce letters, syllables, sentences, and texts. The activities are interactive and use various types of tasks and train various types of skills.

The training program is validated in 1700 training sessions involving 34 children with disabilities placed in family-type residential homes.

The training program and the methodology for its implementation is also presented in a book [2].

The program is now being used by many children with speech and motor disabilities in Bulgaria.

Conclusion

The presented training program using AAC and adapted for use with eye-gaze control aims to give previously non-existent opportunities to children with an extremely unfavourable combination of functional disabilities – inability to communicate with natural speech due to severe speech disorders and to perform purposeful actions due to severe motor disorders. It contains hundreds of activities and allows professionals to use them without modification and the need of advanced skills in usingf specialized software. We hope that these resources will help the rapid entry of high-tech AAC into the system of inclusive education and that they will reach especially the children who until now have been excluded due to their severe functional disabilities.

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Assessing the outcomes of AT for disabled children and adolescents. Is it time for a new approach?

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Abstract

How do we measure outcomes of assistive technology as used by disabled children and adolescents? What does *user-satisfaction* mean for this age-group? What outcomes do young disabled people consider to be most important? We [a] consider existing assessment tools and suggest that there is potential for their refinement for use with disabled people in this age-range and [b] propose avenues for the development of new approaches.

Keywords

Assistive Technology; Outcome Assessment; Evaluation; Methodologies; User-Centred; Co-production

Context

In 2021 an article appeared in Resna's 'Assistive Technology' journal, entitled *Childhood and Assistive Technology: Grow-ing with opportunity, developing with technology.* This important article was written by UNICEF's Fernando Botelha. He argued that assistive technology (AT) is instrumental for the development and participation of disabled children, because it can enable their communication, mobility and self-care; it can support them to explore 'the worlds of family relationships, friendships, education, play, and household tasks, enhancing their quality of life and that of their families'^[1]. His arguments are persuasive. In this paper we ask how we assess the outcomes of AT, to ensure that disabled children and young people are experiencing the benefits Botelha describes, and, most importantly, have user-satisfaction.

In 2022 The Global Alliance of Assistive Technology Organizations (GAATO) published the report entitled *AT Outcomes Grand Challenge Consultation*. This sought to 'identify and clarify the set of current challenges that needed to be addressed to successfully measure assistive technology outcomes and impact at the individual, community, local, national, and global level'^[2]. From this important consultation emerged a long-list of 39 AT Outcome 'Grand Challenges'. In this paper we concerned with measurement of assistive technology outcomes and impact at the individual level, and Grand Challenges (GC) 2, 24 and 25:

- GC 2. We do not have adequate strategies to direct data collection for research or decision making.
- GC 24. Existing outcome measures do not value both quantitative and qualitative data.
- GC 25. Existing outcome measures do not adequately capture all stakeholder perspectives on the impact of AT on the life of an AT user in a holistic way, including quality of life, wellbeing, and health.

We suggest that these can be collapsed into one challenge: to think anew about evaluation methodologies, and the design of AT outcome assessment tools ('instruments') – and to this we add, for disabled children and young people.

Our approach

It is curious that the issue of outcomes has so recently been identified as a Grand Challenge (or set of challenges), given that consideration of AT outcomes has been 'en vogue' in the field of AT since the $1990s^{[3]}$.

Efforts have certainly been made to determine relevant assessments, or what we prefer to term evaluation methodologies, in relation to AT 'interventions'. We are interested in the range of user-centered approaches that have been developed, some of which strive to take into account what users deem to be important in relation to AT performance or their sense of what makes a good 'fit' for them in terms of AT selection. These include the Matching Person and Technology (MPT) tool^[4], Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0)^[5], Psychological Impact of Assistive Devices Scale (PIADS)^[6], Individually Prioritised Problem Assessment (IPPA)^[7] and the Assessment of Life Habits (LIFE-H)^[8].

Valuable insights have *no doubt* been obtained via the use of these instruments. Nevertheless, we suggest that there is potential for refinement of existing assessment tools; and perhaps scope for the development of new approaches. In particular, we propose that more work is needed to determine the most effective assessment tool/s to use when working with disabled children and adolescents.

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In this verbal presentation we will 'assess the assessments'. Our method will be as follows: we will focus on four issues: (1) accessibility and inclusivity; (2) focus; (3) process of development; (4) methodology. We will identify certain strengths and limitations with each assessment.

