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From illustrations to an interactive art installation

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Abstract

Purpose – The purpose of this paper is to set an example of how people with severe learning difficulties could be more integrated into our society.

Design/methodology/approach – The installation consists of puzzles in the form of a specially designed table with an integrated touch screen. As the visual templates for the puzzles serve pictures painted by a person with severe learning difficulties. The pieces of the puzzles are manipulated directly by the player on the touch screen presenting an intuitive and easily learned user interface.

Findings – The framework for the work was a creation of an interactive art installation in the form of a game where users assemble puzzles on a touch monitor, housed in a specially designed table. Paintings by a person with severe learning difficulty served as visual templates for the puzzles. The pieces of the puzzles can be manipulated directly by the user on a touch screen presenting an intuitive and easily learned user interface, which stimulates the learning of fine motor skills and encourages practice, thus making it suitable for persons with severe learning difficulties in an art therapy setting.

Practical implications – As the work has the format of an interactive art installation, this enables it to gain publicity through exhibitions in art galleries.

Social implications – The installation demonstrates how people with severe learning difficulties can be integrated into the broader society. At the same time, these people are encouraged to use modern computer information technology, which is becoming a necessity also for this group of users. Ethical issues regarding how this group of people can get involved in such work are also discussed.

Originality/value – Combining the habituation of people with severe learning difficulties with computer technology in the form of a game, and framing the whole process as a fine art undertaking, to win the public recognition, is a novelty in addressing the needs of these people.

Keywords Art therapy, Computer games, Human-computer interface design, Severe learning difficulties

Paper type Case study

1. Introduction

The motivation for this work was to raise the awareness that people with severe learning difficulties exist in our midst. These people have special needs, but they should be integrated into our society as much as possible while the society must at the same time accept their differences. Most people with severe learning difficulties are born into this condition so that this ethically based goal is grounded also in the Declaration of the Rights of the Child (adopted by the UN General Assembly in 1959) and in the later Convention on the Rights of the Child (adopted in 1989), which states in one of its

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principles: "The child who is physically, mentally or socially handicapped shall be given the special treatment, education and care required by his particular condition". The contemporary comprehension of this principle is that such children and grownups, who require special treatment, should not be isolated in some special institutions but should participate in the broader society as much as possible, taking into consideration their difficulties at the same time.

To achieve this goal, we decided to involve people with severe learning difficulties in artistic activity, whose results could be exhibited in a gallery, giving their achievements public exposure to integrate them and give them a sense of personal worth. Why is art probably the most appropriate vehicle to achieve this goal? The French phenomenological philosopher Maurice Merleau-Ponty (1993, p. 127) argued in his essay Eye and Mind that art, specifically painting, displays the act of viewing the world with openness and immersion that is more truly representative of the continuum of our existence. In fact, the therapeutic influence of art has been known for a long time. Relevant to present time and society, we decided to frame our goal in the paradigm of new media art, which gives to persons with severe learning difficulties an additional advantage. Namely, exposure and learning of new computer-based technology, which is becoming a necessity even for these people. Computer technology enables an interactive, tactile approach to the creation and use of new media artwork, which is an additional benefit to people with severe learning difficulties by raising their body awareness.

This kind of work, which involves people with severe learning difficulties, raises additional ethical dilemmas. These ethical dilemmas are usually discussed in the framework of action-oriented or participatory research with people with learning, communication and other disabilities (Nind, 2008, pp. 4-9). At issue is the question of possible exploitation of such vulnerable people, which is reflected in the first methodological decision to be made, namely, whether the work is to be done on or with people with severe learning difficulties. We clearly aim in our work for a participatory or even emancipatory relationship with affected people. The primary form of their engagement is learning by playing. The game format is not coercive by any means. The engagement of participants can stop at any time, but due to the immersive experience of playing, their engagement is more intensive and lasts longer. In the project that we describe in this article, we strive to empower the persons with severe learning difficulties by enhancing their knowledge and understanding of the world and their place in it.

The project, which is at the center of this article, therefore tries by means of computer-based technology to integrate two, usually very disparate areas, the world of people with severe learning difficulties and new media art.

A substantial part of contemporary art moved away from the production of artifacts toward organizing events or providing services. In the post-industrial society innovations, the use of new technologies, originality and individuality are gaining in importance. Art which is following these trends and using new technologies is simply different from the older art, it is post-objective (Benjamin, 1980, pp. 471-508; Strehovec, 1998, pp. 114-150). The meaning of authorship in modern art has also changed and appreciation of art has evolved from pure contemplation to a much more active relationship with the viewer or participant (Groys, 2002, pp. 121-130). A patron of contemporary new media art expects contents that can be modified, added to or interacted with.

