

# Authentic Reality Mediation for Multihandicapped Children by Multimedia Standard Applications

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**Abstract:** Within the project CATI (Computer-Aided Therapeutic Intervention) new potentials and limitations of computer-supported multimedia applications for the therapeutic advancement of severely handicapped children are investigated. In this context, we are conducting a case study involving an 11-year old severely physically handicapped child. Due to the severe physical impairment, the child is highly mobility restricted and has little opportunity for learning about the natural environment and social contact. For entertainment purposes, the child was very much exposed to videos and Sega games from the world of comics during his childhood. The heroes of these comic movies are completely dominating his thinking and influence his communicative behavior. Therefore, a computer-supported multimedia environment was provided for use in art therapy sessions aiming at the mediation of empirical parts of what we commonly refer to as "reality". The multimedia environment allows for creating artwork with "authentic" features by incorporating multimedia objects like sounds from nature, realistic photographs or videoclips. It was the objective of this case study to observe whether the process of creating artwork on a computer with these special features can initiate reconstruction processes of his notion of "reality" supporting the development of his sense of self and leading to a more age-adequate communicative behavior.

## 1. INTRODUCTION

The goal of investigating the potential and limits of innovative computer-supported multimedia applications for the advancement of special needs children is pursued in the research project CATI (Computer-Aided Therapeutic Intervention) at the Human-Computer Interaction Department of GMD - German National Research Center for Information Technology. In CATI several case studies are conducted dealing with a variety of educational issues in special needs settings. In this case a multimedia environment consisting of videoclips, photographs and standard software suitable for designing multimedia applications like the graphics program „Corel Draw“ and the presentation maker „PowerPoint“ was employed for use in art therapy sessions. The goal of the multimedia environment was not only to offer an additional tool for painting and composing music but rather to mediate extracts of authentic reality to a highly mobility restricted physically handicapped child.

In distinction to augmented reality systems which are designed to enrich the real world with a complementary virtual world (BAJURA et al. 1995), we define authentic reality mediation as the computer-supported presentation of empirical parts of what we commonly refer to as „reality“. The presented empirical parts start off at the „artificial“ notion of reality the child has developed due to the social isolation and mobility restriction he has experienced during his childhood and connect them with events occurring in the „real“ world. This was achieved here by using images from former art therapy sessions which were scanned into the computer as the starting point for creating a multimedia artwork that is enriched by events occurring in „reality“ like thunder and lightning or the route of a garbage truck through the city.

The process of cognitively connecting experiences requires action, that means the child needs to be able to actively manipulate and explore his domain of interest. Modern information technology offers a lot of powerful multimedia tools allowing for self-controlled action, so there is good reason that utilizing these tools to compensate for a lack of action-taking due to a physical impairment might be successful. However, it is important to note that these experiences are of a simulated, non-physical nature which influence the process as well as the outcome of constructing knowledge about the „world“ in a special way. These issues will be under concern of this case study. It is necessary to give a brief description of the background of the child involved in this case study, in order to clarify the preconditions for the design of the multimedia environment.

## 2. DESCRIPTION OF THE CASE

The child participating in this case study is 11-years old, suffering from a centronuclear myopathy causing an anomaly of muscular nuclei leading to the loss of muscular strength (see figure 1). This loss of strength refers to the entire skeletal apparatus also affecting respiration. Therefore the child needs to be connected to an artificial respiratory device almost all the time. For short periods of time, he is able to sit up in a wheelchair especially designed for him. He is able to control his forearm as well as his hands. However they are tiring rather fast due to the loss of strength. His cognitive abilities are not affected by this disability, so he is capable of cultural techniques like reading and writing.



Figure 1

He spent his first seven years of life on the intensive care ward of a childrens hospital until he was physically stable enough to be released home. Since then he had to reenter the hospital once in a while for instance when he had caught a cold. At home he is cared for by a nurse 24-hours-a-day and attends a special education school for a few hours a day.

Due to the severe physical handicap of the child, he is highly mobility restricted and has very little social contact outside his family. Because of the socially rather isolated process of

growing up, he developed an understanding of reality that was very much influenced by the media presented to him during his childhood. For entertainment purposes he was exposed mainly to media like video films, audio cassettes, books and Sega games presenting stories from the world of comics. He still very much identifies himself with the heroes of these stories so that his thinking is dominated by these characters which also influences his communicative behavior. He has internalized their way of communication to the extent that he expresses happiness for instance the same way the comic figure Benjamin Blümchen (an elephant) would do it by trumpeting „Thöröh!“. This makes it difficult for others to communicate with him, because entering a conversation is only possible if a common ground for communication is shared. In order to develop a more appropriate way of communication, it is crucial that he deals with the facets of real life as we all commonly experience it. Beyond this, as it is assumed in individual psychology, construction of knowledge about reality is essential for the development of a sense of self. One objective of the art therapy sessions was the advancement of his communicative skills by connecting his imaginations with what we commonly call „reality“.

