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Using Eye-Tracking Technology as an *Art Medium* and a Tool of Clinical Intervention in Art Therapy of a Child with Multiple Disabilities

Technologia eye-trackingowa jako „art medium" i narzędzie interwencji klinicznej w arteterapii dziecka z niepełnosprawnością sprzężoną

KEYWORDS
art therapy, assistive technology (AT), eye-gaze assistive technology (EGAT), eye-gaze controlled computer (EGCC), action research, child with multiple disabilities

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arteterapia, technologia wspomagająca (AT), eye-tracking w technologii wspomagającej (EGAT), komputer sterowany wzrokiem (EGCC), badania w działaniu, dziecko ze sprzężoną niepełnosprawnością

ABSTRACT

The rapidly developing eye-tracking technology is more and more often used in the diagnosis and therapy of children with multiple disabilities for whom sight is the only communication channel. The aim of this article is to show how eye-tracking technology becomes an *art medium* and how it can be used as an optimal tool of clinical intervention in art therapy for children with multiple disabilities. The author conducted several-month-long *action research* in the form of art therapy sessions for twenty-some children with multiple disabilities. She found that the use of eye-tracking as an assistive technology tool (EGAT) in art therapy enables participants to be relatively autonomous and independent in their creative activity. It allows them to express their emotions and reveal their abilities. Eye-tracking brings a positive change in the well-being and quality of life of children participating in the research. Therefore, contemporary art therapists

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working with children with multiple disabilities should not limit themselves to traditional art therapy classes focused on strictly sensory experiences, but look for innovative tools and software that will allow children to actively and creatively engage in art therapy.

ABSTRAKT

Rozwijająca się dynamicznie technologia eye-trackingowa jest coraz częściej stosowana w diagnozie i terapii dzieci ze sprzężoną niepełnosprawnością, dla których jedynym kanałem komunikacyjnym jest wzrok. Celem artykułu jest ukazanie, w jaki sposób technologia eye-trackingowa staje się *art medium* i może być używana jako optymalne narzędzie interwencji klinicznej w arteterapii dzieci ze sprzężoną niepełnosprawnością. Autorka przeprowadziła kilkumiesięczne badania w działaniu mające formę sesji arterapeutycznych dla kilkudziesięciu dzieci ze sprzężoną niepełnosprawnością. Ustaliła, że wykorzystanie w arteterapii eye-trackingu jako narzędzia technologii wspomagającej (EGAT) umożliwia uczestnikom relatywnie niezależne i samodzielne działania twórcze. Dzięki temu mogą oni wyrażać swoje emocje i ujawniać swoje umiejętności. Eye-tracking wprowadza korzystną zmianę w samopoczuciu i jakości życia badanych. Dlatego współcześni arteterapeuci pracujący z dziećmi ze sprzężoną niepełnosprawnością nie powinni się ograniczać do tradycyjnych zajęć arteterapeutycznych ukierunkowanych na doświadczenia stricte sensoryczne, lecz szukać innowacyjnych narzędzi i oprogramowań, które pozwolą dzieciom na aktywne i twórcze zaangażowanie się w arteterapię.

Introduction

Currently, more and more art therapists in Poland and around the world are conducting art therapy sessions for children and adolescents with disabilities. Some of them use digital technologies in art therapy, which have become part of the everyday life in modern societies (Alders, Beck, Allen, Mosinski 2011: 165). Already in 2000, the book *Art Therapy and Computer Technology: A Virtual Studio of Possibilities* by Cathy A. Malchiodi was published. The author noted that computer technology offers exciting new opportunities for art therapists. Modern drawing, painting and photography software and Internet resources are helping to change the way therapeutic sessions, supervision, training, conferences and knowledge transfer are

conducted. At the same time, harnessing the potential of computer technology becomes daunting for some art therapists due to the large variety of hardware and software and the rapid pace of cybernetic development (Malchiodi 2000: 12–14).