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In the profusion of new artistic artifacts the important question is not only about their contents, the way they are presented, how they appear, but also are they still "real" artistic artifacts, as they are often not created by artists? Engineers, programmers or scientists who are usually without any formal artistic education often produce such artifacts. The described changes in the art scene were possible only because of the changes in other areas of the society and because the reality itself has undergone such drastic changes (Strehovec, 1998, pp. 114-150).

In this article, we describe an interdisciplinary project where artists and engineers have teamed up to build an interactive art installation with an additional twist. The installation has the form of a smart table with a built-in touch screen in the tabletop on which users can assemble visual puzzles by directly manipulating the pieces of the puzzle with their hands. The puzzle is based on the principle of inter-subjectivity where the user/observer meets the image. The philosophy of the whole project is founded on the following principles: from stability to instability, from stationary to dynamic, from perception to action and from artifact (image) to service. The main features of the finished project are playfulness, fun and learning. Playing, as a typical medium of contemporary interactive representation, epitomizes activity that abandons the position of the observer. The observer is instead included into the process itself (Gadamer, 2001, pp. 93-108).

What designates this installation as somewhat special is that the illustrations are a result of art therapy with a person with severe learning difficulties. The design of the user interface takes into account that the intended users of the installation are also people with severe learning difficulties. User interface design for individuals with severe learning difficulties requires special attention due to the cognitive barriers to computer access that such individuals have.

This experimental project started from a collection of visual materials, continuing with the selection of illustrations suitable for puzzles, designing the user interface and, finally, to programming.

The software is running on a personal computer connected to a touch screen that was integrated into a specially designed table.

The use of the installation requires fine motor skills, practice and, finally, sparks also fun. This means that all senses of the players, perceptual, physical and emotional, are engaged. The final result, the table with the integrated touch screen where puzzles can be assembled, is aimed at the younger generation in general, but in particular at people with severe learning difficulties. The whole project is an attempt at integration of such people in the socially creative area of new media art, not only as a user-participant but, in addition, also as a user co-author.

The overview of the rest of the article is as follows. In Section 2, we talk about the general considerations such as interactivity in fine arts, how people with severe learning difficulties can get involved in producing interactive art installations as part of their art therapy, the importance of playing and touching and how the design of human-computer user interfaces must be adapted to this special type of users. In Section 3, we describe the actual development of the installation. Section 4 covers some technical details of the implementation. In Section 5, we discuss implications and experiences that we gained with the installation. Finally, Section 6 concludes the article.

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2. General considerations

2.1 Interactivity in fine arts

The mental process that takes place when we observe an art artifact can already be considered as an interactive process in the sense that the mental process is a response to our observation. When computers appeared they were soon put to use also in fine arts. First, primarily to produce computer generated prints. Later, with the advent of computer technology, computers often became the central part of interactive art installations. Various sensors, cameras in particular, were used in the feedback loop that supported the interactivity. Multimedia and the invention of the World Wide Web gave the new tendencies in the arts a tremendous boost. Interactivity in the context of contemporary art and technology typifies a relation or cooperation between the machine and the subject (Lieser, 2010, pp. 229-231, pp. 233-261). Wilson (2002, 2010) wrote two comprehensive surveys of new media art, where art, science and technology intermix.

An artistic artifact is interactive when a physical action of the observer causes a change in the artistic artifact. Objects and installations that are interactive receive signals from the environment, they process the signals to finally transform the signals again into a visual form which is then "exhibited". Signals or actions from the environment have an influence also on the evolution of the artifact. The artistic artifact is at the inception usually not in its final form, as the artist does not want the artifact to be separated from the everyday life (as artistic artifacts in the past used to be) but to become a living artifact which can be manipulated with or played with, so that the observer becomes an actor. The artist creates the artifact with the intention that others develop it further (Strehovec, 2003a, pp. 45-71, pp. 80-81).

Artistic interactive works range from very simple interactions, where an observer or selected visitor is asked to press a button to initiate an action between the installation and itself. Then, he simply observes the changes of the installation. Sometimes the interaction requires some motor skills, ability and practice, which means that the installation engages all of our senses (Strehovec, 2003b, pp.139-227; Solina, 2004; Solina *et al.*, 2008).

2.2 How can a person with severe learning difficulties enter the production process in contemporary art?

The initial motivation for the installation called "School for cats" was the book entitled "Frogs, centipedes and other main roles" (in Slovenian: "Žabe, stonoge in druge glavne vloge") by Erika Pavlin and Vesna Fabjančič Rustja, which was published by Založba Sanje in April 2011 (Pavlin and Fabjančič Rustja, 2011). The book was the result of collaboration of two authors: Erika wrote the texts (poems) and Vesna made the illustrations. A total of 11 illustrations with associated poems are included in the book. As the title of the book indicates, animal stories and animal pictures are the main subject of the book. However, this was not a case of an entirely standard collaboration on a picture book. The poems written by Erika Pavlin, in her role as an art therapist, served to motivate a very special person, Vesna Fabjančič Rustja, to illustrate them. Why is Vesna special? Vesna is a person with severe learning difficulties[1].

