

The importance of digital art technology for supporting people with vision impairments.

Practices for a museum aiming at social inclusion.

The case of “Mind’s Eye | Opening Arts to the visually impaired 2019/20” at MOMus - Museum of Contemporary Art in Thessaloniki.

By

Anna Kefalidou

A Dissertation

Submitted to the Department of Humanities, Social Sciences and Economics

International Hellenic University

for the Degree of Master in Art Law and Arts Management

Thessaloniki

February 2021

Supervised by Dr Themis Veleni

“Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution.”

Albert Einstein

Acknowledgments

The starting point of the whole idea was my studies in history and my specification in teaching to students with special needs and learning disabilities in conjunction with my intense interest in art. I thought that there could be a way for disabled people and especially for blind people to experience art using new technologies to ripple the benefits of this interaction in their everyday life. As a result, I decided to make small research to find information that led me to the subject of the dissertation. Throughout the research, I have received a great deal of support and assistance.

I would like to thank and express my gratitude to my supervisor Dr Themis Veleni who supported the whole idea from the beginning, always responded to any problem and willingly expressed constructive help.

I gratefully acknowledge the support of all of my professors who contributed with their valuable guidance to my MA studies in Art Law and Arts Management.

Also, many thanks to Stela Anastasaki who so kindly and willingly participated in this research despite her tight schedule. Finally, I could not have accomplished my studies without my parents' help and encouragement.

Abstract

This dissertation aims to investigate ways that can be used by a museum and generally by a cultural institution to enable the access to audiences and artists that are usually excluded because of a physical condition. More specifically it will focus on how digital technology could be applied as an inclusive practise in art and in a museum environment for engaging people who experience visual impairment or blindness. The case of Mind’s Eye| Opening Arts to the visually impaired 2019/20” an initiative by Stela Anastasaki supported by START-Create Cultural Change program and implemented in collaboration with MOMus-Museum of Contemporary Art and CERB (Center for the Education and Rehabilitation of the Blind) will be presented as an example of joining digital technology and contemporary art together aiming for social inclusivity, equality and access for the blind.

At last, the research showed that although cultural institutions use alternative and innovative practices, including digital technology, for engaging the blind there is no a detailed and in-depth list of the digital technologies that could find their application in the museum environment for this purpose so there would be an attempt to make a list of them in the hope that it will act as an advisory tool for the museums.

Key Words: blind, visually disabled, digital technology, art, museum, inclusivity, democratization

Table of Contents

Introduction	6
Facts on Blindness and Visual Impairments	7
Stereotypes concerning art and blind people.....	8
The advantages of participating in the creating process	9
Disability Art and Culture	9
Learning process	12
The acting-out-of-the-box museum of the future.....	13
Assistive Technology Resources	14
The case of Mind’s Eye Opening Arts to the visually impaired 2019/20 ” by Stela Anastasaki in MOMus-Museum of Contemporary Art in Thessaloniki	18
Accessibility in the Corona Virus Era	19
Conclusion.....	20

Introduction

We live in a screen – dominated world. The development and the rapid evolution of digital technologies over the last 40 years have led to the extensive use of digital devices in everyday life. Technology defines culture and communication, provides necessary conditions for new cultural forms and creates beliefs and expectations. It replaces conventional education. Technology is everywhere. It is a state of mind. As expected new technologies have entered the art – world. As a result, digital art was born, a contemporary art – form, which introduces new digital technologies in the art expression. It is the art production or presentation that requires computer involvement (Thomson-Jones, 2015:np).

Digitality in art shapes the future of culture in many ways. First, it could be money-saving depending on the material cost of the medium that an artist would choose to work with. There are plenty of online applications and software to experiment with that are free for everybody to use, such as GIMP. Moreover, anyone who holds a tablet or a smartphone with a touchscreen and a stylus has a digital drawing device with almost no cost. For this reason, new artists have the chance to explore more options concerning their art in the first place. Secondly, the process of creating an artwork is different from conventional art and in the case of an artwork that does not meet the artist's expectations the process can be reversible. Moreover, art products can be permanent while they stay in a computer file form without the danger of degradation on the supposition that the artist or anyone responsible for the artwork's storage would take care of its maintenance in excellent condition throughout the years. At last, the most significant change is that digital art enhances communication while it gives access to artists and audiences that are usually excluded from accessing arts more easily. Digital technology acts as an intermediary between the audience and the art. It creates the link that was missing while it is the tool that if used properly it could open the door to art for wider audiences. The 3D printing interpretation of known artworks to replicas that can be touched is only one choice. Numerous applications and devices recognize objects and space and give instructions and information that can be used in the museum environment. Technology has the power of breaking down barriers and increasing participation and inclusion. Participation not only prerequisites communication but also leads to it. It is a two-way road. The communication is between the artwork and the excluded until recently audience and consequently between the artist and the audience and among different audiences as well. Digital becomes essential in art.

Museums of the 21st century try to overcome the difficulty in following through the rapid technology evolution and in the last decades they manage to integrate new technologies for making knowledge easily available to many people and to attract new audiences. They offer access to their exhibitions through the internet for people that are in distance. They use applications and online games to make artifacts attractive to the new generation. Museums play a significant role in society for public education. People with impairments such as wheelchair users, visually impaired and unhearing people are part of the society who need to be educated and have access to museums as well as others. For many museums, access means just physical access but it is more than that. Many museums have tried to integrate diverse audiences, but when it comes to people with impairments many issues need to be overcome and there is still room for improvement. Digital art offers opportunities for better communication. Museums by using new technologies could provide beneficial space for raising self-esteem and supporting well-being for the people who face such difficulties due to disabling physical conditions. Smartphones, QR codes, websites are great interaction tools that can be used in art enabling people with disabilities.

The dissertation will refer to issues of social discrimination and stereotypical beliefs against the “disabled” in Greek society. Moreover, it will investigate through how digital technology takes place into the art world for supporting initially the people with physical impairments and then it will focus on those who have sight impairments. What are the possibilities that digital art technology offers regarding inclusivity? What strategies museums have used until now for engaging the blind or semi-blind and what new technologies can they use to offer accessibility and equality, to make their life easier and to help them feel accepted? Is it possible for a museum to find new ways for beneficial active engagement and for breaking down communication barriers through innovative interaction approaches and in what way? The research would try to answer these questions by presenting methods that have already been used in the past and by critically comparing them in relationship with the newer ones. Then it will focus on the case study of of Mind’s Eye|Opening Arts to the visually impaired 2019/20, an initiative undertaken by Stela Anastasaki within the framework of START – Create Cultural Change (<https://mindseye.gr/>, 2021) that took place in Momus Museum of Contemporary Art in Thessaloniki to pay attention to the Greek reality concerning the issue. While technology evolves rapidly and offers new opportunities all the time, there will be an attempt to propose new ways that a Greek museum could use for being updated, inclusive and democratized and for engaging blind people through the use of digital technology. One objective for this research is to act as a stimulus for further investigation and to encourage further scholarship since there is a lack of research investigating the importance of digital technology in blinds people’s lives. One more is to function as an advisory tool for the museums to offer access to all people without exceptions.

