

Technology Use and Familiarity as an Indicator of Its Adoption in Museum by People with Intellectual Disabilities

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Abstract. This paper describes the process of co-design of technological products to increase museum accessibility and engagement in visitors with mild or moderate intellectual disabilities (IDs). By using an Inclusive Research approach, a multidisciplinary team of experts, including researchers in Users Experience (UX), psychology, and education, museum curators and a group of participants with IDs (n=9) have participated as the research team. Participants with IDs were involved in two rounds of interviews. The first-round interview aimed to explore participants' use and familiarity with technologies and to understand their interest in using technological tools in different contexts. The second-round interview aimed at exploring participants' spontaneous choice between different tools classified as low (easy-to-read vs Augmentative and Alternative Communication) or high-tech (Augmented Reality) aids for acquiring new knowledge within a museum space. The analysis of the interviews revealed that there was a general consistency between previous technology use/experience/interest and the choice of ICT-based products by participants with IDs. These results highlight the importance of emphasizing a multidisciplinary dialogue and the active participation of IDs users to outline methodologies, programs, procedures, and international standards to foster inclusive access to cultural heritage.

Keywords. Accessibility, Intellectual Disabilities, Experts, Co-design, Inclusion.

1. Introduction

In the last few years, a growing interest in understanding how to promote the access to knowledge for people with Intellectual Disabilities (IDs) and in general for people with Special Educational Needs (SEN), has been fueled by increased legislative priorities and societal expectations for individuals in this population. The Convention on the Rights of People with Disabilities [1] promotes the application of Universal Design principles to avoid any form of discrimination (art. 2) stating that products, environments, programs

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should be accessible and usable by all people without the need for adaptation or specialized design.

In today's information and knowledge society, people with SEN seem to benefit from the use of Information and Communication Technologies (ICTs) [2]. ICTs encourage a flexibility in identifying multiple ways of understanding, processing and elaborating knowledge thereby removing cognitive and communication barriers within formal and informal education contexts (i.e. museums). However, ICTs could become a barrier or obstacle to knowledge for people with IDs if they don't respond to people's needs. What complicates the relationship between disability and technologies is what is called *digital divide*, i.e., the difficulty for people with disabilities not only to access but also to use technological resources [3].

As highlighted by Pinelli & Fiorucci [4], the possibility of accessing the digital world (*Digital Inclusion*) implies the intersection between elements related to the access and use of ICTs. As for the use of ICTs, the authors distinguish between *Digital Skills* and *Digital Competences*. This distinction reflects the inevitable digital gap that may exist between the use of technological resources in terms of the required skills (i.e. capacity to use a technological device) and the required competences (i.e. the actual use of a technological tool and the interest in using it for pursuing learning goals and learning activities).

In the present paper we discuss on how digital skills and competences of people with IDs need to be considered when designing and introducing ICTs within social and cultural contexts (i.e. museums). By using a new methodological approach based on *Inclusive Research* [5,6], we investigated how previous technology use/experience/interest may influence the choice and use of ICT-based products by participants with IDs. Our goal is to reflect on the co-design of technological spaces/products to increase accessibility and engagement in museum visitors giving importance to the process of applicability, usability and effectiveness of ICT tools in meeting people's needs and desires.

2. Method

2.1. Context

The Museum of Natural Science (Trieste) is the context of this research. For several years now, the museum has been giving attention to the renewal of communicative spaces in an inclusive perspective. The museum expressed a particular interest in introducing innovative technological solutions to enhance accessibility, usability, and the overall quality of the interaction with contents available to museum visitors.

2.2. Participants

A multidisciplinary team of experts, including researchers in Users Experience (UX), psychology, education, and museum curators have been working together in several research projects aimed at making social and cultural contexts accessible for people with IDs. Across all the studies, crucial members of the research team were a group of people with mild or moderate IDs part of the Cooperativa Sociale Trieste Integrazione a m. Anffas Onlus (Trieste). The participants with IDs have been working with experts in education over the years and have an established emotional relationship with them. In

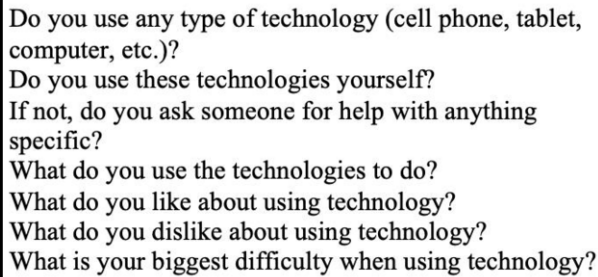
this article we report the results of one of the studies carried out, which saw the involvement of a small group of people with mild or moderate IDs (n=9) with a similar level of schooling (i.e. completion of compulsory schools) and a similar level of reading, writing and textual comprehension abilities.