A person with severe learning difficulties is a person who has substantially lower scores from the average on various intelligence tests and is limited in his overall functioning which is expressed as non-adequate behavior in communication, socialization and understanding. Such developmental disorder is manifested from early

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childhood until death, that is during the entire life of the affected person. This difference is expressed physically and mentally as a combination of movement disabilities and behavioral disorders. Communication with such people is difficult due to the lack of feedback or due to their reactions, which are often outside the scope of our expectations. Working with persons with severe learning difficulties is therefore very demanding.

Treatment of persons with severe learning difficulties requires a completely individualistic approach. This means observing, listening, researching, overcoming obstacles, inventing new ways of communication and motivation. Teaching and guiding such persons, in particular in a creative field, requires a special approach. Vesna was educated in the painting studio of VDC Tončke Hočevar in Ljubljana, which is a therapeutic center for such persons. She is an artistically subtle but a very active creator.

However, working with Vesna is not easy. Despite her enthusiasm and readiness to cooperate it took her art therapist and mentor Erika Pavlin nine years to develop her potentials and to achieve the desired results, which are demonstrated by the illustrations in their book (Pavlin and Fabjančič Rustja, 2011). On this path, her advisor used all her knowledge and experience gained from working with people affected by severe learning difficulties but still had to constantly adjust her approach to meet Vesna's individual reactions and requests.

When mentoring people with severe learning difficulties, one can follow the experience gained in art therapy. Fine art as a therapeutic measure has been known for a long time. Art therapy as a method can be used by educators in different situations and can be creatively modified and developed to reach the desired goals.

2.3 Art therapy

Art therapy considers students holistically, where artistic activity is just one dimension, and addresses the social, emotional and cognitive needs of a person. Artistic activity has an influence on all other human activities, and reciprocally, all human activities can influence a person's artistic expression. Even plain art teaching can have therapeutic results, and art educators can achieve that without the need to change their roles into art therapists. Allison (2013) recounts from her experience as an art educator how art can have a large role in learning, teaching and getting insight into her students, as well as ultimately into one's self. Art and creativity are therefore as important for survival as science and logic, maybe even more so for people with severe learning difficulties.

Art creativity, which originates from within, sustains the integration of one's identity and facilitates personal growth. There is a very strong connection between creativity and emotions. The role of an art therapist is to help the participants to research these connections in their lives in order to enrich the connections between their physical and emotional parts. For persons with severe learning difficulties, art therapy methods must be adjusted to take into account their impaired cognitive functions and lack of fine motor skills. This adjustment can be difficult and can take quite a long time, but it can encourage self-expression of people that are not able or are not willing to express themselves in any other way. Artistic creativity of persons with severe learning difficulties facilitates a better control of their cognitive, emotional and physical functions. Sometimes, quite surprising results can be observed in functions that are not directly linked to creativity. For example, poor motor skills in general could be much improved by learning how to draw.

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Artistic creativity, and creativity in general, is often distinguished by a psychological state of optimal attention and engagement. This special state is in literature also known as flow after Csikszentmihalyi (2009, pp. 23-42). To facilitate artistic creativity and art therapy in particular, one should therefore help individuals enter and maintain flow (Chilton, 2013). Methods on how to enter and maintain flow have been studied even before this new term was constructed in 1991 (Csikszentmihalyi, 2009, pp. 23-42). For example, Edwards (1979, pp. 27-47) developed a series of exercises that during teaching and learning of drawing activate primarily the right side of the brain, as according to neuroscience, the right side of the brain supports holistic and non-verbal thinking which is supportive of creativity. Chilton (2013, pp. 64-70) describes several cases, which facilitate flow, such as appropriate environment, selection of music and discussion about the task or object that the participants will work with during art therapy. All factors should encourage well-being and joy, and the whole process should not be exclusively goal-oriented.

Vesna and her art therapist Erika Pavlin went through such an obstacle prone, several years long process. Obstacles were surmounted due to the individually designed creativity process, and in the end, quite extraordinary results were achieved in the form of a series of illustrations (Pavlin and Fabjančič Rustja, 2011). We report in this article how these illustrations were then integrated into a modern art form, a computer-based interactive art installation, which is again meant to facilitate play, creativity and learning, in particular, of persons with severe learning difficulties.