A few years later, in the article *Art Therapy Meets Digital Art and Social Multimedia*, Malchiodi pointed out a peculiar paradox: although digital technologies are readily and quickly accepted by art therapy participants, "ironically, art therapy as a field is a slow adopter of new ideas" and lags behind related fields such as medicine, visual arts, counseling and education (Malchiodi 2009). Penelope Orr, on the other hand, has noted that there is a lack of specialized training in the use of digital technologies in art therapy: in this case, practice is ahead of education (Orr 2012: 238).

In 2011, the authors of the publication *Technology in Art Therapy: Ethical Challenges* advocated that art therapists should take an interest in the use of digital technologies in clinical interventions and diagnostic procedures to address basic therapeutic problems. They even suggested that art therapy could become a leader in the use of new technologies because of its various possible applications (Alders, Beck, Allen, Mosinski 2011: 167, 169). In conclusion, they remarked that the implementation of digital technologies in art therapy is a way to increase the involvement of its participants in the art therapy process and its innovative documentation.

Accepting the above postulates, I asked myself for which groups of children and adolescents digital technology can be a particularly useful medium and a tool for creative activity. How can eye-tracking technology become an *art medium* (link) and an optimal tool for clinical intervention in art therapy?

In order to answer these questions, I conducted action research at a Rehabilitation and Educational Center (ORE) in Poland. I found that eye-tracking technology is especially useful for children with multiple disabilities. It allows these children to become active participants in art therapy sessions, as they can undertake creative activities relatively independently and autonomously. In this way, the children express their emotions, and a positive change takes place in their well-being and quality of life, although this is experienced sporadically due to the limitations in the availability of eye-tracking technology (only in ORE).

Review of the literature

The literature on art therapy is extensive. In the English language area, an up-to-date review was done by Israeli researchers in the article *Effectiveness of Art Therapy with Adult Clients in 2018: What Progress Has Been Made?* (Regev, Cohen-Yatziv 2018). In Poland, reference lists with links are published on the websites of many libraries. For example, on the website of the Pedagogical Provincial Library in Bielsko-Biała, there is a bibliography of publications for 2014–2018 (Czub 2018). The collection (books and articles) in alphabetical order is located in the Library of the Witelon State University of Applied Sciences in Legnica. It is also available as an annex to Wita Szulc's book: *Wiedza o arteterapii dla pedagogów i promotorów zdrowia* [Knowledge about art therapy for educators and health promoters] (2018: 167–172).

The number of articles on art therapy of children and adolescents with disabilities with the use of assistive technology is gradually increasing (e.g., Gabriels 2003: 196; Brancheau 2013: 144). The publications show that for some children (e.g., with autism spectrum disorders) digital art applications are becoming a desirable art medium, replacing traditional artistic materials, which are not appreciated by these children due to the sensory disorders they experience ("for those who don't like having paint on their hands").

New trends in research are emerging. In addition to the English abbreviation AAC (Augmentative and Alternative Communication), which is popular and widely recognized in Poland, an acronym less known among speech therapists, educators and psychologists has appeared: AT (assistive technology). It covers all solutions that use a computer and other electrical and electronic devices that help a person with a disability to overcome barriers in everyday life and achieve independence. With these technological advances, innovative solutions have been implemented and eye-gaze controlled computers have been used to provide children with multiple disabilities with access to optimal communication, therapy and education (Jaskula, Szkoła, Pancerz, Derkacz 2016: 2; Kochanowicz 2019: 110).

New concepts, terminologies and acronyms related to eye-tracking have emerged in international publications in the field of special needs medicine and pedagogy, which are not yet widely known in

Poland. Such concepts include eye-gaze control devices = EGCD (Hemmingsson, Borgestig 2020: 2); eye-gaze controlled computer = EGCC (Borgestig, Al Khatib, Masayko, Hemmingsson 2021: 1); and the most recent term: eye-tracking assistive technology = EGAT or no use of eye-gaze assistive technology = Non-EGAT or NEGAT (Hsieh, Borgestig, Gopalaro, McGowan, Granlund, Hwang, Hemmingsson 2021: 1–22).