Facts on Blindness and Visual impairments

Blindness is a more complex condition than just a person who is unable to see. In medical terms, there are three types of vision loss. Partially sighted, low vision and blind (Hoskins, 2014:np). Partially sighted have the ability to see very little. People with low vision see blurry and have difficulty in driving and reading and there is the blind person who sees nothing at all, not even light. People with visual impairments ranging from born / complete blind to partially sighted (British Council, 2019:np). Some of them have been born blind and some of them have lost their sight gradually because of a disease or an accident. According to the International Agency for the Prevention of Blindness, the main causes of vision loss are uncorrected refractive errors, cataract, glaucoma, age-related macular degeneration and diabetes ([IAPB](#)). In legal terms blind is the person who cannot have a clear vision but still is entitled to governmental benefits.

According to the Center for Education and Rehabilitation for the Blind, it is estimated that in Greece the number of people with visual impairments is approximately 120.000 to 130.000 (<http://www.keat.gr/index.php/en/>, 2016:np).

Stereotypes concerning art and blind people

"Just because you're limited in sight, doesn't mean you have to be limited in insight"

Michael Williams

"I have created my painting in my head, including colors, before I ever start to paint. It is strictly memorization.

Esref Armagan

From a sociological viewpoint, there is a complexity in the relationship of society with any kind of disability. According to Britannica Encyclopaedia, the bias against people who have physical impairments and disabled bodies is called ableism (<https://www.britannica.com/topic/ableism>, 2013). There is a historical background that explains the social discrimination that people with disabilities face. According to Barnes concerning the arts, there has been a cultural prejudice against the disabled all over history (Barton, 1999:np). From classical antiquity, the arts idealized the perfect sculpted human body without impairments implying that any other body that may have an impairment is not acceptable and need to strive for normality. It seems that art and visual representations contribute to the construction of a certain view concerning disability throughout history. People with impairments used to be depicted as something evil and disfigured in the arts especially in ancient times. This strengthens the stereotypes and false beliefs around them. In Christianity times the depictions of disabled bodies in art were even more and disabled people used to be presented as cursed that need to be healed. The same applies to Medieval era depictions and that of the Catholic Church. This habit led to an attitude according to which all people with disabilities should be excluded. In the nineteenth century, disability became a medical rather than religious issue (Watson, Mann, nd:np). In 1839 the term freak, which was previously described as an unusual thing, meant "an abnormally developed individual" (<https://www.etymonline.com/word/freak>). The term was the result of the classification of all life-forms in species from the naturalists. Whoever did not meet the standards of the perceived characteristics of the human species were usually referred to as "freaks of nature" (Chemers, 2014:np). Albinos, bearded ladies, people with physical impairments and dwarfs were used as entertainers and exhibition objects to freak-shows. It was not until the 40's that freak-shows started to decline. Science, as religion and society did, "sees" disability as something that is not normal and needs change. Deep-rooted notions and beliefs of the impaired body mostly come from the past and remain intact in the present moment by an absorbed in developing descriptions and categories of impairments society (Peters, 2015:np) instead of realizing that there is a strong potential in disability for anybody.

People with disabilities have more difficulty in deal with society than with their impairments. The problem gets worst when they put themselves in the victim's position. It is reasonable but at the same time, it intensifies the wrong beliefs people have. As for blind people, their lives are full of struggles and restrictions in their daily activities. When it comes to their interaction with art, people seem to have a negative point of view. They wrongly believe that a blind person cannot enjoy art the way they do, because of their vision lack. Another stereotype that belongs to history and does not depicts reality is that blind people cannot understand and comprehend nature's diversity, colors and objects. The truth is that even the people who were born blind and have never seen nature and objects before can understand and describe their environment, what's more many of them can create visual art. Esref Armagan is an example of a born blind artist, who managed to prove that this theory

is a misbelief by using in his art colors, shadows, lights and perspectives realistically following descriptions taken from his family (Hayhoe, 2018:np). Museums, with some exceptions, also tend to have the same attitude and that is why they offer limited experiences for the blind (Hoskins, 2014:np). The reason behind this viewpoint is because they are probably scared of the different and they do not know how to deal with it. Another limiting factor for the museums is the high cost of some new technologies and the complexity of their usage.

The advantages of participating in the creating process

"...equality is not about treating everyone in the same way. It is about responding to different needs in the different ways which best suit them"

Bert Massie

People believe that blind people need a lot of help. The truth is they are more limited than helpless. Accessibility in art offers equal opportunities and equivalent information and experiences as anybody else. Connection with art helps them share cultural experiences and brings equality for the blind by breaking down stereotypes and wrong beliefs that affect the way people behave.

The value of creation goes beyond any physical condition. Blind people do not need to stay in the viewer's position, but they can participate in the creating process by expressing themselves through painting. Art is an excellent form of communication with the world. They can immerse themselves in both the creation and viewing and they may have a deeper experience than a sighted person who depends mostly on his visual sense. The act of painting is more connected to feelings than to sense of vision. Being a blind artist is very challenging. Blind people as artist do not only express themselves but they can be a part of a high-spirited and lively community. They can create a professional network in which stakeholders, curators, other professional artists and art professionals are included. This is a great boost in their self-esteem and self-confidence (Charry, 2018:np).

Active participation helps dealing with everyday life and empowers blind people to engage in other areas that are usually considered to be off limits. Full inclusivity is achieved. It is more possible for the blind community to get the support they need from institutions by being creative and active artists than by staying on the side of a passive audience. Moreover, there is a mutual benefit by bringing together sighted with non-sighted artists. While interacting social sensitivity will be encouraged, awareness and understanding for the different will be developed. Blind people will gain skills and employment opportunities and as a result the quality of their lives will be much improved (<https://artbeyondsight.wordpress.com/> :np).

Disability art and culture

"The desire to create continues but ideas, their conception and the use of different materials and techniques to convey this without this has been a whole new game."

Arthur Ellis

Disability art is what disabled artists create that is addressed to audiences both disabled and non-disabled to communicate their needs and their beliefs politically, personally and aesthetically (Sandahl, 2016:np). The purpose of disability art is to break stereotypes concerning the disabled, to

stop the discrimination they suffer, to gain access in the places they are usually excluded from and the most important and groundbreaking to form a positive or even more a proud identity. Through their art, disabled artists want to promote disability culture, to reevaluate their identity and to strengthen their community. By expressing themselves they do not try to fit into the “mainstream” yet to change the traditional image for the appropriate and idealized body by stressing their oddities in their artworks (Sandahl, 2016:np). They try to change the establishment and break the barriers that limit their chances to take part in the community to the same degree as a non-disabled person does.