2.4 Playing

Art therapy in the form of a game is vital for our project. In adult life, playing of games is usually considered merely as fun and a form or relaxation with possible therapeutic effects. Playing of games in childhood is on the other hand considered much more fundamental for proper childhood development from a psychological and educational perspective (Strehovec, 2003b, pp. 227-335). As in a sense people with severe learning difficulties never grow up, games remain an important element in their life. With time, they accumulate experiences, but they do not progress in their cognitive capability. Engaging users of various computer applications in some kind of gameplay is now an established strategy to retain users and motivate them to spend more time with the applications. This strategy is known as gamification (Huotari and Hamari, 2012).

As most of the people with severe learning difficulty cannot read and write, visually based learning is of critical importance for them. From the new media art perspective, playing, as a form of interaction, is a second dimension, which in addition to visualization connects new media art with art therapy for people with severe learning difficulties. Interaction in new media art pushes observers into a more active role, which engages not just their visual perception but also their tactile and motor functions.

2.5 Touching

Tactile sensing is in combination with seeing and hearing a crucial component of human perception, important especially during movement, to orient the body in space and to establish relations to other objects. Each sense has its own specific role for establishing our engagement with the outside world. However, perceptions of different senses must be integrated on some level, and this coordination of different senses is established in early childhood when children play, move around and explore their direct physical

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environment. People with severe learning difficulties often have deficiencies in their motor functions, especially fine motor functions such as finger movements, which might be in part a result of poor coordination of their senses. To improve or to at least preserve the motor functions of people with severe learning difficulties, touching must be an integral part of their therapy.

Until recently, touching was generally strictly forbidden in museums and art galleries. A new paradigm in education encourages touching, especially in places dedicated to children. New media art also encourages visitors of art galleries to touch, interact and engage with exhibited artifacts. This tactile culture is becoming more pervasive also in our everyday life, for example when we use smart mobile phones. The emergence of new computer-based information technologies and of new media art, as a beneficiary of this development, has subtly restored the importance of the human body, its perception and its role in the world of practical activities. The precise coordination of hand movements of a mobile phone user, direction of his gaze, the actual device and its user interface now create at every interaction a very intimate situation (Strehovec, 2007, pp. 473-477).

2.6 Human–computer user interfaces for people with severe learning difficulties

A performer in contemporary art needs to have a grasp of new tools that are constantly evolving. But new technologies used by contemporary artists can be difficult to use by a person with severe learning difficulties. How can these new tools and interfaces be adapted to a user such as Vesna?

Computers have penetrated almost all aspects of our life. Most people now need to use or work with computers, including users with less digital literacy (Williams, 2006). Even people with severe learning difficulties could improve their quality of life by gaining greater access to the computer and to the Internet. Davies *et al.* (2001, p. 108) have listed the following benefits of computer use by individuals with severe learning difficulties:

- *Enhanced self-esteem and self-confidence*: Successful use of computers raises their sense of accomplishment, and appropriate software is essential to successful use.
- *Increased independence and autonomy*: By performing various living tasks independently, one can reduce the amount of assistance required from others. Computers also have the capacity to automate processes that would otherwise be too challenging for such individuals.
- *Training*: Using multimedia and alternative input and output devices enables self-paced and self-directed learning.
- *Opportunities for self-direction and enhanced self-determination*: The opportunities of self-direction in computer usage can enhance perceptions of control and self-determination.
- *Efficient use of time*: With appropriate computer use, the amount of time required from teachers, staff and family members in the completion of daily tasks can be significantly reduced.

Users who exhibit less computer literacy can be divided into three main groups: the elderly, children and people with severe learning difficulties. Although computer-related problems of these three user groups are somewhat different, cognitive issues are common to all of them (Darejeh and Singh, 2013). People with severe learning difficulties

exhibit deficiencies in attention, memory, perception and problem solving which affect the manner in which they interact with computers. Proper design of the user interface is therefore for this group of users of utmost importance. Another related and important group of computer applications are applications for rehabilitation of stroke victims or patients with spine injuries where motivation of patients for repetition and for gradual adjustment of the difficulty level has an additional important role (Peer *et al.*, 2014).

User interaction design requirements for users with severe learning difficulties have been less studied. In practice, an experimental approach to development of computer applications for people with severe learning difficulties prevails (Robertson and Hix, 2002). However, some common principles for the design of such user interfaces have evolved (Davies *et al.*, 2001, p. 111, Robertson and Hix, 2002, p. 181, Darejeh and Singh, 2013, p. 1,447):