We will explain how this analysis set the scene/agenda for new empirical research that we are currently undertaking. At the AAATE Conference 2023 we will deliver a work-inprogress presentation on early findings.

This research is exploring new avenues for developing more integrated (holistic), user-led assessment tools. Stage 1 involves mixed methods: a concurrent survey of young disabled people, aged between 18 and 25 years and living in Europe and online focus groups with young disabled people (English speaking) in the same age range. The research design involves both method and data triangulation^[9].

The survey and focus groups explore young disabled people's experiences of (a) accessing and using AT during their childhood and adolescence; (b) being consulted (or not) about their aspirations for AT outcomes and satisfaction with their ATs. Respondents/participants are also being invited to reflect upon the outcomes of AT that they prioritised (considered to be most important) as a young person.

Conclusion

This is a work-in-progress presentation and as such we will be discussing emerging findings and tentative conclusions only.

Note on Language of Disability

In this paper and presentation we employ identity-first language in keeping with the social model of disability. We do this because this is the preferred language of the UK disability movement and we are based in the UK. However, in our survey we employ the term 'persons with disabilities' (i.e. person-first language) in keeping with the UN CRPD and because the survey is Europe-wide.

Acknowledgements

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A Case study that provides an example of AAC enabling children's rights: Mariam Obtains Voice in Her Mother Tongue

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Abstract

The UN Convention on the Rights of Persons with Disabilities (CRPD) recognizes the importance of access to assistive technology in several articles and urges states to ensure its availability. Implementing AAC at an early age is vital for children's interaction with others, learning, education, and participation in everyday activities. The paper is presenting a case study on how the availability and affordability of AAC system is enabling the realization of the rights of children with disabilities becoming a path towards achieving functional communication and better inclusion.

Keywords

augmentative and alternative communication (AAC), social inclusion, meaningful participation in education, assistive technology

Introduction

The UN Convention on the Rights of Persons with Disabilities (CRPD) recognizes the importance of access to assistive technology in several articles and urges states to ensure its availability. The availability and affordability of assistive technologies can be a barrier to their use, especially in countries that have lower state funding to facilitate the acquisition and updates of assistive technology (AT), including high tech types of augmentative and alternative communication (AAC). Implementing AAC at an early age is vital for children's interaction with others, learning, education, and participation in everyday activities, and is also a path towards achieving functional communication and better inclusion. The rapid developments in digital technologies have had an important impact on the cost and availability of accessible technology for children with complex communication needs.. In the Disability Inclusion Policy and Strategy (DIPAS) 2022-2030, UNICEF restated its commitment to leverage technical expertise working in partnership with the WHO (and other global, regional, and national actors), to increase the availability of and access to appropriate assistive technology.

Armenian Language AAC Application Development

UNICEF Armenia initiated support to innovative national programs that contribute to the policy development toward building national ecosystems for AT and AAC to meet the needs of children with disabilities. The aim is to support the functioning and meaningful participation of children with disabilities in learning and community life from early years through adulthood. Special consideration is given to high tech AAC as this is an emerging area in Armenia. While the Armenian language AAC low-tech and mid-tech solutions were in use for some time, the high-tech solutions are just under development and piloting process. The results of the latest study (Avagyan, Petrosyan, 2023) conducted in Armenia to investigate the use of AAC systems among 51 specialists confirmed the above statement. The data analysis showed that the practice of AAC use for 51 professionals involved in the therapy of individuals with complex communication needs is similar. The rate of non-technological alternative communication interventions was times higher (82.36%) than the rate of medium (11.76%) and high-tech (1.96%)AAC interventions.