2.3. Procedure

The research paradigm was that of *Inclusive Research* [5,6] which is based on a participatory approach allowing an accurate analysis of participants' thoughts, needs and desires [7,8]. Our goal was to reflect on the co-design of technological spaces/products to increase accessibility and engagement in museum visitors giving importance to the process of applicability, usability and effectiveness of ICT tools in meeting people's needs and desires.

For this purpose, qualitative data have been collected to explore thoughts and ideas of people with IDs while interacting with ICT-based products within the museum space. Two sets of interviews have been conducted to investigate how previous technology use/experience/interest may influence the choice and use of ICT-based products by participants with IDs.

The first-round interview aimed to explore participants' experience with technologies and understand their interest in using technological tools in different contexts. The interview consisted of 7 questions (Figure 1), was conducted at the Anffas, was video-recorded and entirely transcribed and analyzed by the authors of this work.



Do you use any type of technology (cell phone, tablet, computer, etc.)?
 Do you use these technologies yourself?
 If not, do you ask someone for help with anything specific?
 What do you use the technologies to do?
 What do you like about using technology?
 What do you dislike about using technology?
 What is your biggest difficulty when using technology?

Figure 1. Interview to explore participant's skills/competence/interest in using technology in their daily-life.

The second-round interview was conducted within the museum and aimed at exploring participants' spontaneous choice between different tools for acquiring new knowledge. The tools presented belonged to two different categories: (i) Low-tech aids consisted of a simplified written text (Easy-to-read, EtR) and a text with pictograms - AAC (Augmented and Alternative Communication); (ii) High-tech aid consisted of an Augmented Reality (AR) tool.

The easy-to-read and the ACC texts (Figure 2 and 3, respectively) were created by a social worker expert in these strategies with the active contribution of the participants with IDs. The current contents of the EtR and AAC text were produced in Italian, the native language of our participants. The contents referred to an exhibit that had aroused particular interest and attention in our participants during a previous visit to the museum. The creation of the two low-tech aids took place through 10 meetings conducted before the present data collection. During these meetings the participants had become familiar with the two low-tech aids they had produced.

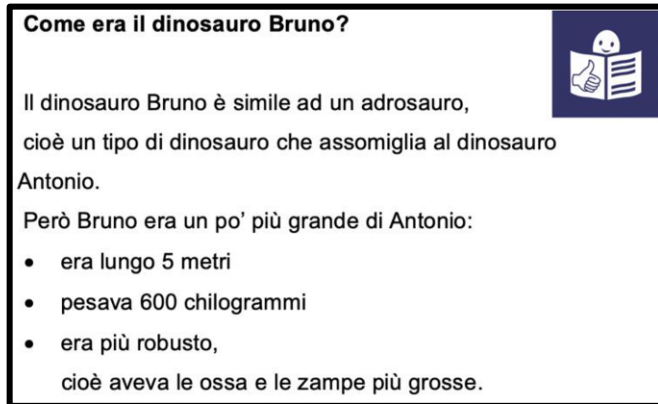


Figure 2. Low-tech aid consisting of an easy-to-read text. The figure represents an extract from the written text.

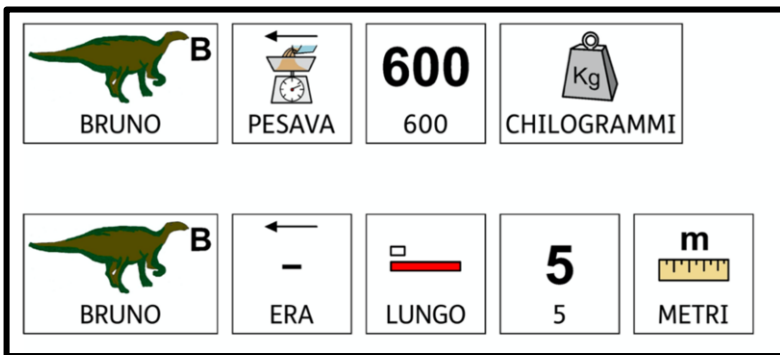


Figure 3. Low-tech aid consisting of a text with pictograms. The figure represents an extract from the AAC text.