- *Pace of screen action should be completely under user control*: Users have a strong need to maintain control of computer and find sudden or unexpected movements startling.
- *Audio prompting*: Playing recorded messages instead of textural messages overcomes reading difficulties. Such messages can explain the use of a button when a cursor arrow is placed above it, or cue the user to the next most likely step in performing a task.
- *Reduced screen clutter*: By reducing the number of features available in the user interface at any given time, the cognitive load is also reduced. Leave a clear open path for movement of icons around the screen.
- Use of graphics (icons) helps to overcome reading and writing difficulties.
- User actions should mimic real life situations, especially using direct manipulation.
- *Personalization and customization*: As there are large interpersonal differences among individuals with severe learning difficulties, the need to customize the interface is critical to suit unique needs.
- *Error minimization methodologies*: Anything that reduces chances of making errors should be used, which includes almost all the principles listed above. The placement of familiar buttons must be consistent from screen to screen, and therefore, resizing of windows should not be allowed. Steps should be automated whenever possible.
- *Game approach*: To facilitate and sustain the flow experience, games are a much better way of engagement than rote-learning drills.

In the art installation described in this article, we also decided to use a game approach, and we designed a touch-based user interface to make the interaction as simple as possible. We divided the illustrations into a small number of puzzle pieces, we used direct manipulation and audio prompts when a puzzle piece locks into the right place and we also did not use any text for navigation.

The goal of our project was to knit the creative world displayed in Vesna's illustrations with the new modes of expressions, which are offered by new media art and enabled by modern computer technology. In this way, we engaged in the process of creating an art installation an individual who cannot manage the new technologies and

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the new media by herself but who can still use and enjoy the results. In the same way, one can also engage in the creative process children who are still too young to manage the entire process by themselves but would like to be included in the creative process (Kroflič, 2010, pp. 24-39).

3. Development of the installation

The art installation "School for cats" has the physical form of a smart table, with a touch screen built into the tabletop. On the screen are displayed visual puzzles, and the user can directly manipulate the pieces of the puzzle to assemble them (Figure 1). The table is made out of plywood and painted with acrylic paints. It features themes from the illustrations in the discussed book. The size and shape of the table is designed with children and people with severe learning difficulties in mind. The design of the table also takes into consideration the necessary ventilation for the computer and the touch screen.

3.1 Selection of visual material for the puzzles

For the puzzles which are integrated into the installation, we selected two illustrations from the book introduced above (Pavlin and Fabjančič Rustja, 2011, pp. 34-37, pp. 42-45), which are shown in Figure 2. The original illustrations are acrylic paintings on canvas of dimensions 60 × 50 cm^2. The figures in the illustrations were first drawn, then painted and finally covered with points/dots that are very evenly distributed over the colored areas.

Source: Erika Pavlin and Vesna Fabjančič Rustja (2011, in Slovenian: "*Žabe*, stonoge in druge glavne vloge")

Figure 1.
A specially designed table with a built-in touch screen was constructed for the art installation "School for cats" and painted with motives from the book "Frogs, centipedes and other main roles"

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The pointillistic rasters in these illustrations, which are of different densities, subtly and plastically represent lighter and darker areas to give the illustrations a greater sense of depth; in particular, the figures gain a 3D quality, as they are painted shadow-less on a background which is often as bright as the figures themselves. Changing combinations of pure warm and cold colors nicely distinguishes each figure from its background in spite of their similar brightness. Using warm–cold relations and not the more usual bright–dark relations makes these illustrations particularly colorful. The large palette of pure colors and pointillistic patterns which induce vibrations and noisiness of all color surfaces are in ideal accordance with the gestural quality of the illustrated animals. The particular brightness of the illustrations, without exaggerated contrasts, and the melting of figures with their background make a restrained and level atmosphere where color as an entity gains in importance.

The commentary in the book "Frogs, centipedes and other main roles" written by Darko Slavec (Pavlin and Faljančič Rustja, 2011, pp. 55-56) states that these illustrations exhibit an exceptional feeling for colors, a nuanced balance between colors and shapes, a sense for different densities and rhythmic accents, for the orientation of the animal figures, for balanced, dynamic and, from case to case, completely different compositions.

The selected illustrations are therefore of high artistic value and, because of their uniform brightness, represent an excellent choice for further usage on computer screens. Among the 11 illustrations in the book, we selected two illustrations and scanned them for further computer processing. Each illustration is based on a particular text/poem, which was written by the art therapist and which served as the motivation for the illustration. Both texts and illustrations were used in this project. We designed a simple and uncluttered user interface, avoiding any text for navigation. We selected a particular sound for each of the illustrations used in the project.

3.2 The first illustration: "How the cat chases"

Figure 2, left, is the illustration of a cat with raised fore paws which have wings attached. Around the cat are birds of different sizes shown in flight. All depicted objects have a well-defined shape. Each shape has a particular "character" and a particular influence on the observer. Some shapes exert firmness, others softness. The combination of firm and soft shapes in the composition introduces vitality to the illustration (Rački, 2004).

