Multisensory Approaches From Interactive Art to Inclusive Design

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Abstract
In interactive art and multimedia installations, the public plays a fundamental part. Visitors change the meaning and the appearance of artwork according to their sensitivity and preferred way of interaction. For designers, this audience is the set of users on which they should focus their projects. Among the most pervasive technologies are a variety of solutions for interacting with the environment, activated by gesture and movement sensors, voice interfaces,.. and a range of ways of enabling people with different abilities. Many of these technologies were born to be integrated into disability devices or are often used to allow access to the usage of an artifact by people with different kinds of impairments. There are many examples of how solutions designed for specific niches have over time been integrated into common use in private and public areas, recreational and cultural spaces. Through an analysis of the process that has given rise to this, it is possible to understand when and how designers should intervene in the creation of their projects to ensure the accessibility and usability of the resulting artifacts. In the empathizing and ideating design phases, it seems necessary to consider the various multisensory modes of interaction to guarantee the usability and scalability of the project. In this way, the outcome may become truly inclusive and accessible, but also a benchmark for human-centered design, starting from specific needs and incorporating them into everyday use to integrate small groups and minorities, not creating projects and devices that separate and divide them.

Keywords: Design for All, Multimedia Arts, Interaction Design, People-Cantered Design

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Introduction

The contribution, as shown in the poster (Figure 1), shows the connection between technologies used for assistive use and the ones applied in interactive art installations. In particular, there's a focus on how touchless technologies may be inclusive.

The contact point between the different fields of application lies in the ways of interaction and activation needed from the users to enjoy the environment or the artifact. The scheme shows which kinds of assistive technologies have been integrated into everyday use and in other fields; most of them are based on voice commands and sensors: they're touchless interactions. Taking into account the multimedia arts field, it's been highlighted how people can engage with the space and its artifacts, enjoying the exhibition through one or more specific gestures. This action may be touchless or touch-based.

When it doesn't require physical interaction, the environment results more inclusive, since the integration of voice and gesture generates an accessible scenario in which coexist the fulfilment of different kinds of user needs - going beyond the mere demand for access but for the satisfaction of standards up to the tip of the 'pyramid of needs' (A. Maslow, 1954)

In the universal design approach, indeed, the aim should not only be to enable, but also to ensure a pleasant, enjoyable, suitable, and above all uniting and not separating experience. This can be done by considering users' abilities from a broader point of view, designing according to modes of interaction that bring together: possibility of choice; engagement and involvement; ease, and speed of interaction.

To emphasise this connection, it's been addressed a variety of case studies of projects in multimedia arts that have been designed using a technology born for a specific need. This shows how antifragile projects can be born out of limitations (N.N. Taleb, 2010), which adapt to the difficulty and feed off it, giving rise to an inclusive and enabling solution, in which the user is at the centre.

To do so, it's been re-defined the concept of 'disability' itself, accepting definitions of inclusive design (The British Standard Institute, 2005) and universal design (N. Steenhout, 2010), assistive technology (L.Lischetti, 2010), and prototype (T.Maiorana, 2020) that are geared towards creating empathy on the part of the designer and designing without the need to produce different solutions that would effectively separate users.

For the contribution it's been crucial to source from various research fields and areas, finding a 'centre of gravity' for research (G. Anceschi, M. Botta, 2009) resulting in an intersection that takes into account an area in which data are at the service of the well-being of the individuals; so a people-centered vision in a human environment and 'systemic eco-efficiency'(E. Manzini, 2004) which takes into consideration the needs of communities in a broader and interchangeable mindset.