The AR tool was designed by the two authors from the Università della Svizzera Italiana based on experience with a similar target group. In order to co-design new solutions, the authors needed to use prototypes already developed [9]. This would allow changes to increase the accessibility, compensate for the lack of abstraction ability, and then achieve the goal of co-designing ICTs.

Participants' familiarization with the AR tool took place within the Anffas association and was mediated by the social worker, the UX-design experts and the psychologists/educators. Figure 4 shows the familiarization phase occurred according to the following steps: (i) participants were shown the QR code and provided with a smartphone with the camera on; (ii) they were asked to frame the QR code as they preferred and to ask for help if they had some difficulties (iii) they were asked to tell what they saw and to zoom in on some details.

We explored participant's spontaneous reaction during their first interaction with the AR tool by applying a coding scheme that allowed the detailed analysis of verbal and non-verbal communication components (i.e. facial expressions and exclamations that express emotions of surprise, fear, indifference etc.).

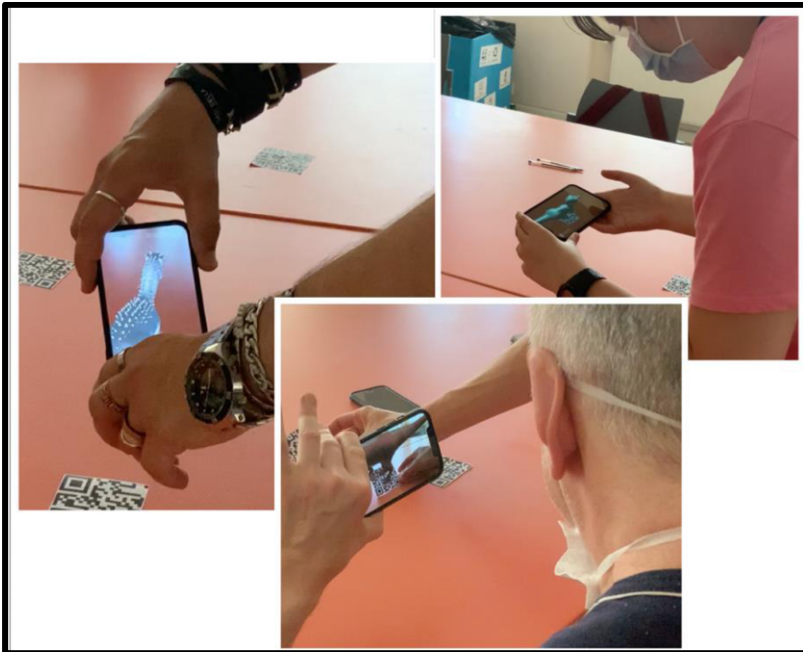


Figure 4. Familiarization with the high-tech aid consisting of an Augmented Reality (AR) tool.

The day after the familiarization took place, participants with IDs and the rest of the research team were involved in a tour at the museum. The second-round interview consisted of presenting to our participants, individually, the three aids (EtR text, AAC text, AR tool) positioned right in front of the related exhibit. Participants were asked to choose one of the three aids to acquire new knowledge on the exhibit. The researchers recorded participant's choice.

3. Results

The analysis of the two-round interviews revealed that there was a general consistency between previous technology use/experience/interest and the choice of ICT-based products by participants with IDs.

In Table 1 we reported a synthesis of the answers to the first-round interview questions.

Table 1. Results from the first-round interview aimed at exploring participants' experience with technologies and understand their interest in using technological tools.