### **3. THEORETICAL BACKGROUND**

The way children usually develop an understanding of the world around them is by interaction. Due to the severe physical impairment of the child, his possibilities to physically and socially interact with his environment are very limited. However since the process of developing a sense of self provokes an analysis of the individual physical and social environment, interaction inevitably happens but is restricted in this case to the world of imagination for compensatory needs. These circumstances lead to emotional disturbances because the child is lacking the possibility to control and explore actively the process of interaction. Computer-supported multimedia environments may offer a compensatory interface in these cases, however all experiences are mediated that means are gained on an emotionally different level than they are in case of a non-handicapped child. It will be part of this research project to investigate the extent to which computer supported multimedia environments can serve for compensation purposes by authentic reality mediation. There are findings from learning theory as well as concepts from art therapy that support this assumption and have influenced the design of the multimedia environment.

From the perspective of the cognitive scientist Jean Piaget, who has developed the constructivist understanding of the process of building knowledge structures, knowledge is self-constructed that means everybody constructs his- or her own understanding of the world (PAPERT 1993). This is an individualistic understanding of knowledge building implying that constructing knowledge is an individual act leading to an individualistic understanding of the world. This approach did not take into account the role of communication, in questioning how knowledge is communicated to others and how the communicative process influences the construction process.

#### **3.1. Artifacts**

Seymour Papert has become known for advocating the power of computers in supporting the process of knowledge construction by providing microworlds offering so called objects-to-think-with (the LOGO example) (PAPERT 1993). He has enhanced the constructivist view of knowledge construction by stressing the importance of constructing a public entity (PAPERT 1991). This might be for instance "a sandcastle on the beach", "a computer game" or in our

case "multimedia artwork", meaning that construction takes place in a social context to which personal meaning can be attached (PAPERT 1991). Furthermore the public character of the artifact (e.g. the artwork) as the outcome of a construction process can be discussed, examined, tested or even simply admired by others. Papert assumes that by interacting with artifacts, tacit knowledge becomes explicit uncovering insufficiencies of knowledge structures requiring further differentiation of problem solving skills. This process forces the learner to reflect upon available knowledge structures and adapt the already existing ones to new experiences. Since the artifacts are public, they offer an opportunity to communicate individual knowledge to others which in turn causes the presenter to look at the artifact and this way indirectly at the internalized knowledge structures from different perspectives. In this procedure cognitive as well as affective processes are addressed crucial for connecting old with new knowledge (ACKERMANN 1996). The importance of enabling affective and cognitive experiences for connecting the inner with the outer world are underlying concepts pursued in art therapy for personality development.

### **3.2. Educational Regression**

In the school of art therapy emphasizing educational aspects in the therapeutic process „educational regression“ as a means of therapeutic intervention (RICHTER 1984) plays an important role. Regression in this sense means returning to the assumed starting point of developmental delay manifesting itself in artistic, verbal and behavioral expressions deviating from what in developmental psychology is assumed to be typical for a specific developmental stage. Educational regression here refers to the construction of skills in dealing with aesthetic materials and operations in accordance to the age and developmental stage of a child the deviation was diagnosed. The therapeutic goal is to foster the age-adequate utilization of symbolic functions becoming apparent in the aesthetic process and product. According to Richter (RICHTER 1977) who is the founder of the educational orientation of art therapy („Pädagogische Kunsttherapie“), therapy means initializing and guiding processes of social learning for the reconstruction of underdeveloped skills by activating the individual in an especially structured educational environment which in this case is a multimedia environment.

### **3.3. RIGS (Representations of Interactions that have been Generalized)**

The assumption of educational regression as an effective therapeutic tool was enhanced by findings from infant research (STERN 1985). In the stage of infancy, a child already interacts with his or her environment on a preverbal level. Infants are assumed to generalize these experiences and represent them in an episodic memory. These representations are called RIGs (Representations of Interactions that have been Generalized) and serve as the basis of the episodic memory (STERN 1985). The character of the episodic memory is dynamic that means it is constantly restructured leading to an integrated network of organized self-experiences. By means of amodal and transmodal experiences the child incorporates invariances of interpersonal interaction (acts and affects). The severe physical impairment of the child concerned in this case study caused a dramatic limitation of modalities available for experiencing his environment. Therefore traditional methods of art therapy like drawing watercolours in a wet-in-wet technique as well as a computer supported multimedia environment are used in art therapy with this child for compensatory purposes. The goal of the multimedia environment is to offer a rich and engaging setting for interaction in order to support the process of reconstruction of the episodic memory.