Also noteworthy are publications based on pioneering science, e.g. describing the design of interactive digital devices that automatically adapt (ability-based design) to the motor, sensory and intellectual abilities of people with disabilities (Wobbrock, Gajos, Kane, Vanderheiden 2018: 62). This is a very different model than the previous one, in which it was the person with disability who had to adapt to the device.

Modern virtual reality techniques (VR) are also developing. They involve a computer simulation of the environment in which the user can move and interact with the virtual space, events, objects and people (avatars). The virtual environment is usually three-dimensional and is often a replica of the real world in terms of appearance and physical phenomena occurring within it (Budziszewski, Grabowski, Jankowski, Milanowicz 2011: 6). An example of innovative technology in this area is the NOBE (No OBstacle to Emotion®) application developed in Italy, which uses a multisensory platform that allows people with disabilities to interactively experience visual art through various sensory organs, i.e. sight, hearing, smell and/or touch (Corradi, Federici, Mele, Sperati, Ruschena, Dandini 2011: 928).

In 2019, a group of researchers from Italy published interesting research results. They saw the need to use even more personalized technological tools in art therapy sessions. The researchers developed the *paINTeraction* system, an intuitive Virtual Reality tool that allows participants to "immerse themselves" in the images they paint. Their every movement is recorded by a camera and generates streaks of light and soap bubbles on the screen. When the participant utters a sound, cascades of letters or streaks of color and light appear near the speaker's mouth. A pilot test of the *paINTeraction* system was performed on 21 patients (7 to 35 years old) with multiple disabilities hospitalized at the Istituto Serafico in Assisi. They participated in three twenty-minute individual therapy sessions, held approximately

one week apart (Donnari, Canonico, Fatuzzo, Bedetti, Marchiafava, Menna, Elisei 2019: 464).

Recently, research on eye-tracking has undergone significant changes in the selection of the research sample. Previously, the case study method was mainly used and one or more cases of people with disabilities were diagnosed. In 2020, the first population-based study was conducted in Sweden to determine the prevalence and usefulness of eye-tracking technology in school and/or home settings for 171 users of eye control devices aged between 4 and 81 (Hemmingsson, Borgestig 2020: 3). Both in school and at home, eye-gaze controlled computers (EGCC) were found to be useful for people of all ages with severe physical disabilities and complex communication needs. It was found that the EGCCs were mainly used for communication, but they also allowed users to do a wide range of other activities (use various applications, the Internet, and AAC). Participants stated that these modern devices are important for their individual development and social participation. Adult clients rated the effectiveness of using EGCC higher and were more satisfied with its accessibility than children. They stressed that some applications and ways of using the eye-gaze controlled computers should be improved, especially for children (Hemmingsson, Borgestig 2020: 11).

The latest multicenter intervention studies have been conducted in Sweden, Dubai and the USA. They included seventeen participants aged 3 to 26 who were diagnosed with cerebral palsy or Rett syndrome. The patients were given eye-gaze controlled computers to use at school and/or in the family home for seven months. The results proved promising. EGCC users significantly increased their expressive communication skills and functional independence. Almost all (16 out of 17) users expanded their repertoire of activities (communication, play) and the range of using the computer. Research has proven once again that the use of EGCC is an effective intervention in the daily life of children and adolescents with complex communication and developmental needs. It has also showed that communication and independence, the two goals of clinical intervention, are indeed achieved when implementing eye-gaze assistive technology (EGAT) (Hsieh, Borgestig, Gopalaro, McGowan, Granlund, Hwang, Hemmingsson 2021: 1–22).

However, in scholarly publications, even those as comprehensive as *The Handbook of Art Therapy and Digital Technology* from 2018 (edited by Cathy Malchiodi), I did not come across any reports on the use of eye-tracking technology in art therapy. It was not until 2020 that innovative texts on the use of eye-tracking technology in art therapy came out. In 2020, Łukasz Kędziora's book: *Art & eye-tracking. A practical guide for artists, art enthusiasts and researches* was published (Kędziora 2020).