This attitude is opposed to the two prevalent models of disability. The social according to which disability is socially created and it did not come from a person’s physical impairment (Sulewski, 2012:np) and the medical which introduces the idea that disability is abnormal. Both take for granted that the person with an impairment needs to be fixed to adjust to the environment (Peters, 2015:np). As a result of the exclusion of the disabled, disability culture and art made their appearance to raise awareness to society and to construct a positive identity for people with impairments in which disability cease to be considered as a problem for the person who has it. They do not need to hide rather they can express themselves and celebrate their uniqueness and identity through art.

Concerning the blind, benefits are mutual for the art and the artists. Art helps artists to deal with the negative aspects of their visual deficit and to communicate their disability more easily. On the other hand, there are many artists abroad who are blind or have visual impairments and have contributed to the art field of disability culture especially to visual arts with the help of digital assistive technology. Despite their vision lack, they prove that great art can be interpreted with other senses than the eyes (Hale, 2020:np). Although sometimes the artworks that are created are intended initially for audiences with visual disabilities, many blind or non-blind artists create work that is intended for audiences both sighted and non-sighted. Blind artists usually draw instinctively or by memory. In many cases, they need the assistance of the people from their environment to help them with a verbal description of an object to help them draw. It seems that the interaction between sighted and non-sighted is essential and helpful in the creating process.

John Bramblitt is a blind artist, who is trying to find ways to make art more accessible by creating multi-sensory exhibitions for both sighted and non-sighted. Painting helped him overcome a severe depression because of his blindness. He thinks that color is essential in describing his feelings and he uses the technique of *raised lines* to paint, by using his fingers to orient himself on the canvas in the same way he navigates himself in the city with a cane. He managed to replace sight with the sense of touch. He also runs blindfolded workshops to teach people how to “feel” art the way he does. His seminars are open to everybody, blind or not. The interaction between sighted and non-sighted leads to new ways and new perspectives of thinking art. “*When I was sighted, I thought your physical eyes is where vision comes from...but when I lost my sight my brain still made the images*” he claims. 3D printing technology offers him unlimited options and acts as a reminiscent of exact features of known artworks that his memory might be slipped off (FitzPatrcik, 2018”np). He exhibits his artworks on the D EmptySpace, a Digital Art Gallery.

Keith Salmon is another blind artist known for the Oregon Project in collaboration with Microsoft which is an interactive audiovisual experience. Keith Salmon records nature and with the help of professional engineers, he interprets the sounds into soundtracks that would accompany his artworks in an exhibition (Hale, 2020:np). The Oregon Project imitates visual experience and sounds to offer a holistic approach for the blind. It works with the Kinect technology. As the person moves through

the room and in front of the artworks his position is tracked and he hears sound descriptions of Salmon's pictures. From a distance, the person hears sounds of the drawn scenery that Salmon recorded himself. If he approaches he hears sounds connected to every single color the artist used. Even closer he hears sounds connected to the artist's real movements at the time of creation. Every sound is matched to a different detail and is activated depending on the person's moves. It is a very interesting and personal inclusive experience for both sighted and non-sighted people.

Victorine Floyd is a blind photographer known for the light painting technique she uses. Light painting is a combination of film and photography (Rooney, 2020:np). According to Mark Andres light painting technique does not require taking pictures with the lights on. Instead, the pictures are being taken in a dark room with a digital camera using a flashlight. The result is not typical photographs but pictures that are reminiscent of something magical that exceeds the reality in the way the imagination does unlike the eyes (Andres, 2017:np). It is surrealistic. Pete Eckert is a blind light painting photographer as well, who uses sound and touch to create images. After losing his sight his memory became his vision.

Roy Nachum is a visual digital artist who draws digital pictures using pixels (Voyatzis, 2012:np) and investigates new techniques he can use to incorporate new audiences into the art experience. He believes that human interaction keeps the work alive (Hoskins, 2014:np) and his art aims to inclusion and requires participation. He supports the idea of accessibility for everybody and for that reason he inserts Braille texts in his paintings to be readable as well as for people with visual impairments. In this way, he *"explores the borderline between visual and non-visual perception"* (Hoskins, 2014:np).

Hal Lasko was a blind digital artist known as the *Pixel Painter*. He suffered from wet macular degeneration which caused him blindness in the center of his vision. Lasko painted his digital masterpieces using Microsoft Paint which is a basic and easy application that gave him a second chance as an artist. He was artist before he his vision impaired and digital technology helped him creating even after his sight declined. In the documentary concerning his art, *"The Pixel Painter"*, he claims that computer helped him in magnifying the objects of his paintings. His art was a combination of pointillism and 8 – bit art. Artists usually change their style and their technique after losing their sight. Lasko was a great example of that kind and proof that digital technology is an important tool for participation, creation and inclusion (<https://www.hallasko.com/> :np).

Some blind artists took art one step further not only by using digital technology to create art but by being themselves the digital technology for this purpose. One of them is Neil Harbisson who became the world's first cyborg artist. He has got a chip implanted in his head connected to an external camera that interprets colors into sounds in the form of vibrations. He can *"hear"* the colors. Moreover, he can sense ultraviolet radiation. According to Harbisson his perception and understanding of the world are more intense than it was before the implant device and as strange as it may seem he feels more connected to nature (Donahue, 2017:np). *"Becoming a cyborg isn't just a life decision. It's an artistic statement – I'm treating my own body and brain as a sculpture,"* he says. (Jeffries, 2014:np). What he managed to do is to create a whole new experience in the art field by being famous for his sound portraits. He creates paintings by converting sounds into colors or by creating portraits of famous people depending on the sounds of their face colors and the light of their skin. He sees a face, writing down the sounds of the face depending on its hues and then creates an artwork that color is the dominant feature.

Learning Process

When one sense is damaged, the part of the brain that runs that sense is able to learn to execute another function (Bandakkanavar, 2017: np). People are so visually-oriented that they underestimate the power of their other senses, especially of touch. Only by touching a subject, they can find out its structure, geometry, quality, texture and size. Regardless of sight, neuroscientists claim that blind people can enjoy art the same way as everybody else because the eye is just one of the brain channels that process information. All the other senses play a significant role as well and most important the connection between the artist and the audience is not necessarily visual but emotional and intellectual. In fact according to a study conducted by the Departments of Psychology and Neuroscience of Allegheny College in the USA and by Smith-Kettlewell Eye Research Institute in San Francisco in the USA blind people are superior in the experience of touch comparatively to sighted people because they are more experienced of how to take advantage of it by using their hands (Morash, Pensky, Tseng, Miele, 2014:np). Moreover, another study conducted by J Farley Norman and Ashley N Bartholomew had shown that in tangible tasks blind participants were better in their ability to distinguish objects than the sighted ones (Norman, Bartholomew, 2011:np). By combining digital technology and the sense of touch the learning experience is enhanced.

According to John Kennedy, professor of Psychology Department at the University of Toronto, *“blind people are intuitively capable of understanding the visual world, even without training or education”* (Bird,1991:np) which means blind people are capable of comprehending and understanding the space and the shapes around them and instinctively *“catch”* feelings and emotions without any specialization. Art offers shapes and space in conjunction with emotions and feelings and together with technology, digital technology creates many possibilities for involvement.