In 2022 UNICEF Armenia contributed to the Armenian language AAC app testing. ARMAV Continuous Education Center developed the AAC app through US Embassy Armenia funding. This is the first Armenian language high-tech AAC system for tablets offered free of charge in the App Store and Google Play. A team of 13 specialists composed of speech therapists from ARMAV Continuous Education Center (Yerevan, Armenia), Harmony Speech Therapy and Diagnostics (California, USA), IT specialists, voice artists, UI UX designer, graphic designer, researcher-consultant from Minnesota University and the AAC app user-consultant collaborated to develop

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the application. The process included:

- The development of core vocabulary for the Armenian language AAC App. For this purpose the components of core vocabulary were reviewed from Mary Ann Romski and Rose Sevcik's System for Augmenting Language (SAL) (1996, 2006), V. Khalatyan Armenian Sign language Dictionary (2004) as well as several studies consulted that reported on the importance of core vocabulary based on frequency of use and flexibility across contexts and partners (Banajee, DiCarlo, Stricklin, 2003; Beukelman, Jones, Rowan, 1989; Dennis, Erickson, Hatch, 2013; Marvin, Beukelman, Bilyeu, 1994; Trembath, Balandin, Togher, 2007).
- A graphic designer replicated the core vocabulary into images. He created some of the symbols and adopted others based on https://globalsymbols. com, https://www.vecteezy.com/, https://www. freepik.com/popular-vectors databases.
- Recording of voices for each word included in the core vocabulary. To ensure that Armav AAC app is user friendly, gender and age sensitive four voices were considered: a man, a woman, a girl, and a boy read all the words. Each recorded word was saved as an MP3 and attached to the appropriate symbol. As a result, the App provides about 1700 Armenian language words with four different voices.

Case Study – Mariam Obtained Voice in Her Mother Tongue

Precious was especially the contribution of the AAC app user consultant - Mariam Nersesyan, a young Armenian girl who lives in Italy. She has severe motor and communication difficulties. She has been attending public school since she was seven years old but found it challenging to communicate with classmates and teachers. Mariam started using the English language AAC App five years ago. It changed her life. She became more independent and began feeling herself part of the school community. The chance to communicate with others opened new perspectives. Now she is an active student at British International School. Mariam participates in school activities, initiates disability awareness events, and speaks about the rights of people with disabilities. Mariam greatly benefits from the English language AAC that allows enhanced inclusion in education and socialization. Despite the mentioned successes Mariam faced difficulties when she needed communicating in her mother tongue-Armenian.

Every year Mariam's family visits Armenia to meet their relatives and friends. Mariam felt isolated from family gatherings and celebrations since she couldn't use the English language AAC app to communicate in her mother tongue (there were no Armenian - speaking apps yet). She could understand everything that was being said around her, but she was unable to express herself because the only available means of communication for her was the English-speaking app.

The Armenian language AAC app was a dream for Mariam. As a five-year user of English-speaking apps, she provided several suggestions and insightful criticism to Armav AAC app team on how to improve the app and make it more user-friendly. She now uses the app when visiting Armenia, at home, and whenever she wants to tell her mom a secret so that no one in Italy can understand her. We view Mariam's case as successful and deserving of attention since she is not only an AAC user, but also someone who contributed to the development of the Armenian language AAC app, officially being a team member. Being someone who knows the value of communication in the mother tongue, she bears the responsibility of speaking up for the non-verbal Armenian community, as well as contributing to their endeavors in overcoming communication barriers and smooth inclusion in education.

Way Forward

In 2023 UNICEF initiated piloting of the Armav AAC app in the institutions under the jurisdiction of the Ministry of Education, Science, Culture and Sport, the Ministry of Health, and the Ministry of Labour and Social Affairs. The aim is to:

- further enhance relevant professionals' capacity to use high-tech ACC systems
- increase the awareness and knowledge of key stakeholders and decision - makers related access to ACC devices and services and
- document the data on how to further improve and scale up the use of the Armenian language AAC application.
 Upon complication of the pilot UNICEF plans to pre-

pare a brief with recommendations to the government on the institutional set-up, legal framework, and procedures on the use of AAC for enhancing the social inclusion of children and youth with disabilities.

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Developing possibility-focused practices to support technology related transitions for young people with learning disabilities

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Abstract

The focus of this presentation is the support that young people with learning disabilities receive to use assistive technologies when they leave compulsory education. I will argue that support during and after the transition from compulsory education is important because we know that adults with learning disabilities are digitally excluded and that levels of digital inclusion are lower for adults with learning disabilities compared to other disabled and non-disabled groups [1,2,3]. Lacking access to assistive technologies when transitioning from compulsory education can reduce life opportunities such as finding employment [4,5]. **Keywords**