As I have been working with children and adolescents with disabilities for several years, I decided to conduct my own research. My starting point was the assumption that art therapy pursues two basic goals: an indirect aim, i.e. the expression of feelings relieving increased psychophysical tension (perceived as a state of dissatisfaction, distress, anxiety, anxiety, excitement, and apathy) and the final goal, i.e. favorable changes in thinking, emotions or behavior (Tokarz 2005: 9). According to Wita Szulc, this goal means "introducing some beneficial change in its participants: in health, well-being and quality of life, level of fitness—physical or mental, level of competence (increase in skills), self-image and relations with others" (2011: 201).

I was also inspired by the authors' emphasis that art therapy is constantly evolving to meet today's ever-changing social demands. However, it always performs three functions: recreational, educational and corrective (Kulczycki 1990: 13). Its tasks remain the same: "they consist in improving the cognitive, emotional-volitional and interpersonal processes of people with various dysfunctions" (Rudowski 2009: 39).

Research procedure

Since the 2016/2017 school year, as a speech therapist for rehabilitation and educational groups at a Rehabilitation and Educational Center, I and some other teachers have been identifying educational problems (health, therapeutic and communication problems) of children with multiple disabilities in the context of the potential use of eye-tracking technology in the facility.

In 2017, I implemented eye-tracking technology in two ORE offices: the speech therapy office and the vision-impairment therapy

office. I used eye-tracking in activities addressed to children with multiple disabilities, to children with an evaluation of the need for remediation and remedial classes, and to children with severe intellectual disabilities (Ministry of National Education Regulation 2013; Ministry of National Education Regulation 2017). At that time, I organized a scientific and training conference in Wrocław on *Modern technologies in communication with a disabled child. Pointing with eyesight (eye trackers, CyberOko/C-Eye)* for academics and teachers. Thanks to the transfer of academic knowledge and the experience of ORE practitioners, I was able to define the initial research questions.

In 2018, ORE teachers received a mobile eye-gaze controlled computer. We started using EGCC to verify the diagnoses given to children in psychological and pedagogical counseling centers (their cognitive, visual and auditory abilities related to auditory-visual coordination, cause-effect skills, etc.) as well as to help them master eye control and arrange communication situations.

When starting the research, I asked myself two basic questions: For which groups of children and adolescents with disabilities is eye-tracking technology particularly useful in art therapy classes? How can it become an *art medium* and an optimal tool for clinical intervention in art therapy? I also wanted to find out which of the functions of art therapy is fulfilled in art therapy classes with the use of eye-tracking technology: recreational, educational or corrective. What determines the effectiveness of EGAT art therapy? In what school and/or home settings and thanks to whom can a child with multiple disabilities discover the possibilities of eye-tracking technology and digital programs?

In my research, I decided to use the action research method, which allows for direct interference in the environment of the respondents and relatively thorough insight into its participants. I was guided by the words of Maria Czerepaniak-Walczak, who emphasizes that "any study makes sense as long as it contributes to improving the existing state of affairs. Contributing to change may take place both through the use of the results of the research, i.e. after its completion, and through events that take place during the research process, at its individual stages. It is precisely what happens in the process of cognition and change, in its various stages, that is the source of action research value" (2014: 185).

Since action research is focused on social change with the main goal of solving the real problems of a given community, it primarily serves those who want to better understand their practice and the factors that influence it; and to change/improve the way they do their professional work. The main participants in action research are specialists from a particular community who become reflective practitioners and reflective researchers. Due to the practical nature and interest of this type of research, it is eagerly undertaken by teachers and is effective in building theories relating to the education and therapy process.

As part of the action research method, I used methodological triangulation: analysis of medical and therapy documents, the participant observation technique (explicit and structured) and "headnotes," creating a specific type of knowledge, namely records of non-verbalized content in the researcher's memory (Hastrup 2008: 92). I realized that participant observation is a privileged way to learn about the features of isolated social groups, characterized by difficult or no permeability. However, the ethics of observation are often questioned when the participants are not aware of it (Nieporowski 2015). In ORE, parents consented to their children participation in the research, and the children "knew" that they were observed while performing certain activities, e.g. with the use of eye-tracking technology, although they were not aware that the results of the observations could be disseminated (naturally with maintaining the principle of anonymity).