Figure 2.
On the home screen of the installation "School for cats", two illustrations from the book by Pavlin and Fabjančič Rustja (2011) are arranged next to each other. Left, the first illustration: "How the cat chases". Right, the second illustration: "Worms – woodworkers")

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3.3 The second illustration: "Worms – woodworkers"

Figure 2, right, features five wood worms across the entire pictorial surface. Three worms are represented in their entirety, with their heads and bodies. The other two have only their heads displayed. The composition also incorporates rectangular planes and other more geometric forms such as a yellow and red heart. The composition is energetic due to different orientations of individual forms while the combination of firm and soft forms adds liveliness. The cold and warm color spectrum creates a harmonic balance despite pure color contrasts.

4. Technical aspects of the installation

For the implementation of the interactive installation, we used HTML5 and JavaScript programming languages. We decided to use these technologies to make the installation usable on different hardware and software platforms so that anybody with a computer and a Web browser could use the game, although touch screens give the best user experience.

The combination of these technologies is also supported on tablets and mobile phones. We also used the library CreateJS (www.createjs.com), which is a combination of different tools that enable simple creation of rich and interactive experience with HTML5 programming language. The library CreateJS simplifies the handling of HTML5 Canvas elements (EaselJS), animation (TweenJS) and sound (SoundJS), and enables the coordination of loading of images and sound. For cutting up the first illustration (Figure 3) into a jigsaw puzzle and dividing the second illustration (Figure 4) into vertical stripes, we used Adobe Photoshop.

4.1 Human–computer user interface

We were striving to make the user interface as simple as possible. There are three views of the application: home menu, where one of the two puzzles displayed next to each other can be selected (Figure 2); the puzzles themselves (Figures 3, 4); and the story/poem about each puzzle (Table I). Each screen is assembled out of "Canvas" HTML5 elements. We can add on the Canvas "stages" which can be further divided into "containers".

Figure 3.
In the first puzzle, "How the cat chases", elements on the left and the right of the screen must be inserted into the appropriate white shape in the central picture

"Bitmaps" can be dropped into the containers. To each bitmap and stage, we can tie an "event listener", which performs a predefined function when a certain event takes place, for example pressing on the touch screen. We used the CreateJS library to handle all elements and events.

Both puzzles use sound effects that give an aural feedback when individual pieces of the puzzle lock into their correct place and when the entire puzzle is solved.

First puzzle, "How the cat chases", is selected by touching the left illustration on the home menu (Figure 2). The selected illustration is then displayed in the center of the

Figure 4.
In the second puzzle, "Worms – woodworkers", vertical stripes must be arranged into their correct order by shifting them left and right to assemble the original illustration

Kako maček lovi

Komu ste verjeli do sedaj?
Da maček plazi se po travi
da lovec že je po naravi
od margerite do zlatice
dobro ve, na katere
metulji sedajo cvetlice
Ste mislili
da pet in več ur na preži prečepi
da kakšno miš nazadnje ulovi?
Verjetno šlo vam je po glavi, da noro pleza
s strehe na drevo
in potem še više, tik pod nebo?
O, ne, ne primerja se prav nič od tega
Za mačka prevelika bi bila pretega
če v življenje odrinil bi od vsakdanjega brega
Urna povezava na svetovni splet
Omamila ga je vse tja do pet
Kako leteti do neba
kako potopiti se do dna
in kako kar čim hitreje priti tja
Tako maček se sprašuje
ko po spletu naglo pluje
medtem pa tuhta in kramlja
da pomemben podatek izbeza
Takoj ko nečesa loti se
vestno po načrtu dela
enkrat si le oglejte ga
kako prebrisano loviti zna
Erika Pavlin

Note: The poem written in Slovenian is about a cat that instead of frolicking in nature and chasing mice, is rather immersed in the World Wide Web chasing for interesting information
Source: (Pavlin and fabjančič rustja, 2011, pp. 34-37)

Table I.
The poem "Kako maček lovi/How the cat chases" served as the motivation for the illustration in the first puzzle

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screen with the bird figures cut out so that only their white silhouettes of different sizes remain in the illustration (Figure 3). On the left and right of the illustration are scattered the individual figures/birds that were cut out of the illustration. The goal of the user is to fill with these pieces all corresponding holes in the illustration. When the pieces of the puzzle are close enough to their correct position they lock-in. On the bottom right of the screen is a button for displaying the corresponding story/poem that gave the motivation for the illustration. The poem (Table I) is also displayed when the puzzle is successfully solved.

Second puzzle, "Worms – woodworkers", is selected by touching the right illustration on the home screen (Figure 2). The puzzle itself is then displayed in the center of the screen with empty space left and right of it (Figure 4). We are confronted with a puzzling composition, and our goal is to rearrange the vertical stripes into the correct order by pushing individual stripes left or right to reveal the original illustration. On the bottom left is a button "back" that leads us back to the home screen.