Learning disabilities, transition, support

Context

A common response to the digital inequalities experienced by people with learning disabilities is to turn to the Convention on the Rights of the Persons with Disabilities [6] for indications that taking appropriate action to reduce digital exclusion is expected of those governments who sign up to the convention. Analysis of the content of the Convention on the Rights of Persons with Disabilities (CRPD) indicates that assistive technology is explicitly referred to in eight of its fifty articles. For example, Article 4 refers to promoting the availability and use of assistive technology, and to provide accessible information about assistive technology. However, the CPRD has been criticized for its narrowness of scope in relation to assistive technology. For example Borg et al. highlight that each article fails to cover all the key areas of assistive technology, such as production, availability, affordability, information, training and use [7] Adding to this criticism, it is my contention that the CRPD fails to stress the importance of ensuring that levels of access to assistive technology and related support do not reduce during or following transitions from one context to another.

The factors that influence support

In this presentation I will draw on my research into how adults with learning disabilities are supported to access and

use technologies [8.9,10,11] to discuss the factors that influence whether and how young people with learning disabilities are supported to access and use assistive technologies when they leave compulsory education.

The History of Technology in Special Education Study undertook an historical examination of technology use in the field of special education needs that covered a period of thirty years (1970-1999) and drew on the memories and experiences of a large group of UK practitioners in the field [7]. A major aim of the study was to identify what can we learn from past practice in the field that might inform future practice. Many of the practitioners discussed their concern at the lack of support that young people received once they left school or college, which they likened to 'falling off the edge of the world'.

The Telling Tales of Technology Study sought to capture the life histories of adults with learning disabilities, particularly in relation to their use of technologies from childhood through to adulthood [8]. Two co-researchers and eight participants with learning disabilities used memory boxes, scrapbooks or multimedia presentations to tell their stories. Analysis of the stories revealed that many of the participants were encouraged to use technologies at school. For some of the participants this encouragement continued once they left school and they were able to maintain and develop their technology use into other aspects of their life such as employment or leisure pursuits. For other participants, this encouragement disappeared once they left school and was often replaced by active discouragement that was related to the perceived risks of being online. This resulted in a loss of confidence or a fear of using technologies.

The Keeping Connected and Staying Well project explored whether and how adults with learning disabilities living in the UK during the coronavirus pandemic were supported to use technology [. The aim of the project was to identify

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the creative practices that 'supporters' were adopting in order to use technologies to enable people with learning disabilities connect with others, access services or lessen feelings of isolation during the lock-down. Interviews with teachers who were working with young adults with profound and multiple learning disabilities in schools or colleges offered three important insights. Firstly, how important it is for schools and colleges not to assume that their students will have access to standard school or college approved technologies such as Microsoft Teams or Google Apps at home. Secondly, how family members play an important role in supporting and encouraging access to and use of technologies, but how some family members lack digital skills or the confidence to use technologies. Thirdly, collaboration between teachers and family members can encourage and develop use of technologies by young people with learning disabilities.

Conclusion

I will conclude the presentation by distilling from the three studies a framework for 'possibility-focused' support practices that I suggest has the potential to facilitate technology related transitions for young people with learning disabilities. There are four key components of possibility-focused support. (1) Creativity, seeking to identify possibilities for positive outcomes; (2) Risk management, managing risk in order to decrease the possibility of negative outcomes; (3) Shared decision-making: involving people with learning disabilities in decisions about possible outcomes of technology use and (4) Resilience, drawing on the potential of both adults with learning disabilities and those who support them.

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Disabled people's needs in virtual reality

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Abstract

We designed an online survey in order to question disabled people about their needs in virtual reality. The results of this study will be presented at the conference and discussed in light of the current state of research on this topic.

Keywords

virtual reality, human centered design, users needs, disabilities

Context

Recent research focuses on virtual reality as a new learning medium in higher education due to the development of immersive technologies and their decreasing cost [1]. However, if this technology represents new opportunities for learners, it also raises many questions about its usability, especially for users with disabilities.

In the literature, some studies are developing alternative adaptations to enable people with disabilities to use virtual reality. For example, Zhao et al. (2019) propose a set of 14 tools for low vision users allowing them to, among other things, modify contrasts or add text-to speech [2], [3]. Agullo et al (2019) present in their paper a way to implement subtitles to 360° videos in virtual reality for people with hearing impairment [4]. Other studies propose accessibility guidelines applied to the design of games or systems in virtual reality [5], [6]. These various resources are essential but still insufficient for the design of accessible virtual reality systems because of the variety of interaction modalities and use among the disabled users population.