Lowenfeld argues that there are two types of creative activity. Visual and haptic (Zucker,2017:np). Visual is what we see. Haptic is what people comprehend using the sense of touch concerning their former experiences whereas Bird says that *“in a proper environment with the proper tools all people can understand art”* (Zucker,2017:np). According to the National Center for Biotechnology Information haptic exploration is an active process that requires touching and manipulating objects to feel their texture and perceive their shape. *“Touch cannot replace the visual sense but it enhances the experience for the blind people,”* says Aaron McPeake, a blind sculptor (British Council, 2019:np).

The act of painting is not only visual. Many artworks, especially those of contemporary art, exceed the limits of visibility. The senses of hearing, touch, taste and smell play a significant role in the art education (Veleni, Kourakis, 2012:np) especially when targeting blind audience. Sometimes a different approach through “touch” and “smell” is more important in understanding and comprehending. Blind or visually impaired people learn mostly on their hands together with other senses. Learning is not a passive event.

Putting blind people to interact with art is a big challenge for a museum because art is highly visual. Feeling and experiencing art is a very different concept than seeing art and it needs different handling. It needs tactile representation supporting by the acoustic description repeatedly to comprehend and absorb any new information. Inclusive activities in a stimulating environment where they can use their bodies is very important. Adaptation of the two - dimensional visual art projects into three-dimensional interpretations is the key to offer access to such audiences. Different surfaces, shapes and materials can make the tactile experience more attractive. Touching means both receive and express communication. Other stimuli such as sounds, odors and textures, which

transform paintings into sculptures (Campbell, 2017:np), create a multi-sensory environment, enhance the art experience and make it more playful, enjoyable and attractive to the audience.

According to Kristy Bird, there are two different approaches concerning the learning process that serves the blind. The first refers to the basic shapes of an artwork that need to be understood. The three-dimensional technique such as replicas or the raised ink method on two-dimensional surface of a visual artwork can be used to serve this purpose. The impasto technique also creates texture on a canvas for the blind to experience. The second approach defines the artist's style. Dots with different colors and textures could be of great help. Moreover, the use of sound description combined with the tactile approaches creates a multi-sensational approach to perception.

Themis Veleni focuses on the power of triggering other senses to experience artworks, a practice that breaks the barriers of the visual domination in the art field and enacts a multisensory perception. Many well-known artists were inspired by music, such as Kandinsky Klee and Matiushin, and have incorporated in their educational systems in the art schools the correspondences between sound and image. (Veleni, Kourakis, 2012:np). Historically, there have been many different systems that proposed a connection between music and color. Usually, the link between them is the interpretation of music into colors during the creating process. When it comes to blind people and people with visual impairments this connection between music and art can enhance learning (Kennedy, 2020:np). A novel and interactive approach could be a combination of a 3D reproduction of an original abstract painting together with instrument sounds connected to the different colors of the painting and vibrations that activated while touching the colors of the artwork. The incorporation of the sound in the painting cannot only convey the whole image of a piece of art but evoke strong emotions as well. Another approach is listening to music while touching a work of art while asking the user to express feelings. Visual artworks become installations that offer a holistic approach to the user (Veleni, Kourakis, 2012:np).

A research conducted by the King Saud University regarding digital technologies as an object identification tool for the blind or visually impaired have shown that when humans interfere in the process the results are better (Albraheem, AlMotiry, Abahussain, AlHammad, Alshehri, AlDosari, AlKathiru, 2014:np). Given that digital technologies can be used in the art experience for the blind in a museum environment, sighted peoples' participation in the form of oral description would be of great value.

In the past, the adaptation of artwork into 3D tactile work of art used to be at great expense. Digital technology not only cuts the high costs of 3D printing and make art more accessible to different audiences but also creates a whole new art.

The “*acting out -of- the-box*” museum of the future

“Every act of kindness helps create kinder communities, more compassionate nations and a better world for all ...even one painting at a time.”

Jeff Hanson

Traditionally the conventional museum used to be inaccessible to people with impairments for many years. There were space deficiency and scarcity in services in the museums for the blind. Their needs had been neglected. Visual art is accused of being elitist. The old-fashioned ‘*Do not touch*’

sign was a strong limit that no one allowed to exceed for reasons of protecting the artworks in a sterilized environment, until recently when museums try to be open to as many different audiences as possible. According to Mitchell, “*seeing painting is seeing touching, seeing the hand gestures of the artist, which is why we are so rigorously prohibited from actually touching the canvas*” (Zucker,2019:np). This attitude has changed because of the Convention on the Rights of Persons with Disabilities 2006/2008 concerning accessibility (CRPD). As a result, museums realized that in order to offer to equal access for all in art they need to adopt new strategies. To be more democratic, the museum of the 21st century examines the prospect of including different audiences that used to be left out of aesthetic experiences. In an attempt of searching for alternative methods to include such audience museums embrace digital technologies. When it comes to blind people museums incorporate tactile and sensory art in their exhibitions. They also offer descriptive tours, touch tours and three-dimensional tactile interpretations of two-dimensional visual artworks. The new holistic approach by the museums redefines the common notion that “*visual art is not for the people who cannot see*”.

In virtue of new technology reaching a larger audience at lower costs is way easier than it was in the past. Museums have the chance to be more innovative and follow a more experimental approach, by offering non-visual access technology for incorporating the blind. Until now many museums have produced three-dimensional tactile replicas using 3D printing technology. Computers create raised lines and along with the braille text system, they create a whole new experience not only for the blind but for all audiences as well.

Concerning inclusivity, the most important thing that a museum has in mind is that blinds people’s needs are not different from the sighted people. Their expectations from a museum may vary. They do not all have the same taste in art and each one may probably expect something different from an institution, according to his taste and interest in art. Some of them may not interested in art and museums at all. Museums bear in mind that it is not only about offering accessibility in practical terms but it is about offering a variety in experiences to be more interesting and attractive to non – sighted people. They consider how they meaningfully engage blind people by presenting academic material through technology use in an interesting and non-threatening or boring way (Anderson,2015:np).

The *Tactual Museum* in Athens which was found in 1984 is a great example of a non-traditional museum. It is one of the five tactile museums worldwide. All the exhibits displayed are replicas of original artifacts that all visitors are allowed to touch. It has an ancient Greek collection, a Byzantine collection and artworks made by the visually impaired or blind people. Every exhibit is accompanied by descriptive signs written in Braille. Its educational programs are addressed both to sighted and non-sighted students. During the programs sighted students are blindfolded in order to enter for a while the world of the blind (<http://www.tactualmuseum.gr/indexe.htm> :np).

