Playing with a Learning Environment Subject Formations and Digital Culture

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Abstract: In this paper we present the first outcomes of the research project *SKUDI - Subject Formations and Digital Culture*. The project aims at understanding self-construction processes of young people in digital cultures. Our starting point is the empirical study of the correlation between learning and playing. Do young people perceive interaction in virtual learning environments as playing or learning? The learning environment *Der Schwarm* is used to answer the question. We organized and evaluated a 1½ days workshop *Theatre with the Flock,* in which the participants explored technical aspects of *Der Schwarm* and finally staged a play. Project content, terminology, methods employed and results are shortly presented. Participants experienced the workshop as a playing process where they learned at the same time about abstract algorithms and technology.

1 Introduction

The traditional understanding of learning as sitting still while listening to an educator or studying a book is outdated, especially when the subject is Digital Media. Making experiences and involving people's interests in learning environments provide new opportunities to learners and educators. Our aim is the combination of playing and learning with and about technology. „No, we don't learn we play and have fun" said a child in a workshop of our research group. *Playful Learning* is the postulation of Resnick, who "focuses on ways to integrate play and learning" [Re87]. He found that "people's best learning experiences come when they are engaged in activities that they enjoy and care about" [Re87]. Based on these ideas and our research results of the last years we designed a workshop concept in the context of the research project *SKUDI*. By using the learning environment *Der Schwarm* (the flock, the swarm) our aim is to find out whether young people perceive the interaction with *Der Schwarm* as learning or playing process. After a short introduction of the research project *SKUDI* and the definition of the frequently used terms learning and playing we present the learning environment *Der Schwarm*. Then we describe the workshop concept *Theatre with the Flock* and evaluation methods before we finally discuss the results and further work.

2 Subject Formations and Digital Culture

The research project *SKUDI - Subject Formations and Digital Culture, New Subject Formations in Interaction with Socio-Cultural Practices in Cyberspace*[1] started in September 2009 and involves four universities from Germany[2] and Austria[3]. The main goal is to investigate to which extent socio-cultural practices (working, communicating, learning, playing, creating, and thinking) are the basis for new subject formations which designate yet unknown dimensions of human existence as intrinsic elements of a digital culture. This question is investigated in the techno-medial performative arenas of web-based occupation (University Hamburg-Harburg), communicative publics in cyberspace (University Klagenfurt), and learning by interacting with technical artifacts (University Bremen). At first we outlined preliminary definitions of the socio-cultural practices and gained first empirical results about two socio-cultural practices learning and playing in combination with a digital learning environment. Therefore the definitions of learning and playing are introduced in the following.

2.1 Learning

Our understanding of learning states a change in experience and behavior of the individual [Pi01]. This change results from the subject's recurring experiences during the interaction with its environment [PI77]. Learning processes cannot be controlled but triggered. Therefore, learning is defined as the (active) process of self-directed knowledge construction [Pa94]. In this process the subject gains deeper insight initiated by the (active) reflection of results and experiences [Ac96]. These insights start a process of development and culminate in the ability of abstraction, i.e. the ability to transfer acquired knowledge to similar problems.

2.2 Playing

Playing is a free [Hu04] interactive action in an intermediary space that can be executed alone as well as in company. Playing means to break daily routines and enter a sphere of activity with a tendency of its own. The playing field may be of material or immaterial nature. It opens a space for creativity and self-experiments and is fundamental for the development of subjectivity [Wi71]. Playing allows crossing the border between subjective and objective world (intermediary space) and follows given or self-made rules. Experiences in winning and losing are inherent to play. Ideals of cultural expression and social life are satisfied and furthermore playing enables the development of subjectivity through interaction with the social and material environment.[4]

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[2] PD Dr. Raphael Beer, Westfälische Wilhelms-Universität Münster, Prof. Dr. Gabriele Winker, TU Hamburg-Harburg, Prof. Dr. Heidi Schelhowe, Universität Bremen
[3] Prof. Dr. Christina Schachtner, Alpen-Adria-Universität Klagenfurt
[4] The *SKUDI* team in Klagenfurt elaborated this preliminary definition of play.