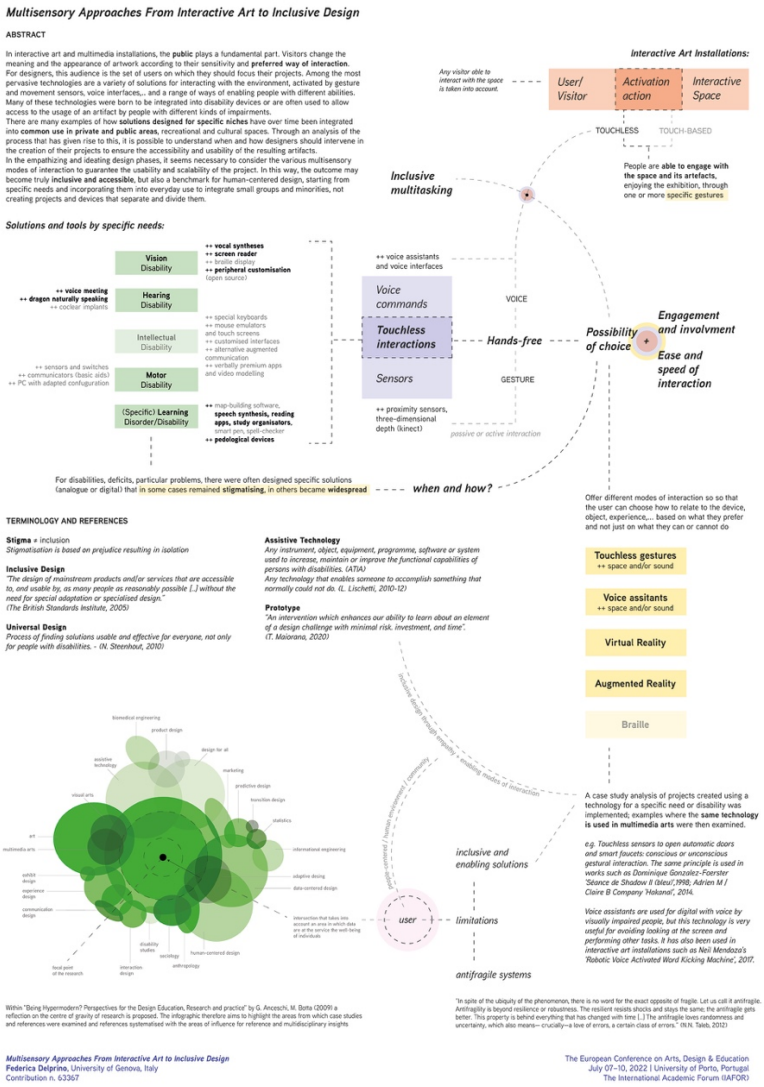

Figure 1: Poster presented to the conference

From assistive design solutions to interactive art installations

Solutions and tools may be identified and classified according to the specific need they assist or compensate. The process of analysing which technologies have remained used just by certain users and which ones, on the other hand, spread to be put in mainstream devices and used by the majority of populations, it's needed a classification according to the disability or disorder they have been designed for.

For vision disabilities there are I) vocal syntheses II) screen reader III) braille display IV) peripheral customization (open source); for hearing disabilities I) voice meeting II) dragon naturally III) speaking cochlear implants; for intellectual disabilities, I) special keyboards II) mouse emulators and touch screens III) customized interfaces IV) alternative augmented communication V) verbally premium apps and video modelling; for motor disabilities, I) sensors and switches II) communicators (basic aids) III) PC with adapted configuration; for (specific) learning disorder/disability I) map-building software, speech synthesis, reading apps, study organisations, smart pen, spell-checker II) pedological devices. (Figure 2)