My study began in September 2019 and ended in March 2020 with the outbreak of the Covid-19 pandemic. As part of speech therapy, I conducted individual art therapy sessions for 26 children from 4 to 25 years of age, half an hour a week for each child. The classes were held in a speech therapy office equipped with eye-gaze assistive technology (EGAT). I used one of the smallest devices available on the Polish market that allows you to operate the computer with your eyesight. This is PCEye Mini Track & Learn—Featuring Gaze Point & Gaze Viewer, which smoothly converts eye movement into cursor movement on your computer screen. The device allows you to operate the computer regardless of glasses, contact lenses, lighting or uncontrolled movements of the head. PCEye attaches to any computer with a magnet and connects via the USB input. The high precision of the

tool and the zoom function mean that you can "click with your eyes" even on small elements on the screen, that you have access to many applications, and a large tracking field. The tool allows you to work with a computer in a comfortable position: sitting or lying down, and compensates for head movements: moving your head within the tracking field does not interfere with working with the device (see https://www.tobiidynavox.com/pages/products [access: 25.10.2021].

The device uses the Gaze Viewer software to provide insight into the areas of the screen of interest to the user, for any application, photo, movie or game. Such information is used to assess the user's interests and cognitive abilities as well as to prepare reports on the progress in the field of eye control. The software can also be helpful in diagnosing the level of comprehension or different cognitive competences in children with multiple disabilities. A child's skills can be tested under favorable conditions on a material convenient for him/her (film, photo, game, or AAC applications). Gaze Viewer allows you to see what the user was looking at, in what order and on what element he/she was focusing their attention. The ability to save eye tracking results as videos, photos and maps can provide proof of the user's current skills, as well as an evaluation of his/her progress (Harezlak, Kasprowski 2018: 177; Kochanowicz 2019: 111).

Findings

Targets of art therapy and eye-tracking technology

In the course of my research, I found that the following groups of children benefit most from the implementation of EGAT: children with cerebral palsy, children with rare genetic defects, neurodegenerative diseases, muscular atrophy and children with multiple disabilities (intellectual disability and mobility problems, with sensory and communication disorders), for whom vision is the only communication channel, and children who do not use their hands intentionally. In the category of privileged users of EGAT, I also include children who have not made eye contact so far due to numerous undesirable behaviors, and for whom interaction with a computer has become attractive, predictable and allows for first acts of agency. In their case,

the use of EGAT has revealed that they can acquire and process information, use memory, thinking or visual attention (conscious, controlled, intentional vs. unconscious, automatic, reflex).

Implementation of eye-gaze controlled computers in art therapy

My research shows that teachers and specialists (music therapists, dog-assisted therapists, alpaca-assisted therapists, and therapists for vision-impaired children) at ORE conduct group art therapy classes focused on strictly sensory experiences in everyday therapeutic work. The main forms are music therapy, visual arts therapy, dog-assisted therapy, alpaca-assisted therapy, elements of bibliotherapy, film therapy, choreotherapy, theater therapy, chromotherapy and silvotherapy. The participants also take part in classes in the World Experience Room and in the sensory garden.

During the research, I noticed that teachers sporadically used the mobile EGCC equipment during rehabilitation and education classes focused on art therapy. I noticed the deeply rooted habits of teachers and specialists, resulting from their many years of experience, to use traditional methods of conducting classes, in which the teacher dominates and arranges therapeutic situations in a dyad, in which he/she models and interprets the child's behavior. On the other hand, a child deprived of the teacher's physical assistance does not perform almost any activities independently and autonomously. Due to the children's medical condition and their developmental dysfunctions, the teacher often cannot achieve the desired therapeutic and communication goals, and fails to notice the relative educational progress or the objective cognitive, visual, auditory and other abilities of the child.