Assistive Technology Resources

The state of art in digital technology

Digital technology not only can change the experience of art engagement for the blind but it can impact their daily life. It is the tool that a museum can use to expand access to its visual art collection by making the artworks touchable. According to Gary Woodill, the technologies that are functional

for the blind are the ones that are related exclusively to computer vision, AR and geolocation technologies (Woodill, 2016:np). Until now the most common way that digital technology entered the museum environment for engaging the blind or people with low vision is the interpretation of the 2D surfaces of images into 3D modeling replicas.

3D molding can help blind people to “see” famous masterpieces that they did not have the chance to experience until recently. One problem with this approach is that as regards large pieces of art a blind cannot touch it as a whole thus they face difficulty in comprehending it. They can only experience the visual components of the artworks after they are deconstructed into smaller parts to be studied (Patrick, L., 2018). Moreover, a smaller replica of a big size artwork does not meet the reality (Hoskins, 2014:np). At last, during the 3D printing process, many details of the artwork may be sacrificed for the sake of highlighting the general impression of it but especially for reasons of comprehension by the blind.

In this case, museums need to find other ways to offer such an experience to a blind audience. Mobile phones or other small displays equipped with braille software are a great option for inclusion and for offering a multisensory environment for everybody. The latest technologies that can be used by an art institution and that can respond to blind audience’s needs are mentioned below.

- a. *Sensational Blackboard*. Ann Cunningham, an artist being devoted to the creation of multi-sensory environments for the blind, is the designer of it (FitzPatrick2018:np). It is a great and inexpensive tool for instantly creating tactile images. The user can create raised line drawings. It consists of the blackboard, whose one side is made of plastic and the other one is made of rubber. Putting a piece of paper on its smooth side the user can draw with a plain pen. Blind or partially sighted people can quickly and easily make images. It makes blind artist’s art less difficult. It can also be used by museums in projects or workshops for blind or semi-blind students and artists aiming for inclusion in the art experience (Shaheen,2012:np). John Bramblitt made use of it in his workshops in well-known museums such as the Metropolitan Museum of Art, in galleries and universities. According to him the Sensational Blackboard is a useful tool for both new and skilled artists (<http://www.sensationalbooks.com/products.html#blackboard> ,nd:np).
- b. *Haptic Technology*. People are already using haptic technology in their daily life. It is the combination of human senses with digital technology. Many smartphones with touchscreens vibrate when the user push buttons to give them the sensation of feeling. Haptic technology can be applied to the VR experience using haptic gloves in a virtual environment allowing the user to feel and to push an object that does not exist (Sreelakshmi, 2017:4182-4187). Virtual 3D artworks can be created from laser scans and can be “touched” by the blind to “see” the artwork through vibrations.
- c. *Feelif tablet*. Feelif is a touchable device with numerous built-in applications that a blind person can use. It works with the braille system in the form of raised dots on a tactile surface interacting with the user’s fingers along with vibrations and audio descriptions that work as guidance in a fully unique and accessible learning environment. It can be used like any other smartphone or tablet. It does not work as an image creator while the

dots are static, but the user can move his fingers along the line of these static dots while listening to the audio directions describing shapes or lines that will vibrate or make different sounds when someone touches them. The combination of tactile raised dots and lines, vibrations, sounds and voice description creates a multisensory environment for a blind person to become digitally sighted (<https://www.feelif.com/> { 14/02/2021 }).

Museums can become innovative and accessible to the blind by using it. They can offer a whole new learning experience concerning visual artworks.

- d. *The BrainPort Vision Device*. The device relies upon the sensory substitution technique. The loss of one sense is replaced by gathering information into another channel in the brain (Renier, Volder, 2013:np). A tiny external camera placed on the user's forehead collects visual information which is then gathered in a central processor. In the processor, information is encoded in digital form. Afterwards, the data take the form of electronic pulses (Layton,nd:np) who send information from the camera to the brain receptors in the same way the eye perceives color from independent stimulation. The receptor is an electrode array that applies the information to an array of electrodes placed on the surface of the tongue. A trained user may eventually identify the information he receives and interpret them into objects. Moreover, he may recognize perspective, size, shape and depth of space and objects (Bandakkanavar, 2017:np).
- e. *EnChroma Color Blind Glasses*. Some people are not blind but have color blindness. It is a color vision deficiency in which the person cannot distinguish the shades of blue, green and red. New technologies help them see more colors. EnChroma lens, a patented lens technology that won an award from the National Eye Institut, artificially expand the chromatic spectrum and enhance the color discrimination whose deficiency confuses the individual. They increase the contrast among colors. (<https://eu.enchroma.com/pages/how-enchroma-glasses-work> { 14/02/2021 }).
- f. *Augmented reality glasses*. These smart AR glasses is a future technology project as it has not been launched yet. It is the work of vision scientist Philip Torr and neuroscientist Stephen Hicks of the Oxford University of the United Kingdom. The glasses recognize weaknesses in the user's eyesight and "corrects" them by enhancing the details he needs to navigate independently ([https://www.financialexpress.com/industry/technology/augmented-reality-glasses-for-visually-impaired/929416/.](https://www.financialexpress.com/industry/technology/augmented-reality-glasses-for-visually-impaired/929416/), 2019:np).
- g. *Instantly Braille translator device*. It is a cheap and portable device that translates texts into Braille. It works with an internal camera. The user can take a picture of a printed text that he wants to translate. The text is converted into a digital one and then translated into Braille. The translation appears on a display connected to the translator device. It was designed by the Tactile Team, a team of six undergraduate women who won the *Lemelson – MIT Student Prize for Inventors*. When launched, it will be life-changing (Brackmann, 2017:np).
- h. *Graphiti[®] Interactive Tactile Graphic Display*. It is a low-cost assistive technology using a cheap Braille external display that can easily be connected to computers and

smartphones and can be used both from a museum for purposes of inclusion of the blind and from blind artists as well to create art. It offers access to graphical images, drawings and photographs by using moving pin-arrays. The pins can be put to different heights representing different colors. Moreover, users can create graphics themselves and they can make modifications and adaptations through computer use. (Hagen, 2020:np).

- i. *Proxemic audio interfaces*. It is an interactive sonic experience that provides an audio interpretation of existing 2D paintings based on four zones. The four zones are based on the user's proximity in front of a painting. The user is free to move forward or back. The first zone is the background music that conveys the mood of the painting with music selected by people who have seen the painting. The second zone is called sonification. In this stage, the user hears sounds that are connected to the colors of the artwork. He can also move his hand to select which piece of the painting he wants to be sonified. The third zone is the sound effects in which sounds that are connected to the objects of the painting are presented. The last stage is the verbal description in which information and the history of the painting are described to the person. It is a fully engaging and immersive experience for a blind person and it is also money-saving for the museum (Rector, Salmon, Thornton, Joshi, Morris, 2017:np).
- j. *Seeing AI App*. It is a Microsoft application that uses camera to recognize people, their facial expression, objects, colors, products, notes and barcodes and turns them into audio descriptions. It scans documents and detects light. It gives great autonomy to the user (Choney, 2019:np).