5. Discussion

Play and tactile sensing are two important components of the described art installation "School for cats". In therapy of people with severe learning difficulties, a proper mood and atmosphere must be established so that they can immerse themselves in a situation, to feel in other words as fish in the water. Their awareness during such immersion is not based on a conscious analysis of their situation but more like a relocation from their daily life into a completely new, imaginary world. When a person with severe learning difficulty steps behind the smart table with the installation, she or he does not analyze the workings of the puzzle but uses one's finger to start dragging pieces of the puzzle on the monitor and literally settles into the virtual situation. One can touch the images captured in the installation to control and get hold of the puzzle pieces with the pads of one's fingers. As small children, one is more a tactile observer than a looker. One can actively participate in the "story", one can change and rearrange the image. Users of the "School for cats" can enjoy themselves much more than just by listening to the story and looking at the illustration.

Merleau-Ponty (2006, pp. 37-45) argued that all that we know about the world is based on our perceptions and experience with the world, even scientific theories would not make any sense to us without our actual perceptions and experiences. This concept of grounding all our understanding of the world on our direct bodily experiences is even more valid for people with severe learning difficulties.

From the user perspective, one of the most important features of computer games is the possibility of immersion, which depends on a convincing feedback communication between the user and the computer application. Fast and consistent reactions together with changes in the virtual space where new possibilities open up are key features that attract and stimulate the players of computer games (Strehovec, 2003a, p. 286). Walter Benjamin's conviction that modern technology has also a therapeutic nature is therefore still relevant (Strehovec, 2007, p. 217).

The interactive table "School for cats" was successfully presented to the public for the first time at the exhibition DIGITAL RELOCATIONS 4 in ŠKUC Gallery in Ljubljana, 21 May-2 June 2013.

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The feedback from this and other exhibitions was very positive. The installation has its permanent home in VDC Tončke Hočevar, the therapeutic center for people with severe learning difficulties.

As the implementation was from the very beginning designed with portability in mind, the installation is also available over the World Wide Web (http://black2.fri.uni-lj.si/macjasola) and on smart mobile phones.

This installation is in Slovenia the first case of reusing an artifact resulting from art therapy in new media, which is then used again for art therapy. Other therapeutic centers still rely for art therapy mostly on classical media (drawing on paper, painting on canvas, sculpting with clay, etc.).

A systematic quantitative testing of the installation in an art therapy setting would be very difficult. One of the main reasons is due to large interpersonal differences of people with severe learning difficulties. Literature therefore rarely addresses researching people with profound and multiple learning difficulties, as qualitative research with this group is particularly rare and difficult (Nind, 2008, p. 4). A demonstration of the installation's usefulness in a therapeutic setting is therefore by necessity more episodic and in the form of case studies.

As the introduction of this installation in the therapeutic center in summer of 2013, a 20-year-old female person with severe learning difficulties started under the influence of the described installation to actively use a computer program for painting. She created already more than 30 illustrations, which will be published in a book form. A 3D Web animation of the main character from these illustrations is also in preparation. In this case, we followed a similar path but in an opposite direction. A person with severe learning difficulty has first created illustrations with a computer-based tool; these illustrations will then be printed in a book and, at the same time, transformed into an animated 3D figure for the Web.

6. Conclusions

In the twenty-first century, artistic articulations combine contemporary art with science, new life styles, intelligent technologies and new media. Art is today a domain of different modes of communication, not only of pure art in the classical sense but rather of art in much broader terms. The actors of contemporary art are not only artists, more often they are even not artists at all. They come from very different spheres and with very different interests (Strehovec, 1998, pp. 114-150). How can children and, in particular, persons with severe learning difficulties (given corresponding help and attention) be familiarized with new informational technologies in creative and fine arts. How can artistic concepts be represented in different media? They need to learn from classical incidence of art all the way to interactive installations which are tuned to the present times and society. The described project is just an attempt to address some of these questions and a demonstration how this can be implemented with a "different person", transforming in the process people with severe learning difficulties from participants-users to participants-co-creators.

Art therapy was in this particular case the framework and the computer-based art installation the means for introducing modern computer technology to people with severe learning difficulties. We hope that with this project, we have achieved an ethically worthwhile goal in an ethically sound manner.

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Note

1. Vesna Fabjančič Rustja is a true ambassador of people with severe learning difficulties. She was very anxious to have the book with her illustrations published and she participated in several public presentations for the promotion of her book, which were covered in local media. She is also very appreciative of the creation of the interactive art installation with her illustrations.

References

Allison, A. (2013), "Old friends, bookends: art educators and art therapists", *Art Therapy: Journal of the American Art Therapy Association*, Vol. 30 No. 2, pp. 86-89.