3 The Learning Environment

Der Schwarm had been developed within a student project[5] and has been enhanced theoretically and technically by our research group. The installation is frequently used in workshops with children and young people [HP08]. In this paper, we focus on the installation's aspect as a learning environment.

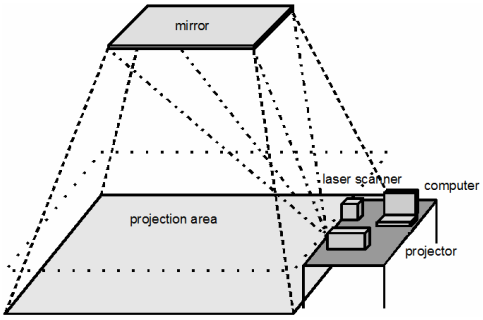

Figure 1: Technical setup of *Der Schwarm*

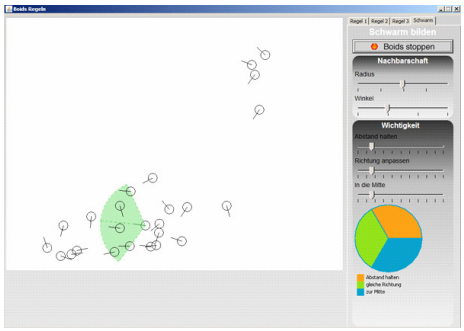

Figure 2: User interface *Boids Regeln*

Free body movements are tracked and a computed response of swarming light spots is projected on the floor. The interaction between body movements and virtual light spots opens a semantic space of playing and learning. The hardware structure (figure 1) includes a laser scanner to track movements, a projector and loudspeakers for visual and audible feedback, a mirror that reflects the projection to the floor, and a computer with special software. The programmed swarming light spots react to free body movements depending on the protagonist's velocity and movement level with one of six states: trust, curiosity, observance, escape, confusion, aggression. The distinguishing features between the states are color, appearance, and a set of parameters such as velocity and level of herd instinct. Variation in the protagonist's gesture and movement speed provokes a state change and gives direct response to her/his movements, such as following and fleeing. Thereby a meaningful interaction between protagonist and virtual swarm is created as the concept *Embodied Interaction* [Do01] suggests.

3.1 Abstract Algorithms

In addition to the sensual experience one may explore the abstract structure on which swarm behavior simulation is based. We employ Reynolds' concept for steering behaviors of autonomous characters (boids) which provides three rules: separation, cohesion, and alignment. Every boid reacts and thus moves according to the three rules, if another boid enters its local neighborhood which is specified by the parameters angle (field of view) and distance (size of neighborhood). Boids outside the neighborhood are ignored [Re99]. We developed the enhancement *Boids Regeln* (boid control, boids' rules) that provides playful exploration of the three rules. The interface allows direct manipulation of the boids' neighborhood and rule balancing [HB09].

[5] Idea, concept, and, first realization particularly by Merten Schüler and Andreas Wiegand.

Figure 2 shows a *Boids Regeln* screenshot with the ongoing swarm simulation. The rule balancing and the neighborhood parameters are adjustable through the sliders on the right. The effect is shown immediately within the simulation window in which the green area represents a boid's neighborhood. Thus, conclusions about the principles of swarm behavior simulation and abstract algorithms in general can be drawn easily [HB09].

3.2 Immersive Sound

According to Ackermann's concept of *Diving-in* and *Stepping-out*, sensual immersion is as important to learning as cognitive reflection [Ac96]. Auditory feedback in addition to physical interaction can enhance the understanding of abstract concepts [FP08]. The component *Dancing Sound* aims to foster sensual immersion and increase the motivation to learn. Every boid produces a sound depending on its state, velocity, and orientation. Within a geometric three-dimensional space every boids' status is assigned to a sound and vice versa. These parameters are mapped to the musical characteristics pitch/timbre, interval/duration, and arrangement. The mapping model is inspired by existing mapping strategies e.g. body movement – sound, swarm intelligence – sound event, and emotion - musical characteristics [HH09]. An interface provides the possibility to reflect the sensual experience and change the mapping of the sound axes within the model.