Indoor Geolocation Technologies

- a. *Hololens Building navigator*. It is a mixed reality system, in which both real and virtual objects are taking place, that helps with high accuracy the spatial orientation of a blind person indoors. The device is portable and wearable. It recognizes the space, turns the data that collects into a spatial map and creates sounds that guide the person into a building (Zijlstra, 2017:2,6)
- b. *Tango Augmented Reality System*. *Google's 3D indoor mapping and positioning technology*. It is a mobile device by Google which helps the blind to navigate themselves in a building. So does the GPS out of a building. It recognizes objects in a room and directs the user to an object by showing him a specific path to follow in the form of virtual dots on the floor (Woyke,2016:np).

Object Identification

There is an increasing interest in the field of object recognition for the blind, in which objects can be identified for the moment only in the event of being recorded in a specific database and with the assistive help of a sighted person. More steps need to be taken in this field which has raised scientist's attention. Research of the Information Technology Department of the King Saud University in Saudi Arabia has shown that there is a classification regarding technologies used for object identification. The automatic that do not need human intervention and the human-powered

technologies in which human attendance is necessary. Some of them that can be used by a museum are mentioned below (Albraheem, AlMotiry, Abahussain, AlHammad, Alshehri, AlDosari, AlKathiru, 2014:np).

Automatic Technologies:

- a. *LookTel Recognizer App*. An application that scans and recognizes objects in real time (<http://www.looktel.com/> , 2021:np).
- b. *Eye Ring*. It is a device with a camera that acts as an eye on a finger. The user marks an object of his interest, takes a picture of it, uploaded it on his smartphone and takes a verbal description of it (Ridden, 2012:np).

Human Powered Technologies:

The applications that belong to the human-powered technology field could function providing that sighted people would take part as volunteers and interact with blind people. The user after taking a picture of an object uploads it online and asks for information regarding the object. The volunteers' answers will be converted to verbal descriptions for the blind. It is a great tool for the museums for projects in which sighted and non-sighted participate, offering benefits for both sights and encouraging interaction between them (Albraheem, AlMotiry, Abahussain, AlHammad, Alshehri, AlDosari, AlKathiru, 2014:np).

The case of “Mind’s Eye | Opening Arts to the visually impaired 2019/20” at MOMus - Museum of Contemporary Art in Thessaloniki

Stela Anastasaki is an art historian, cultural manager and freelance curator. She is the person behind the of Mind’s Eye| Opening Arts to the visually impaired 2019/20 which was launched by the Momus Museum in the city of Thessaloniki. It is a project aiming at cultural inclusion, engagement, equality and accessibility in art experience for people with impaired vision. It is the first time that such an endeavor concerning the blind takes place in Thessaloniki.

The forerunner of the Mind’s Eye was another cultural attempt that took place in Sofia some years ago, the *Matter Over Matter Project*. It was an international project by Goethe-Institut in the framework of the Cultural Management Academy 2017 – Sofia, Bucharest, Thessaloniki which was funded by the CMA Project Fund. Stela Anastasaki with other professionals from the field of culture conceived the idea of bringing together artists of the contemporary art field and 3D designers from Bulgaria and Greece and investigating how new technologies could be used in the field of contemporary art to create artworks that enable tangibility (<https://matterovermatter.blogspot.com/2018/11/matter-over-matter-is-realized-in.html>, 2018:np).

After that Stela Anastasaki came back with the idea of access in the art for everybody. She inspired and designed the of Mind’s Eye| Opening Arts to the visually impaired 2019/20, a pilot project that took place in the Momus Museum of Thessaloniki in collaboration with CERB within the

framework of START – Create Cultural Change. The choice of Momus was not irrelevant. She used to work there for many years and it acted as a home ground for her idea to develop.

The project offers an experience not only for people with vision impairments but for every single person that has an interest in art. It brings people in getting in contact with the experience of art through a different path than the usual of not touching the artworks. It is a combination of tactile and acoustic stimuli. In the entrance of every room, there is a tactile map that guides people with sight loss around the place. This helps them create a mental outline of the space in order to navigate their way through the museum space.

Ten artworks of well-known artists of all kinds of mediums from the permanent collection Alexander Iola's donation at the Macedonian Museum of Contemporary Art (1984) were interpreted into 3D replicas through 3D printing technology and laser cut. The audience can touch them and listen to audio descriptions by using their mobile phones. Every artwork is accompanied by a caption that bears the description of all the artwork's features and information in the Braille that are important to the user. Pieces of art are also tagged with a QR code in which all these details are included in an audio description form. The content of the exhibition and the descriptions of the artworks are also accessible in an inclusive catalog, especially for people who experience blindness and deafness at the same time, which entails texts in Braille, QR codes and acoustic descriptions. At last, the project is accompanied by three interactive museum educational objects, designed by Katerina Bakaliou, to present three of Taki's artworks interactively (<https://mindseye.gr/en/home-english/>, 2019/20:np).

According to Stela Anastasaki digital technology is a great tool in the road of accessibility and equality. People's participation despite the adverse circumstances of the pandemic was remarkable a fact that is hopeful for the future (Mylona, 2021:np).

Accessibility in the Corona Virus Era

In the era of the Corona Virus people's routine has changed in all of its functions and everybody needs to settle in. Social distancing is the prerequisite to be safe. In the future, access will be achieved remotely. A transition in digital environments is fulfilled. Physical appearance cannot be replaced however digital technology is the only resource that offers an opportunity of staying "in touch". Until recently the main concern regarding the blind and people with vision impairments was the accessibility in the physical space. Now the pandemic deprived them of the sense of "touch". Museums rebuilt the barriers in a desperate attempt to stop the virus from spreading.

Museums try to adapt to the new reality. They resort to digital alternatives to offer access to their exhibitions through digital online tours. In the case of the blind and of people with visual impairments remote online access through audio description may be in some cases a better solution than physical attendance. Until now they faced difficulty in reaching a museum, a theatre or a concert because of the lack of the proper facilities for them (<https://vocaleyeyes.co.uk/wp-content/uploads/2020/08/VocalEyes-Museum-survey-report-August-2020.pdf>, 2020:1-23). In the Corona Virus Era, they can freely choose and attend any event they like without worrying about the way they reach the place. The possibility of an audio description of an exhibition through a website gives the user the chance to alter the volume and the settings to make it more accessible for him according to his needs.

Despite the difficulties that occurred there is room for development. This era is a great opportunity for the museums to build access from the beginning and make a fresh start including new audiences.

Conclusion

In today's uncertain times' museums can act as an anchor in the storm (Carlsson, 2020:np). Now more than ever, in the new Corona Virus era the normality has drastically changed for everybody and the need for communication and learning is crucial. Museums can help society accept more easily changes, especially those that are sudden, unexpected and out of people's control. They have the power to bring people together. By using digital technology as a medium they offer space for interaction and communication.