Benjamin, W. (1980), *Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit*, Gesammelte Schriften, Band I, Teil 2, Suhrkamp, Frankfurt am Main, pp. 471-508.

Chilton, G. (2013), Art therapy and flow: a review of the literature and applications, *Art Therapy: Journal of the American Art Therapy Association*, Vol. 30 No. 2, pp. 64-70.

Csikszentmihalyi, M. (2009), *Flow: The Psychology of Optimal Experience*, HarperCollins, New York, NY.

Darejeh, A. and Singh, D. (2013), "A review on user interface design principles to increase software usability for users with less computer literacy", *Journal of Computer Science*, Vol. 9 No. 11, pp. 1443-1450.

Davies, D.K., Stock, S.E. and Wehmeyer, M.L. (2001), "Enhancing independent Internet access for individuals with mental retardation through use of a specialized Web browser: a pilot study", *Education and Training in Mental Retardation and Development Disabilities*, Vol. 36 No. 1, pp. 107-113.

Edwards, B. (1979), *Drawing on the Right Side of the Brain*, Penguin Putman, New York, NY.

Gadamer, H.G. (2001), "Svet kot igra", *Resnica in metoda*, Literatura, Ljubljana, pp. 93-108.

Groys, B. (2002), *Teorija sodobne umetnosti, izbrani eseji*, Študentska založba, Ljubljana, pp. 121-130.

Huotari, K. and Hamari, J. (2012), "Defining gamification: a service marketing perspective", *Proceedings of the 16th International Academic MindTrek Conference*, ACM, *New York, NY*, pp. 17-22.

Kroflič, R. (2010), Art as Inductive Educational Practice: Education Through Art in the Kindergarden Vodmat, Kulturno žlahtnenje najmlajših, Vrtec Vodmat, Ljubljana.

Lieser, W. (2010), *The World of Digital Art*, Langenscheidt, Ullmann, Köln.

Merleau-Ponty, M. (1993), "Eye and mind, in the Merleau-Ponty aesthetics reader, philosopy and painting", in Galen, A.J. (Ed.), Northwestern University Press, Evanston, pp. 121-149.

Merleau-Ponty, M. (2006), *Fenomenologija zaznave*, Študentska založba, Ljubljana.

Nind, M. (2008), "Conducting qualitative research with people with learning, communication and other disabilities: methodological challenges", *Conducting Qualitative Research with People with Learning, Communication and Other Disabilities*, Methodological challenges Economic & Social Research Council, National Centre for Research Methods, University of Southampton, Southampton.

Pavlin, E. and Fabjančič Rustja, V. (2011), *Žabe, Stonoge in Druge Glavne Vloge*, Sanje, Ljubljana.

Peer, P., Jaklič, A. and Šajn, L. (2014), "A computer vision system for rehabilitation of a human hand", *Periodicum Biologorum*, Vol. 115 No. 4, pp. 535-544.

Rački, T. (2004), *Veščina likovne kompozicije v slikarstvu, oblikovanju, fotografiji, filmu, kiparstvu, arhitekturi in gledališču*, Javni sklad RS za kulturne dejavnosti, Ljubljana.

Robertson, G.L. and Hix, D. (2002), "Making the computer accessible to mentally retarded adults", *Communication of the ACM*, Vol. 45 No. 4, pp. 171-183.

Solina, F. (2004), "15 seconds of fame", *Leonardo*, Vol. 37 No. 2, pp. 105-110.

Solina, F., Batagelj, B. and Glamočanin, S. (2008), Virtual Skiing as an Art Installation, ELMAR, 50th International Symposium, Vol. 2, IEEE, Zadar, pp. 507-510.

Strehovec, J. (1998), *Tehnokultura, kultura tehna: filozofska vprašanja novomedijskih tehnologij in kibernetske umetnosti*, Študentska založba, Ljubljana.

Strehovec, J. (2003a), Umetnost interneta: umetniško delo in besedilo v času medmrežja, Študentska založba, Ljubljana.

Strehovec, J. (2007), *Besedilo in novi mediji*, LUD Literatura, Ljubljana.

Strehovec, J. (Ed.) (2003b), *Teorije igre pri Johanu Huizingi, Rogerju Cailloisu in Eugenu Finku*, Študentska založba, Ljubljana.

Williams, P. (2006), "Exploring the challenges of developing digital literacy in the context of special educational needs communities", *Innovation in Teaching and Learning in Information and Computer Sciences*, Vol. 5 No. 1, pp. 1-16.

Wilson, S. (2002), *Information Arts: Intersections of Art, Science, and Technology*, The MIT Press, Cambridge, MA.

Wilson, S. (2010), *Art + science now*, Thames & Hudson, New York.

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