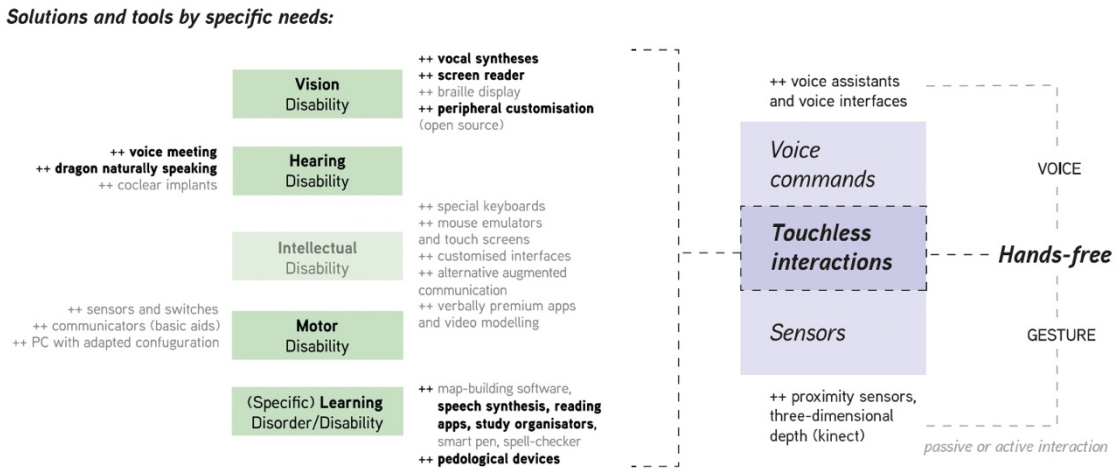

Figure 2: Solutions and tools by specific needs, an analysis of the ones which become widespread and the ways of interaction that have in common

For disabilities, deficits, particular problems, there were often designed specific solutions (analogue or digital) that in some cases remained stigmatising, in others became widespread.

A case study analysis of projects created using a technology for a specific need or disability was implemented; examples where the same technology is used in multimedia arts were then examined. e.g. Touchless sensors to open automatic doors and smart faucets: conscious or unconscious gestural interaction. The same principle is used in works such as Dominique Gonzalez-Foerster 'Séance de Shadow II (bleu)', 1998[1]; Adrien M/ Claire B Company's 'Hakanai', 2013[2]. Voice assistants are used for digital with voice by visually impaired people, but this technology is very useful for avoiding looking at the screen and performing other tasks.

Referring therefore to classification in the beginning of the paragraph, one can identify several technologies that are indeed used and originated to respond to needs related to specific disabilities, but that can also be found within everyday devices and are used for multimedia and interactive art. These, in particular, are vocal syntheses and assistants, screen readers and peripheral customization (open source) that respond to visual deficits; voice meetings and software or technologies such as dragon naturally speaking for hearing disabilities; voice syntheses, reading apps, study organizers and more generally pedagogical devices that were born to aid learning problems.

This thereby highlights how the same design solution can be spent with an assistive purpose and for a cultural, entertaining, engagement-creating purpose.

Products, services, and artifacts in general that are created for the disabled do not necessarily have to be relegated to this use but can be instruments of involvement and union, creating unique solutions for users with different physical, cognitive, and motor skills.

[1] retrieved on https://www.tate.org.uk/art/artworks/gonzalez-foerster-seance-de-shadow-ii-bleu-t12752 , last visited 10/08/2022

[2] retrieved on https://www.am-cb.net/projets/http-www-am-cb-net-projets-hkn, last visited 10/08/2022

Enablement and engagement: multimodal activation actions

Looking at the diversity of environments and contexts between assistive technology per se and the same technology used in the arts, we will see that at the center is precisely the interaction the user can make with space. The gesture in itself, or in any case the multitude of senses brought into play to activate the space and the objects within it, is a fundamental element. Hence the point is the characteristic that these technologies have in common, which have made their way from a specific need to mainstream use, and the possibility of choice that gives rise to a concept of 'inclusive multitasking' that is not the child of bad design, but which gives the possibility of performing several actions at the same time or even doing just one, but in such a way that this can be for those who have several possibilities of interaction a choice and for those who have only one an important activating element that makes it possible for people with different needs and abilities to enjoy the same space. This does not interfere with the speed of interaction, on the contrary, it creates a variety that gives rise to a level of engagement and involvement that is inherent to the technologies themselves and that has the possibility of being developed in a design manner. The multi-modality of interaction and including touchless also gives rise to a hands-free perspective (Figure 3).