Technology continuously transforms the reality of people's lives. Especially when it comes to people who experience visual impairments or blindness, digital technology is the most important tool for the museums of the future in the path of engagement and access. It opens the doors to learning, breaks the boundaries of exclusivity in the museum or virtual environment and makes people more mindful of people with different needs. Moreover, it can be used by anyone. Every display of any digital device, such as smartphones, can be effortlessly incorporate the Braille system for the blind or modified enlarged letters for the people who have low sight.

Museum of the 21st century is not only open to different audiences but they offer open space and support for disabled artists as well to express themselves. Digital technology is the medium that allows self-expression. In the Greek environment museums continuously redefine their role in society by offering new experiences for every audience. They try to adapt to suit the needs of the blind, not the opposite. They do not function as a visual place but they are open to all senses.

A common and usual strategy that many organizations have adopted is the Universal Design approach. It is a concept of designing an environment to meet the needs of all people who want to use it to the greatest extent possible despite their age, ability or disability. The purpose is to create an environment friendly and usable to all. Many museums embraced the concept not only for accessibility reasons but for reasons of people's satisfaction as well. Culture organizations that have adopted this visitor-centered approach offer building accessibility, tactile experience, audio projections, interactivity, guided-tours, Braille and audio formats for the blind, enough lighting and simple language for all (Watkin, 2017:np).

Digital technology and Universal Design offer great potential for the blind to become independent and enable access to experiencing art. There is always room for more assistive digital technology ideas for inclusion. It remains to be seen whether these strategies are effective in improving their everyday life.

References in English

- Albraheem, L., AlMotiry, H., Abahussain, AlHammad, L., H., Alshehri, M., AlDosari, R., AlKathiru, A. "Toward designing efficient application to identify objects for visually impaired", 2014, <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7147525> {14/02/2020}.
- Anderson, A. "Arts Integration and Special Education – An Inclusive Theory of Action for Student Engagement", 2015, https://books.google.gr/books?id=8yQhBQAAQBAJ&pg=PA187&lpg=PA187&dq=How+students+with+disabilities+learn+in+and+through+the+arts:+An+investigation+of+educator+perceptions.&source=bl&ots=A00dN0MPGC&sig=ACfU3U2AMgEptt1TyVHWiPcW_HuFTvAZAg&hl=el&sa=X&ved=2ahUKEwj1pOmHsLPrAhXj6OAKHcuBC_4Q6AEwCXoECAoQAQ#v=onepage&q=How%20students%20with%20disabilities%20learn%20in%20and%20through%20the%20arts%20An%20investigation%20of%20educator%20perceptions.&f=false {14/02/2021}.
- Andres, M. "Photographs of the Mind", 2017, <https://journals.sagepub.com/doi/pdf/10.1177/1536504217714261> {14/02/2021}.
- ArtBeyondSight, "Bringing Art Culture to All", <https://artbeyondsight.wordpress.com/> {14/02/2021}.
- Bandakkanavar, R. "BrainPort Vision Device", 11/07/2017, <https://krazytech.com/technical-papers/brain-port-device> {14/02/2021}.
- Bird, K. "The Possibilities of Art Education for the Blind", 1991, <https://www.nfb.org/sites/www.nfb.org/files/images/nfb/publications/fr/fr10/issue3/f100325.html> {14/02/2021}.
- Brackmann, L. "Instant Braille translator can fit in your hand", 24/05/2017, <https://www.cnet.com/news/portable-braille-translator-mit-students-team-tactile/> {14/02/2021}.
- Britannica, The Editors of Encyclopaedia. "Ableism". *Encyclopedia Britannica*, 16 Dec. 2013, <https://www.britannica.com/topic/ableism> {14/02/2021}.
- BritishCouncil, "Aaron McPeake", 2019, <https://www.disabilityartsinternational.org/artists/profiles/aaron-mcpeake/> {14/02/2021}.
- Campbell, L. "You don't need eyes to see, you need vision: teaching art to students with vision impairment", 01/03/2017, <https://www.rnib.org.uk/insight-online/fine-art-adaptations-student-vision-impairment> {14/02/2021}.
- Carlsson, R. "Why we need museums now more than ever", 08/10/2020, <https://www.museumnext.com/article/why-we-need-museums-now-more-than-ever/> {14/02/2021}.
- CERB, "Center for Education and Rehabilitation for the Blind", 28/07/2016, <http://www.keat.gr/index.php/en/> {14/02/2021}.
- Charry, P. "Visual Art Instruction for the Visually Impaired", 23/05/2018, <https://aif.org/visual-art-instruction-for-the-visually-impaired/> {14/02/2021}.
- Chemers, Michael M. "Freak show". *Encyclopedia Britannica*, 05/11/ 2014, <https://www.britannica.com/art/freak-show> {14/02/2021}.

- CRPD, “Convention on the rights of Persons with Disabilities”, 2016/2018, <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html#:~:text=The%20Convention%20on%20the%20Rights,signature%20on%2030%20March%202007.&text=This%20is%20the%20highest%20number,Convention%20on%20its%20opening%20day.> {14/02/2021}.
- Donahue, Z.M. “How a Color-Blind Artist Became the World’s First Cyborg”, 03/04/2014, <https://www.nationalgeographic.com/news/2017/04/worlds-first-cyborg-human-evolution-science/> {14/02/2021}.
- EnChroma, “How EnChroma Glasses Work”, <https://eu.enchroma.com/pages/how-enchroma-glasses-work> {14/02/2021}.
- Feelif, “When the blind can feel pictures on touchscreens”, <https://www.feelif.com/> {14/02/2021}.
- Financial Express, “Augmented Reality Glasses for visually impaired”, 25/01/2019, <https://www.financialexpress.com/industry/technology/augmented-reality-glasses-for-visually-impaired/929416/> {14/02/2021}.
- FitzPatrick, L., “How the Art World is Making Way for the Visually Impaired”, 10/09/2018, <https://www.mutualart.com/Article/How-the-Art-World-is-Making-Way-for-the-/40BD2955157C32C1> {14/02/2021}.
- Hagen, M. “Orbit Research Introduces the Graphiti Interactive Tactile Graphic Display”, 23/03/2020, <https://www.closingthegap.com/orbit-research-introduces-the-graphiti-interactive-tactile-graphic-display/> {14/02/2021}.
- Hal Lasko, “The Pixel Painter”, 2021, <https://www.hallasko.com/> {14/02/2021}.
- Hale, J. “Telent, tech and visual art”, 02/06/2020, <https://wellcomecollection.org/articles/Xse8FxAAACIAhtsq> {14/02/2021}.
- Hoskins, C., “How do we Ensure Art Accessibility for the blind and visually impaired?”, 17/04/2014, http://fir.ferris.edu:8080/xmlui/bitstream/handle/2323/4724/Chakila_Hoskins_Ethics_Sp2014_ac.pdf?sequence=3&isAllowed=y {14/02/2021}.
- Hayhoe, S. “How a blind artist is challenging our understanding of colour”, 28/03/2018, <https://blogs.bath.ac.uk/senseculture/2018/03/28/how-a-blind-artist-is-challenging-our-understanding-of-colour/> {14/02/2021}.
- IAPB, The International Agency for the Prevention of the Blindness, “Eye Conditions”, nd, <https://www.iapb.org/learn/knowledge-hub/eye-conditions/> {14/02/2021}.
- Jeffries, S. “Neil Harbisson: the world’s first cyborg artist”, 06/05/2014, <https://www.theguardian.com/artanddesign/2014/may/06/neil-harbisson-worlds-first-cyborg-artist> {14/02/2021}.
- Kennedy, R. “Music as Art”, 10/07/2020, <https://interlude.hk/music-as-art/> {14/02/2021}.
- Layton, J. “How BrainPort Works”, nd, <https://science.howstuffworks.com/brainport3.htm> {14/02/2021}.
- LookTel, “What is LookTel?”, 2021, <http://www.looktel.com/> {14/02/2021}.
- Matter Over Matter, 2018, <https://matterovermatter.blogspot.com/2018/11/matter-over-matter-is-realized-in.html> {14/02/2021}.