Furthermore, as far as we know, no study has directly studied the needs and uses of virtual reality by disabled people without focusing on a particular disorder (e.g. low vision).

Our research is part of the JENII project (Jumeaux d'Enseignement Numérique Immersifs et Interactifs – Digital Twin in Higher Education), funded by ANR (Agence Nationale de la Recherche – National Research Agency), which aims to develop a training offer via immersive and collaborative environments, by using virtual reality devices. We aim to include the diversity of users' abilities and preferences in the design of serious virtual reality games. Our aim is to develop solutions that can be used by as many people as possible by proposing different interaction modalities and adapting the content. In order to provide solutions adapted to the needs of as many people as possible, our design will not be oriented towards a particular disorder, but will aim to take into account the variety of forms of disability. In order to offer a solution that is as close as possible to the users' needs, we have oriented our methodology towards a user-centered approach [7], [8]. We will include users throughout the design process: from the needs assessment to final evaluation.

Our approach aims to detach ourselves from the deficit view of disability by asking the user about their usage preferences and needs, rather than basing the design on their impairments.

In line with user-centered design, the starting point of our approach is to identify the current uses of virtual reality users, in particular the disabled ones, and their needs in relation to possible usability issues of the system. This will allow us to guide the design of the system and to prioritize our actions.

Methodology

In order to ask people with disabilities about their needs we designed a survey that was distributed online (by email, social networks) to various associations and structures dedicated to people with disabilities. The distribution of an online survey will allow us to collect a larger number of responses than with other methods (e.g. focus groups or interviews) and thus obtain a broader representation of the population's needs. The survey was carried out with the software Limesurvey¹ which includes the necessary tools to ensure that the content was accessible (e.g. sufficient contrasts between text and background colors). In addition, questions were translated into FSL (French Sign Language) with videos.

This survey is composed of three distinct parts: (1) the respondent's life habits, (2) their current use of virtual reality, and (3) their needs related to the usability of virtual reality.

The first part of this survey (1), will allow us to target the type of communication preferred by the respondents and some of the adaptations or technical aids they use on a daily basis (e.g. for travel or for the use of computer tools). This information will contribute to the definition of

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¹https://www.limesurvey.org/fr

the different interaction modalities necessary for the use of virtual reality devices according to the user's preferences and abilities.

The second part of the survey (2) focuses on the adaptations or settings used by the respondents to optimize their use of virtual reality. This part will allow us to identify many of the functionalities that should be implemented in JENII.

Finally, the last part (3) will allow to identify the possible functionalities or adaptations currently missing in virtual reality. These results will guide the development of the necessary adaptation solutions to enable disabled people to participate in virtual spaces.

In order to facilitate the completion of the survey and the data processing, most questions are multiple choice questions. Some open-ended questions are included to allow respondents to specify concrete situations or to raise possible missed points.

The questionnaire is currently being disseminated, since may, for one month. At the end of the dissemination period, the responses will be analyzed. The answers will be studied jointly in order to formalize concrete problems and to answer them.

The definition of usage patterns, including the most used functionalities that should be integrated into the system, and the definition of missing functionalities will allow us to formulate recommendations adapted to our usage context.

Although the results obtained will allow us to orient the development of applications within the framework of JENII, the proposed approach is intended to be generic and adaptable to the various contexts of use of virtual reality.

The results of this study will be presented at the conference and discussed in light of the current state of research on this topic.

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Re-Conceptualizing Disability Simulations: a guided strategies-based approach

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Abstract

This paper examines approaches to developing disability simulations for the higher education context, that can help improve the design of learning materials for persons with disabilities. This research focuses on the use of: (i) guided, (ii) strategies-based; and (iii) task-based approaches to conceptualise simulations for a proposed platform for higher education teachers to have virtual encounters with students with disabilities.

Keywords

Digital Accessibility, Higher Education, Simulations

Context

Simulations are artificial but realistic scenarios used to enable people to experience a situation which they normally would not undergo. Disability simulations are a type of activity that provides an encounter with persons with disabilities (PWD) by approximating sensory and functional characteristics of their interactions and daily activities. This is intended to evoke certain changes in participants, including enhanced knowledge about disabilities [1], increased empathy [2], and changed attitudes towards PWD and the experience of disability [3].