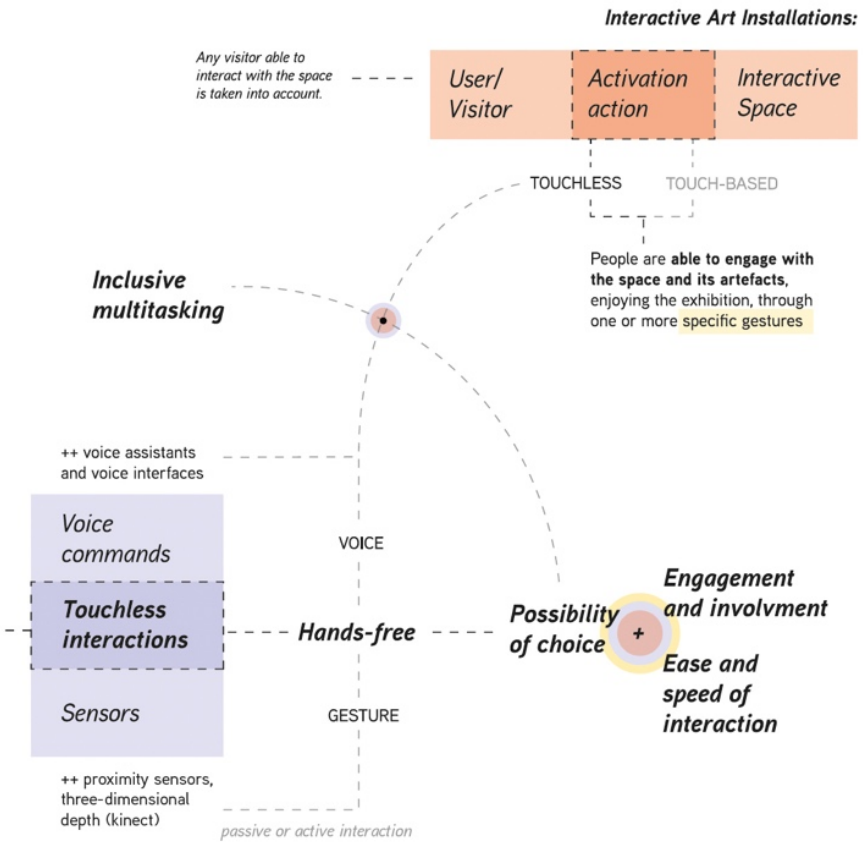

Figure 3: Interactive art installations and inclusive ways of interaction: features of touchless interactions based of possibility of engagement and access of visitors/users.

In the case of the artistic field or in any situation where assistive technology goes beyond the use for which it was intended, the concept of disability is not brought into play or questioned as central.

There is thus a key additional parameter within the operation of comparing these technologies concerning the case studies analysed: at the centre, indeed, is not only the technological element in itself but the mode of interaction it generates. The latter stands to be the real discriminating factor for the inclusive nature of the project. In fact, at the centre is the user and the possibilities he or she has to take advantage of what is around him or her. The stigma is based on a prejudice that results in isolation; what causes stigmatisation in the first place is precisely the fact that some devices are a source of separation and are often designed only to accomplish a function, without any thought for the aesthetic or social implications, which are important for maintaining a user's point of view of identity aside from their disability. To adopt a transversal point of view on certain types of technologies, one can take into consideration the definition of the Assistive Technology Industry Association (ATIA), according to which an assistive technology is ‘any instrument, object, equipment, programme, software or system used to increase, maintain or improve the functional capabilities of persons with disabilities’ merged with the fact that ‘any technology that enables someone to accomplish something that normally could not do’ (L. Lischetti, 2010-12).

Broadening perspective and definitions on assistive technologies for a common benefit

By shifting the definition of technologies created for disability towards the idea that compensatory solutions are enabling in a broader sense, it will be perceived that every user makes use of objects to help them achieve something they would not normally be able to do themselves.