	B.	S.	E.	H.	M.	M.	A.
1	Tablet PC	Mp3 I had a Tablet that broke	Tablet PC Smartphone	Smartphone Interactive whiteboard	3 tablets 2 radio TV PC Wii Smartphone	Tablet Smartphone	PC Smartphone
2	Yes	Yes	Yes	Yes	No	Yes	No
3	I once asked my mom for help to turn	To turn on the mp3	My sister helps me to	I once asked for help to charge my cell phone	No	I ask for help to recharge	Mom helps me, e.g. to take a

	on the PC, after that I learned	and to use it	turn on the pc		my cell phone credit	picture my mom holds the phone and I press the button
4	To send messages, to play games	To listen music and play games	I use the Tablet to play games, my computer to write poems and my cell phone to take pictures	I use my cell phone to make calls, my media board to draw, to look at pictures	I used to use the Wii for exercising now I don't use it anymore. The cell phone for texting, watching videos and surfing the Internet. The Tablet I use to send messages on WhatsApp to friends, listen to music and play games	I use my computer to write children's stories and my phone to send messages with WhatsApp and to go on Facebook and Instagram
5	I like to use it	I like to use it	NA	Drawing and looking at photos	NA	NA
6	NA	I don't know	NA	I don't like games on the multimedia board	NA	NA
7	NA	I don't know	NA	I don't know	NA	NA

Legend:

1. Do you use any type of technology?
2. Do you use these technologies yourself?
3. If not, do you ask someone for help with anything specific?
4. What do you use the technologies to do?
5. What do you like about using technology?
6. What do you dislike about using technology?
7. What is your biggest difficulty when using technology?

NA: Not Available

The second-round interview consisted of presenting to our participants, one at a time, the three aids (EtR text, AAC text, AR tool) within the museum space. Participants were asked which one they wanted to use in order to acquire new knowledge. Results showed that the 80% of participants have chosen the AR technology. Participants who made this choice were those showing a more mature experience with technology in terms of skills and competence. These results indicated that participants that manifested an already established experience with and/or an interest in technologies also showed a preferential choice of the AR technology.

The analysis of our participants' verbal and non-verbal communication components in their interaction with the AR tools showed some relevant behaviors. For example, some participants manifested the "wow-effect" during the hands-on session, and/or a dissociation between real vs. realistic aspects (i.e. M. said "It is the dinosaur Antonio!"). This analysis allowed us to extract related user requirements to guide the design of AR tools and increase accessibility and engagement in museum visitors.

4. Conclusions

These results highlight the importance of emphasizing a multidisciplinary dialogue and the active participation of IDs users to outline methodologies, programs, procedures, and international standards to foster inclusive access to cultural heritage.

Museums are increasingly interested in adopting ICTs solutions that meet the needs of different visitors. Given the advent of new technologies for the promotion and enhancement of cultural heritage [10,11,12,13] it is important to activate a multidisciplinary debate by involving experts from different backgrounds in understanding which might be the role of new technologies in removing barriers to knowledge [14].

The active involvement of people with IDs in this process allow the comprehension of their ideas/perceptions and obstacles to accessing knowledge. By using an inclusive research approach, Mastrogiuseppe et al. [15] involved a group of people with IDs to design a tool aimed at understanding the readability and comprehensibility of textual resources within museums. A recent work by Soares Guedes and collaborator [16] described a cycle from ideation to testing and redesign of an accessible application to navigate through museum content focusing on thoughts, expectations, and ideas of people with ID.

By using a participatory design approach, the present paper allows to reflect on the importance of considering digital skills and competences of people with IDs when designing and introducing ICTs within museum contexts. Previous technology use/experience/interest showed to be an indicator of the choice and use of ICT-based products (AR technology) in museum by participants with IDs.

Results of the present study allow us to reflect on two main points. The first has to do with the fact that it is important to use a Universal Design perspective when designing procedures and tools within social and cultural spaces. Cultural sites should provide multiple ways of understanding, processing and elaborating knowledge in order to avoid any form of discrimination. The second one has to do with the fact that, in our today's information and knowledge society, the right of accessing the digital world should be extended to everyone. To reduce the digital divide and promote a digital inclusion all the people, especially the most vulnerable, should be given the opportunity not only to access but also to use ICTs. Based on their own abilities and interest, all people should be provided with the adequate digital skills and competences to meet the challenges of our society and to actively participate in it.

In future studies, our goal will be to involve both the users with IDs and the stakeholders in some brainstorming sessions to create an affinity diagram on the relevant themes (clusters) emerged from the interviews. Further, we can extract related user requirements to guide the design of new tools to increase accessibility and engagement in museum visitors. From a Universal Design perspective, we believe that the tools and actions we are developing through the active involvement of people with ID could be functional and prove valuable to other populations (e.g., children, the elderly).

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