Disability simulation activities are most often used in professional training programmes for medicine and allied health, in teacher education, and increasingly in inclusive product design and development. Most commonly used are analogue activities such as blindfolding participants [4] or having them use a wheelchair [5] for a given period of time. In digital formats and in the context of digital accessibility, browser extension tools like Chrome's Web Disability Simulator and other similar products allow the user to experience what it is like to navigate websites while having certain disabilities, e.g. colour blindness, tunnel vision, Parkinson's disease or dyslexia.

However, these digital tools were originally developed to assist designers who already had some knowledge about accessibility, to better test their websites. These simulators, when used as awareness tools, have disputable success in terms of increasing education and awareness of disabilities, as users often have an *"impact bias"* where short-term positive or long-term negative aspects of disability are highlighted, thus reducing the intended impact [4].

This research takes place within a larger project de-

veloping interactive personas of PWD, including using game design techniques to develop simulation prototypes associated with these personas.

Related Work

Although disability simulations are popular in education and rehabilitation training, and to a lesser degree in user experience design, existing research heavily criticizes the use of simulations in the context of disabilities and advise against using them [6], [7], [8], [9]. French [10] argued that when used for disability awareness training, embodied simulations tended to inculcate negative rather than positive attitudes towards PWD. They were reported to not adequately address coping strategies and skills that PWD develop in living with the disability or the cumulative psychosocial effect of encountering barriers across a long period of time [9].

Silverman [4] found that simulations resulted in a reduction of participants' perception of the adaptability and judgement of the capabilities of PWD. Due to an impact bias created by their limited exposure to the disability, the user overestimates the long-lasting effects of becoming disabled, which has a negative effect on their perception of PWD. The simulation user focuses on the limitations and uncertainty rather than the adaptive behaviour of the PWD [4], [9]. This often involves a sympathy or pity response rather than one of empathy [4], [11]. One study [12] suggests that there should be less focus on the practical simulation of bodily impairment, and more direct interaction with PWD. They argue that empathy should not be viewed as a direct understanding (limited in time and scope) of the disabled experience, but rather a "commitment to forming relationships and accountabilities" with regard to accessibility.

Methodology

The data for this study were taken from the BlindDate platform which is being developed as part of the *Hochschul-Initiative Digitale Barrierefreiheit für Alle* (SHUFFLE) project. The project aims to improve digital accessibility in German higher education. BlindDate is being

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designed to provide teaching staff with a "virtual encounter" with students with disabilities, through the use of interactive personas and associated digital artefacts such as simulation-based serious games (SSG). Personas were developed through a co-design process that centred the experiences of the students at multiple design and feedback stages, with workshops, surveys and interviews used to collect quantitative and qualitative data.

Once the persona prototypes were developed, the interaction design team used a two part methodology for development of the initial game designs. The first stage involved a literature review of related work to identify the main problems associated with disability-based simulations, and recommendations from research on how they could be used more positively and effectively. The second stage involved iterative game design using key elements such as game mechanics, development of narrative structure, and construction of a SSG pattern that could be extended to a range of disabilities with minor modifications. An initial prototype was created for the persona with a visual disability.

Proposed Approach

The literature analysis yielded a focus on three conceptual approaches that have had some success in positive disability simulations. This was encapsulated in a statement that "To be beneficial, simulations must include guided exposure to effective methods for completing daily tasks with disabilities" [13], i.e. disability simulations with strong beneficial effects should be (i) guided, (ii) strategies-based, and (iii) task-based.

(i) In a **guided simulation**, the user is accompanied through the scenario by a real or fictitious person. This is necessarily a person who is affected by the simulated disability themselves and is already well adapted to it. They assist the user, who is not playing as a PWD, but as themselves, by explaining the problems they encounter. This includes admitting that the simulated disability does indeed present problems, but above all proposing strategies for solving them. In the BlindDate context, the guide is the fictional persona whose disability is being addressed. They emerge after the user previously had difficulty navigating the simulated disability. With their explanation of possible problem solving strategies, new digital features are unlocked, that represent real-world strategies simplified as game mechanics, and with whose help the user can now master the simulation.