The idea of inclusive and accessibility-focused design thus does not become the aim of a specific branch of research or design that is intent on finding solutions for specific deficits, but becomes an attitude that is the prerogative of all users, as they can be related according to different abilities. Inclusive design may be seen, so, as "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible [...] without the need for special adaptation or specialised design" (The British Standards Institute, 2005).

In terms of necessity, therefore, from a design point of view, one does not necessarily have to focus on a lack, but also on the will of the user. The fact that technologies created for disabilities are inserted in cultural contexts, entertaining, created to create engagement or to make spectators ponder makes one realise how much potential there is in design methodologies that move towards universal design. We can define this concept by identifying it as the "process of finding solutions usable and effective for everyone, not only for people with disabilities" (N. Steenhout, 2010).

The art world, with its installations and the desire to bring to life through interactive art a different and involved role for the spectator who thereby becomes a user, is a prime example of the possibility of union and inclusion provided by the integration of touchless solutions involving the use of voice and gestures to activate the surrounding space. This creates, on the one hand, a certain unity between visitors, but also enhances the singularity of the experiences, emphasising the importance of the use of one's own body and normalising viewers towards modes of interaction that are often not perceived as primary.

The latter, nonetheless, found a strong diffusion with the advent of the covid-19 pandemic, which challenged all those interactions based on comma touch as a possible carrier of comma

viruses and paved the way for the use of other modes of activation and relationship with the surrounding environment.

Possibilities of choice and limits: new skills for new touchless interaction relationships with space and artifacfts

The pandemic period itself challenged exactly the possibility of choice and the resulting limitations gave rise to designs conceived for a time when touch interaction was not considered predominant. This at global level has also broadened the range of people's skills, developing not only awareness but also the everyday habit of using touchless technologies, leading them to mainstream. There is a before, during and after era that defined certain experiences and modes of interaction as not replaceable, but opened up a range of possibilities between the physical, digital and phygital (Morozzo M.C., Bertirotti A., Delprino F., 2021). Thus, proposals and situations that were only experienced in particular situations or within an artistic context often become part of a city itself, on a community and personal level. There are touchless scenarios (Figure 4) which involve touchless gesture, relying on space and/or sound; voice assistants; virtual reality; augmented reality. Other solutions include a tactile part such as braille or multi-sensory solutions such as some panels that provide several types of sensory exploration, which can be combined or integrated with touchless ones.