Until EGAT is made available to children with multiple disabilities, due to complex developmental dysfunctions, they are deprived of the possibility of independent and direct creative activity (e.g., coloring, playing instruments, switching on a song) in art therapy classes. Of course, many children who use AAC and so-called *Participation Model* can inform teachers about their needs, preferences, choices (color, instrument, song), or control their activities using printed visual aids. However, then it is the "therapist-contractor" who paints on the easel, and the "child-architect" decides about the type

of drawing or colors. Children participating in art therapy classes conducted in a traditional way, without use of eye-gaze assistive technology (Non-EGAT, NEGAT), are mostly passive recipients. They may possibly participate in these activities with physical assistance from the teachers, but often to a limited extent.

Children's activity in art therapy with the use of eye-tracking technology (EGCC)

During art therapy with the use of EGCC, children with multiple disabilities discover their potential for creative tasks and new ways of engaging in activities. The appealing qualities and vivid colors of computer programs catch their eyes, and shape completely new skills: from spontaneous "cause-and-effect" action and screen exploration to precise pointing with the eyes, from deliberate looking to controlling the computer. Interaction with the computer triggers a number of new unknown experiences in the child, and meets his/her basic needs, e.g. to make choices, to play, and to relax. During art therapy classes using EGAT, one of my students, in whom it is very difficult to elicit any reaction (especially a positive one), discovered a sound that made him laugh out loud and repeated it. When looking at the screen during a "Look to Learn" exercise, he consistently activates the sound of lightning and reacts spontaneously to it. In this way, he becomes active, expresses his emotions and achieves a state of satisfaction.

As for other ORE students participating in my art therapy sessions, I noticed that they can quickly find their favorite applications on the computer screen. For example, the "Henhouse" (eyefeel) exercise is highly appreciated; "Egg," "The cake war" (Look to Learn), "Locating: a bee" (eyeLearn). Since the target users of this innovative software are children with disabilities, the designers made sure that the tool was easy to use and that the therapist could adjust various parameters (e.g. background color, size of the dot for eye tracking, time needed to click, pointing precision or sound intensity) to the individual abilities of the child, taking into account, for example, his/her field and range of vision or the dominant eye.

At ORE, we also use the Polish software eyeLearn (see https://assistech.eu/pl/eyelearn [access: 25.10.2021]), created by combining academic knowledge and practitioners' experience. I was the

co-creator of this application. One of the exercises I designed clearly shows the point of creating innovative applications. The exercise is called "Cake and Candle" and involves blowing out a candle on the computer screen with your eyesight. You can choose the type of birthday cake and the number of candles appropriate to the child's age. I designed this exercise because I noticed in the ORE that children celebrating their birthdays were not able to blow out real candles from the cake on such an important day due to their motor dysfunctions and limitations related to the respiratory and phonic systems. Now, thanks to the EGAT exercise, they have a chance to act autonomously, which not only imitates reality (the sound of blowing comes from loudspeakers), but arouses great excitement in all the participants of the celebrations. In social events arranged this way, the important substitution function of eye-tracking technology becomes apparent.

Art therapy carried out with the use of EGAT performs all its important functions: *recreational*, because it reduces the level of tension, triggers positive emotional reactions, gives a sense of joy, relieves pain, and relaxes children. As the children gain new skills and knowledge about themselves and the world around them, they learn new forms of spending time and interacting with their environment so the *educational* function of art therapy is realized. In turn, the *corrective* function of art therapy is fulfilled in improving disturbed developmental functions of children (e.g., visual-auditory coordination, and expanding the field of vision), compensating for deficiencies (vision as a communication channel) and activating the child's abilities (thanks to the precision of action on the computer screen) by initiating developmental activities through the child's spontaneity and activity.

In the course of the research, it was not possible to obtain a reliable answer to the question under what conditions (school and/or home) the eye-tracking technology is particularly useful for a child with multiple disabilities. This is due to the fact that currently only one girl out of 65 ORE participants has an eye-tracking device at home (Kochanowicz 2020: 138).