(ii) In a strategy-based simulation, the main mechanic is not encountering barriers due to disability, but overcoming them despite disability. The strategy to overcome a barrier, in turn, is explained to the user by their guide. These strategies can be physical or cognitive in nature, or include the use of assistive technologies. In the BlindDate context, the designers looked at ways to implement strategies mentioned by PWD as core game mechanics, whereas the disabilities themselves are only secondary mechanics. The very mechanic of the strategy is only unlocked to the user after the persona has explained it in the course of the game. Before that, the game's tasks are, by design, not solvable by the newly impaired user.

(iii) In a task-based simulation, the user is given a clear task to solve in the course of the simulation and with the simulated impairment. This is a very easy, but realistic task that the user is familiar with from their own everyday life without an impairment, and that a PWD could also be confronted with in everyday life. The task is embedded in a short, natural story that the user can easily relate to. The user can first perform the easy task without any impairment. On BlindDate, the user is presented with a task that is contextually integrated into the persona's daily study routine. In this way, the immersion of the fictitious personas is additionally increased. The task suddenly becomes very difficult for them when the simulation starts, and is only solvable again with the guide's strategy. The usage of tasks contradicts the free exploration on any website, which is why the simulation is implemented as a dedicated stand-alone application.

Design Pattern

When combining these three aspects, a four-step design pattern for simulations was created.

In the **first step**, the user is still fully-abled as the simulation has not started yet. They are given a task which they can solve easily.

In the **second step**, some ability is taken from the user via a simulation. As a result, they can no longer solve the given task.

In the **third step**, the guide comes to the user's aid. They describe the disadvantage of the disability and explain a strategy to overcome the problem. The user is able to solve the task again, albeit slower than when fully-abled. Having the user solve the task fully-abled in the first step increases the perceived contrast with the unsolvable task in the second step. Similarly, the task being completely unsolvable – instead of just difficult to solve - in the second step, increases the perceived contrast to the task which is now solvable again in the third step.

In the **fourth step**, the guide is continuously present and explains what external circumstances contribute to their ability to apply the strategy even more effectively. The task is altered to meet these conditions and the user is able to solve it with more ease, despite the disability. In this step, learning takes place as the user understands what they can do to increase accessibility for PWD, and how to enable PWDs' efficient use of strategies and enhance their existing capabilities.

Conclusion

Authentic simulation of disabilities with high fidelity is not possible in either analogue or digital form, as a timelimited simulation cannot replicate the experience of living with disability. This study suggests using a guided, strategies-based approach with a four-step task pattern. This is intended to teach users how to work together with PWD to help create an environment where PWD can use their strategies most efficiently under the best possible conditions.

Acknowledgements

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Making 360-Degree Interactive Content Less Inaccessible – Authoring Guidelines and Lessons Learned

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Abstract

360-degree immersive environments are increasingly employed for learning content at schools and Higher Education institutions. However, there is a lack of specific guidance for content authors on how to make 360-degree content accessible. In a quick heuristic study, we applied the "functional performance" criteria of EN 301 549 to 360-degree learning content in ThingLink. As a result, we found issues with keyboard access, missing alternative texts for images and audio descriptions for videos, missing captions for videos, and some contrast issues. We present these findings and a new set of guidelines for ThingLink authors that we derived from the study. We conclude with lessons learned.

Keywords

360-degree, accessibility, learning environment, LMS, ThingLink

Introduction

360-degree immersive environments are increasingly employed for learning content at schools and Higher Education institutions. They are a special type of Virtual Reality in which a user is immersed into a photographic 360-degree scenery, but without the ability to change their viewing position arbitrarily. A user can "jump" from room to room and position to position, and consume embedded learning contents (text, images, videos). Interaction takes place by clicking on "tags" (symbols in 3D space acting as landmarks) which sometimes have a text label attached.

Content in 360-degree platforms can be rendered on a **variety of user equipment**: (1) On desktop and mobile browsers (optionally in "full-screen mode"), for mouse and touch interaction; (2) on mobile browsers mounted to a "Google cardboard"¹ holder ("VR mode"), for interaction by head pointing and dwelling; and (3) on VR headsets such as Oculus Go ("VR headset mode"), for interaction by hand controller.

At Aalto university, the 360-degree learning platform ThingLink² has been used for several learning courses. One of them is "Swedish for 360-degree"³ which serves as an online learning course for Swedish which is a mandatory second language for many students.