- Morash, V., Pensky, A., Tseng, S., Miele, J., “Effects of using multiple hands and fingers on haptic performance in individuals who are blind”, 2014, <https://pubmed.ncbi.nlm.nih.gov/25154288/> {14/02/2021}.
- Norman, F., Bartholomew, A. “Blindness enhances tactile acuity and haptic 3-D shape discrimination”, 10/2011, <https://pubmed.ncbi.nlm.nih.gov/21671153/> {14/02/2021}.
- Online Etymology Dictionary, “freak”, <https://www.etymonline.com/word/freak> {14/02/2021}.
- Peters, S. “Disability Culture”, 21/12/2015, <https://www.britannica.com/topic/disability-culture> {14/02/2021}.
- Rektor, K., Salmon, K., Thornton, D., Joshi, N., Morris, R.M., “Eyes-Free Art: Exploring Proxemic Audio Interfaces For Blind and Low Vision Art Engagement” , 09/2017, <https://dl.acm.org/doi/abs/10.1145/3130958> {14/02/2021}.
- Renier, L., Volder, A. “Sensory Substitution Devices: Creating *Artificial Synesthesias*”, 12/2013, <https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199603329.001.0001/oxfordhb-9780199603329-e-042> {14/02/2021}.
- Ridden, P. “Camera-toting EyeRing could help blind people to *see* objects”, 23/08/2012, <https://newatlas.com/eyering-object-recognition-aural-feedback-mit/23677/> {14/02/2021}.
- Rooney, A. “Seeing the Light”, 13/03/2020, <https://highlandscurrent.org/2020/03/13/seeing-the-light/> {14/02/2021}.
- Sandahl, C. “Disability Art”, 03/06/2016, <https://www.britannica.com/art/disability-art> {14/02/2016}.
- Sensational Books, “Sensational Blackboard”, <http://www.sensationalbooks.com/products.html#blackboard> {14/02/2021}.
- Shaheen, N. “Without a Classroom”, 23/03/2012, <https://withoutaclassroom.wordpress.com/2012/03/23/the-sensational-blackboard/> {14/02/2021}.
- Sreelakshmi, M. “Haptic Technology: A comprehensive review on its applications and future prospects”, 2017, <https://www.sciencedirect.com/science/article/pii/S2214785317303188> {14/02/2021}.
- Sulewski, J. “Art and Disability: Intersecting Identities among Young Artists with Disabilities”, 2012, <https://dsq-sds.org/article/view/3034/3065> {14/02/2014}.
- Tactual Museum, <http://www.tactualmuseum.gr/indexe.htm>, {14/02/2021}.
- Thomson-Jones, K. “The Philosophy of Digital Art”, 23/02/2015, <https://plato.stanford.edu/entries/digital-art/> {14/02/2021}.
- Veleni, T., Kourakis, O., “Virtual reality and multi-sensory stimulation: a joint method of teaching art history” *InSEA 2012 European Congress*, 25-27/06/2012, <file:///C:/Users/Hp/Downloads/InSEA%202012%20Proceedings.pdf> {14/02/2021}.
- Vocal Eyes, “Survey of Blind and Visually Impaired People about Museum and Heritage Site Re-opening and Live-streamed Events”, 08/2020, <https://vocaleyecol.co.uk/wp-content/uploads/2020/08/VocalEyes-Museum-survey-report-August-2020.pdf> {14/02/2014}.
- Voyatzis, C. “Visual Art for the Visually Impaired by Roy Nachum”, 01/03/2012, <https://www.yatzer.com/visual-art-visually-impaired-roy-nachum> {14/02/2021}.

- Watkin, K. “What is Universal Design?”, 18/12/2017, <https://saskmuseums.org/blog/entry/what-is-universal-design#:~:text=Universal%20Design%20is%20the%20concept,ability%2C%20or%20status%20in%20life.> {14/02/2014}.
- Watson, K., Mann, J. “Disability in Art History”, nd, <http://arthistoryteachingresources.org/lessons/disability-in-art-history/> {14/02/2021}.
- Woodill, G. “How Augmented Reality Helps People with a Visual Impairment”, 28/09/2016, <https://gowithfloat.com/2016/09/how-augmented-reality-help-people-with-a-visual-impairment/> {14/02/2021}.
- Woyke, E. “The Next Must-Have Smartphone Feature: Google’s new location-sensing system will make augmented reality far more useful”, 16/08/2016, <https://www.technologyreview.com/2016/08/16/158172/the-next-must-have-smartphone-feature/> {14/02/2021}.
- Zijlstra, T. “Using the HoloLens’ Spatial Sound System to aid the Visually Impaired when Navigating Indoors”, <https://fse.studenttheses.ub.rug.nl/16312/1/ThesisHoloLens-ArjenZijlstra.pdf> {14/02/2021}.
- Zucker, A. “Lenka Clayton’s Inquiry Based Learning”, 06/05/2017, <https://theartsandeducation.wordpress.com/2017/05/06/lenka-claytons-inquiry-based-learning/> {14/02/2021}.

References in Greek

- Mind’s Eye, “Ένα πρόγραμμα για την προσβασιμότητα ατόμων με οπτική αναπηρία στην εμπειρία της τέχνης”, 2021, <https://mindseye.gr/> {14/02/2021}.
- Milona, M. “Στέλα Αναστασάκη: Η εμπνεύστρια του project *Mind’s Eye*, έκανε πράξη το όραμά της, για μία ισότιμη πρόσβαση στον πολιτισμό”, 15/01/2021, <https://www.cozyvibe.gr/%CF%83%CF%84%CE%AD%CE%BB%CE%B1-%CE%B1%CE%BD%CE%B1%CF%83%CF%84%CE%B1%CF%83%CE%AC%CE%BA%CE%B7-h-%CE%B5%CE%BC%CF%80%CE%BD%CE%B5%CF%8D%CF%83%CF%84%CF%81%CE%B9%CE%B1-%CF%84%CE%BF%CF%85-project-mindsey/> {14/02/2021}.