Conditions for the effectiveness of art therapy with the use of eye-tracking technology

The effectiveness of art therapy with the use of EGCC depends first of all on creating the appropriate conditions for controlling the computer by sight. This means setting the mood with the children and preparing the room (e.g. adequate shading). Since the children have severe motor disorders and problems with auditory and/or visual perception, the child and the computer screen with the webcam must be positioned appropriately. This requires the art therapist to exercise additional competences, tailored to the individual needs and capabilities of a specific child. At the beginning, the child needs time and appropriately selected exercises to learn to control the computer by sight. Once this skill has been mastered, the therapist arranges art therapy situations, choosing exercises appropriate to the child's age and cognitive abilities, and then withdraws to allow the child to freely follow the screen and explore, to act on a cause-effect basis (discovering the sense of agency) and make choices (drawing, colors).

Research reports show that children using EGAT become easily fatigued due to their health conditions, which may reduce the effectiveness of the technology over time (Hsieh 2021: 17). My research confirmed the above conclusion, therefore the decision to conduct classes, their length and form must be made dependent on the condition of EGAT users on a given day.

Conclusions

When it comes to recognizing and satisfying the individual developmental needs of a child with multiple disabilities, parents and teachers often look for a link, a tool to establish contact with the child or to make an adequate diagnosis, but above all to overcome the barrier related to his/her motor limitations. Such a tool can be modern art therapy, which not only focuses on the child's well-being and internal resources, but through the use of eye-tracking technology, it also enables a child with multiple disabilities to express their emotions, reduce tension, stimulate imagination, and discover a sense of agency. Thanks to eye-tracking technology, it is possible to arrange therapeutic situations, and to construct new knowledge about

children, including children with severe intellectual disabilities. This technology allows us to verify diagnoses and organize therapies: from creating conditions for individual spontaneous and/or intentional actions, to stimulating visual and other functions, to communicating with the world around.

I am aware that my interpretations of the events that I witnessed during art therapy sessions with the use of eye-tracking for children with multiple disabilities may be subjective and not easily generalizable. However, I have no doubt that for the children, eye-tracking technology has become a real *art medium* and a tool for clinical intervention. Thanks to eye-tracking, the children could truly participate in art therapy classes, reveal their creative potential and establish a dialogue with the social environment by creating artworks, expressing themselves, having fun (e.g. putting out a fire in a building with their eyes or setting a snail in motion), coloring (e.g. filling a picture with color dots), and playing instruments (e.g. guitar strings or xylophone strings). In children with four-limb paralysis with higher cognitive abilities, I observed a slow awakening—thanks to eye-tracking technology—of the ability to create art on digital devices. This is art understood not only as a source of knowledge about the artist and his/her experiences, but also providing observers with completely new aesthetic experiences.

I believe that the task of contemporary art therapists working with children with multiple disabilities is to create a stimulating environment and search for innovative software and tools in clinical intervention that will enable this child to act creatively. Today, it is possible to build your own non-commercial eye-tracker called EyeWriter. The original was designed ten years ago for the graffiti artist Tony Quan (nickname Tempt1), who was diagnosed with amyotrophic lateral sclerosis (ALS) in 2003. The completely paralyzed artist can now make drawings on a computer screen using his eyesight. EyeWriter consists of a system of inexpensive cameras and free software to track the user's eye movements. The original source code can be downloaded, redistributed and modified. Instructions for constructing the tool can be found at: https://alsnewstoday.com/news-posts/2021/02/15/improved-eyewriter-eye-tracking-system-expanded-capabilities-helps-als-patients-draw-create [25/10/2021].

While conducting research in action, I noticed that it favors "shaping the research culture at school, arousing cognitive inquisitiveness in all subjects and confidence in the discoveries made" (Czerepaniak-Walczak 2014: 192). At the same time, I know that this research perspective has its limitations. Therefore, during art therapy sessions with the use of EGAT, I also made objective measurements of children's reactions (using the PCEye Mini Track & Learn tool—Featuring Gaze Point & Gaze Viewer). I will present the results in the next publication using the case study method.

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