Existing Guidance on the Accessibility of 360 Interactive Content

VR platforms come with many challenges for persons with disabilities which VR developers and authors are mostly unaware of. Creed et al. (2023) [1] provide a good summary thereof, with regard to the various user groups. With regard to guidelines, there are some existing accessibility guidelines, but mostly focusing on VR games (e.g. Game Accessibility Guidelines [2], Xbox accessibility guidelines [3]). Among the general VR guidelines, the W3C XR Accessibility User Requirements [4] postulate criteria on an abstract level. However, there is a lack of specific guidance for 360-degree learning content that would support authors (e.g. teachers, instructional designers) in their job of creating learning contents.

In a quick heuristic study, we applied the **"functional performance" criteria** (chapter 4 of EN 301 549 v.3.2.1 [5]) to an exemplary 360-degree learning content (for test purposes) in ThingLink, since these criteria are the basis for legal requirements on universities in the EU. Among the many issues we found, keyboard access, missing alternative texts for images and audio descriptions for videos, missing captions for videos, and some contrast issues were the most prevalent ones. Some issues occur only for certain types of tags and video players, and can be avoided by employing other tag types and video players. In a nutshell, blind, low-vision, deaf and hard-of-hearing users are most affected by these issues in all viewing modes. For "VR mode" and "VR headset mode", users with motor impairments on head, hands and fingers are also affected.

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¹ <u>https://arvr.google.com/cardboard/</u>

² <u>https://thinglink.com</u>

ThingLink strives to make their platform accessible according to WCAG 2.1. To make up for accessibility deficiencies in its regular player, they are now offering an "Accessibility Player" [6] as an alternative viewer. In the Accessibility Player, tags and their contents are "printed out" as a linear document with heading structure, depriving the user from any kind of immersive experience. Therefore, its use only makes sense for screen reader users and for print-outs. While it is good to see that ThingLink cares about accessibility, a drawback of the alternative player approach is that a user must decide upfront which player they want to use. It would be better for the user to be able to "mix and match", i.e. using the regular player with some selected features of the accessibility player. This is a missed opportunity for designing a player that follows "universal design" principles, which would benefit all users.

Note: The ThingLink platform is frequently updated; therefore our current analysis (as of Jan. 2023) may soon be outdated (hopefully to the better).

Summary of Authoring Guidelines for ThingLink

We derived concrete guidelines for authors of the ThingLink platform which are publicly available [7] under a CC-BY 4.0 license. They are structured into sections for general guidance, scenery settings, tags, images, videos, PDF documents, links to other sceneries, and platform settings.

These guidelines can be summarized in the following 9 rules:

- Allow for operation by keyboard only.
- Make all content accessible to screen readers.
- Provide alternatives for images.
- Provide captions and (if necessary) audio description for videos.
- Use colors redundantly. Make sure content has sufficient contrast (min. 4,5:1 for text, 3:1 for graphics).
- Make it easy to navigate.
- Avoid animations, unrequested audio and flickering content.
- Make sure the desktop browser mode is fully accessible. Also, try to make the other viewing modes (2D on smartphone, VR) as accessible as possible.
- If you link to Web pages or online documents, make sure they are fully accessible according to the legal requirements that apply to them.

Lessons Learned

Here are some insights we learned from this small study:

It is currently not possible to provide a fully accessible immersive user experience (conforming to the law) for all users on the ThingLink platform.

- As authors, we need to use work-arounds to circumvent the worst accessibility issues. At the moment, we focus on making the (less immersive) browser view as accessible as possible. It will take more time - mostly on the side of the developers - to make the VR modes fully accessible for all users, in particular users with vision and motor impairments.
- We need more specific and platform-specific accessibility guidelines for authors of 360-degree learning content.
- Alternative versions (such as ThingLink's Accessibility Player) are less helpful since they do not allow users to get a personal user experience that is finetuned for their specific preferences and needs, in the spirit of Universal Design.
- Platform developers and educators would benefit from fully (or at least semi) automated creation of accessible 360-degree environments. It would already be helpful if content authors were prompted for information making the resulting content more accessible (e.g. alternative texts). While this is currently not available, the recent progress of AI models provide promising venues for exploring the options.

There is a high need for realistic cost estimates of accessible design scenarios of 360-degree environments, and engaging training models to get educators and educational developers early on to actively include accessibility in their development work.

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