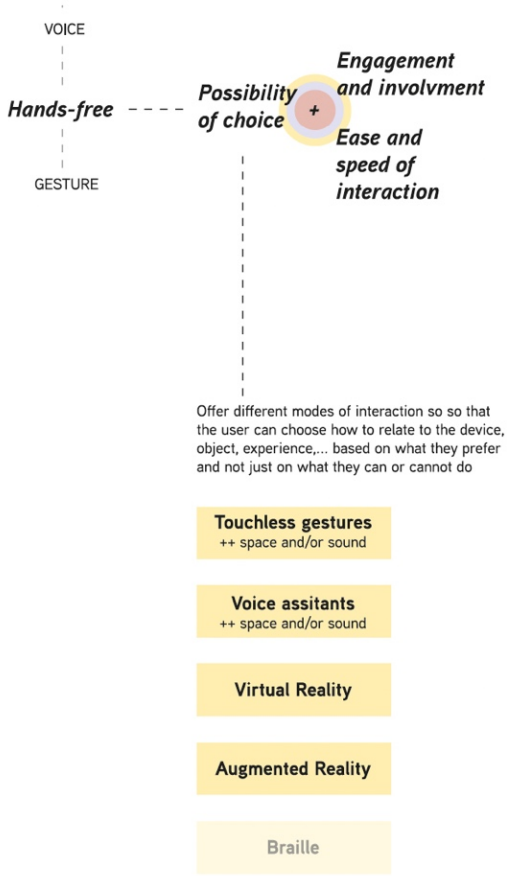

Figure 4: Touchless scenarios

The former includes the interactive work ‘EGO’ (2015) by Klaus Obermaier with Stefano D'Alessio, Martina Menegon[3]; ‘The Treachery of Sanctuary’ by Chris Milk (2012-2014)[4]; ‘IRIS’ by HYBE Studio (2012); which use motion sensors and/or kinect to make the viewers' movement create a change for the environment and installation that depends on the user's own body and movement. On the level of sound interaction, there is ‘The Forty Part Motet’ (2001) by Janet Cardiff[5], a reworking of ‘Spem in Alium Nunquam habui’ (1575) by Thomas Tallis attraversp 40-track sound recording and 40 speakers activated and experienced by the audience by approaching or not approaching them. Speaking instead of sensors in everyday life, with our bodies we can open the automatic doors of a building or activate a tap with a special sensor. Although less performative and entertaining, the underlying concept is the same sensor technology, then linked by other elements and strong concepts and set-ups.

Art installations that make use of voice assistants include Neil Mendoza's ‘Robotic Voice Activated Word Kicking Machine’ (2017)[6], in which users can approach a speaker, pronounce a word and it will be visually generated on a screen along with those of the other visitors, repositioned by a King machine that literally but virtually launches them with those pronounced by others. Then there are software and applications such as VoiceDraw that allow you to draw with your voice. The latter is a hands-free voice-driven drawing application for people with motor impairments (Harada et al., 2007). In this case it may be compared to Paint, with the difference that can be used with voice, but voice assistants have since spread to personal devices, for education and work.

For virtual and augmented reality, one can relive and explore the ruins of Brescia thanks to CarraroLab's 'Brixia Time Machine'[7]; see graffiti and murals in motion thanks to the AR project 'MAUA'[8] in Palermo, Milan, and Turin.

These are some valuable case studies to be taken into account in order to broaden the consideration of interaction and reference for the use of inclusive, compensatory, assistive technologies in stimulating ways and towards a common benefit.

Conclusion

Regardless of the ambit and the design tools, therefore, an awareness of the inclusive potential of integrating different forms of interaction which are not only based on tactile integration but also on the vocal and gesture aspect, is important to build the empathisation phase of the research and design itself. In the design process often a part of prototype realisation concerning the empathisation towards users with special needs, that do not correspond to those of the work team and that they do not know from direct experience, tools are used to better understand the circumstances. These can be interviews, shadowing, simulation methods that are often costly in terms of money and time. Prototyping can also be more generally any “intervention which enhances our ability to learn about an element of a design challenge with minimal risk, investment, and time” (T.Maiorana, 2020).

[3] retrieved on http://www.exile.at/ego/, last visited 10/08/2022
[4] retrieved on http://milk.co/treachery, last visited 10/08/2022
[5] retrieved on https://cardiffmiller.com/installations/the-forty-part-motet/, last visited 10/08/2022
[6] retrieved on https://www.neilmendoza.com/portfolio/robotic-voice-activated-word-kicking-machine/, last visited 10/08/2022
[7] retrieved on https://www.carraro-lab.com/portfolio-item/brixia-time-machine-ar-glass-e-augmented-catalog/, last visited 10/08/2022
[8] retrieved on https://mauamuseum.com/, last visited 18/07/2022

The same consciousness-building about ways of interacting that can be more inclusive, helps to expedite this process and make it more effective even when one is not in a position to have a direct relationship with certain users and to address specific needs, but at the same time still wants to build an environment, an object, a set of inclusive artefacts.

The idea that an inclusive project and an antifragile structure can be born out of limitation is fundamental. This perspective, rather than resilience, is underpinned by an economic model and a philosophy that seeks to feed on contingency, being willing to change and integrate the limitation itself. At the centre is therefore the user seen in terms of their needs as an individual and as part of the community, a relational entity. By taking into account the ways of interaction accessible to the user, it is possible to create inclusive solutions. These multisensory modes of interaction become 'enabling' in many respects.

The next step is to develop design tools and strategies for empathy in order to take these ways of interaction into account as an integral and structural part of profiling users and generating inclusive projects, both auxiliary and engaging.

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