#### **4. THERAPEUTIC SETTING**

During the last stay of the child in the childrens hospital, he became acquainted with the graphics program "Corel Draw" running on the personal computer on his ward. Due to the physical impairment of the child, he is hardly able to use a standard keyboard for input, however he can use a standard mouse for operating a computer. He easily learned how to handle the program and designed sophisticated images. So when starting the case study, it seemed most reasonable to build upon this knowledge. In order to allow for designing interactive stories and incorporation of sounds and videoclips by the child himself, "PowerPoint" was also installed. A collection of his „hand-made“ images were scanned onto the harddisc and in the beginning he enriched them only by sounds. Very soon he then started to create new images during his art therapy sessions. The ease by which images could be produced on a computer particularly compared to all the effort it takes for a severely physically impaired child to move pencils, facilitated the desire to move on and explore further. He designed for instance a sunrise image and animated sunrise and sunset by moving the standard scrollbar up and down. From a psychological point of view it is very important for the development of self-esteem to be able to „make things happen“. Animating objects on a computer screen is a means of experiencing feelings of initiating and controlling action which a physically impaired child hardly has the chance to. So creating images with a computer offered the child the possibility to achieve more complex images with less effort, which in turn left free energy for action.

After some images were designed telling about how his day passes by, it became suggestive to connect these images to a story. The images were enriched by sounds occurring in nature (sounds of birds, ringing of the bell of a church at noon, thunder and lightning). The child was then offered photographs of for instance a garbage truck that passes by the house the child lives in and he accepted to enrich his story by objects from „reality“. Formerly when confronted with realistic photographs, he did not show much interest and rather talked about one of his Sega games. However, by studying the photography of the garbage truck, he decided that the road signs were missing and started to draw them on the computer. Road signs had interested him already some time before when he was taken to school by bus. So he reacted to corresponding material (i.e. traffic sign icons) offered by the therapist with a personal experience. Thus, a preverbal dialogue took place in the process of developing an artistic artifact, which could later be transferred on to verbal age-adequate communication about the purpose of road signs, traffic, people and the like.

This example underscores a general assumption of "authentic reality mediation" in art therapy: a therapeutic process aiming at constructing knowledge about „reality“ with the goal of developing communicative skills anyway needs to employ a client-centred approach. Only the imagination of the child and his readiness to accept offered material (i.e. multimedia representations of "reality") is likely to initiate motivation for connecting his inner with the outer world.

#### **5. CONCLUSION**

The use of computers in art therapy is a new but emerging field (AATA 1999). Little is known about the psychological aspects of the computer-supported artmaking process as opposed to the traditional methods of artmaking in therapeutic settings. It is agreed, however, that for use of art therapy with physically disabled people computer art therapy offers quite a few

advantages. First of all, the expressiveness of an image is no more limited by the physical capability of the “artist”. It is only a matter of selecting the appropriate tool for drawing with e.g. broad brushstrokes in a desired color. Furthermore, enabling a handicapped person to create images conveys a sense of mastery and control fostering feelings of self-esteem. And, the mutability of computer images allows for exploration and experimentation as all steps can be undone without leaving a trace. Whereas there are first attempts reported about the use of VR-systems in art therapy (AATA 1999), the impact of creating multimedia artwork by enriching images with sound, videoclips, animation and branching options, facilitating the networking process in knowledge building, is not researched yet. All these functions are of special concern in this case study, since empowering a multi-handicapped child to create non-static artwork with „authentic“ multimedia features makes it reasonable to assume that a computer is a meaningful tool for constructing knowledge about „reality“ from a learning as well as a psychological perspective. The case study presented here is in the beginning stage. It was the goal so far to explore, whether it is possible to gain interest and foster communication with the child about issues of „reality“ like events in nature (sunrise, thunder and lightening) or everyday events as trash collection. This step was taken successfully, so now we are in the stage of developing a methodological design for observing and defining psychological processes that can be initiated by offering a multimedia environment for therapeutically exploring „reality“ by self-defined protagonists, e.g. an animal or comic figure as an avatar, under the child's control.

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