4 Workshop

In order to answer our leading question about learning in interaction with technical artifacts we developed the workshop concept *Theatre with the Flock*. The aim is to gain understanding about the participants' view of their interaction with *Der Schwarm*. The concept is designed for up to twelve students (about 20 years at age) without knowledge about *Der Schwarm* for a 1½ days workshop. The students have experience in acting, so the goal is to create and stage a thirty-minute play. Therefore, the participants need to understand the general interaction principles, algorithms, and the sound function of *Der Schwarm*. By arranging a performance the participants can demonstrate their ability to transfer newly acquired knowledge to another context. Several group sessions allow the students to experience *Der Schwarm* and its facets such as *Boids Regeln* and *Dancing Sound* through bodily and mouse/screen interaction. Group discussions, interviews, and the thinking aloud method are supposed to deepen reflection. The complexity of the final performance and the use of *Der Schwarm* are meant to give information about the participants' understanding about *Der Schwarm*'s inherent abstract concepts.

5 Evaluation Method and Results

The general evaluation method used in *SKUDI* is Grounded Theory [SC91]. The instruments to obtain data to be evaluated are participative observation, thematically-focused interviews with a narrative initial question [Ro04], group interviews, the method of thinking aloud [BT00], and photos as well as video recordings. Until now, the group interviews were sequential and reconstructive analyzed [Ro08].

In general the analysis reveals a deep understanding about the installation's technical aspects by all participants. We achieved a knowledge transfer to the common sense world. In particular emerge two focal categories relating to playing and learning: In the participants' self-perception they either play or playfully learn with *Der Schwarm*. Firstly, we discuss the playing and then the playfully learning participants.

Most of these participants gave interview comments like "I found it playful", „it was trial and error", „then we had a look at what happens" (translated from German). Furthermore, they explicitly mentioned "play" in connection with the workshop. They described an open situation in which they could easily experiment with *Der Schwarm*. In our definition of play, the socio-cultural practice is characterized by a high degree of creativity which is not as important in the case of the socio-cultural practice learning. The consideration of playing as non-serious and purpose-free also becomes obvious in the comments of the participants. One girl's comment makes her understanding of playing especially clear: „When the animals and I are together, we are playing. When I am not with them, they play with each other". The girl regards every action of *Der Schwarm* as playing regardless of someone interacting with the flock. *Der Schwarm* wants to play with everybody, she explains. This kind of perception could be observed throughout the whole workshop, since the participant perceived the light points acting like creatures depending on their mood. This girl in contrast to the other participants, who studied every step of the performance using their knowledge and curiosity about *Der Schwarm*, improvised her scenes each time. The participants playfully explored the features of *Der Schwarm* and got involved in the process of constructing it. The results show the participants' enjoyment in preparing the play according to their acting experience. *Der Schwarm* was part of the theatre, so the participants were creative to combine their passion for acting with their knowledge about *Der Schwarm* to a play.

The other main category is based on comments like „We playfully learned everything about *Der Schwarm*" or „It is a playing, but also a learning process, because we test out everything about *Der Schwarm*. We are right in the middle of the installation, we have to do something. That is why it is playful learning". It becomes apparent that the background is a game in which the participants are active learners. As the participants are actively integrated into the process they need to take actions in order to gain knowledge. Play is a concrete part of implementing the learning process thus, playing and learning are closely related practices. Play can encompass learning in a positive way, because the playing field comprises new possibilities for learning processes.

6 Conclusion and Future Work

We introduced the ongoing research project *SKUDI - Subject Formations and Digital Culture* and the learning environment *Der Schwarm*. We developed and implemented a workshop concept in order to answer the question: Do young people perceive interaction in virtual learning environments as playing or learning? The analysis of the empirical data indicate two categories of workshop participants who either perceived the interaction with *Der Schwarm* as pure playing or as playful learning. All participants whatsoever experienced the workshop as a playing process where they learned about

abstract algorithms and technology. In near future we plan more workshops in other domains like *Smart Textiles* to gain results on the nature of learning and the changes in subject construction by young people in digital cultures.

References

[Ac96] Ackermann, E.K.: Perspective-Taking and Object Construction: Two Keys to Learning. In (Kafai, Y. B.; Resnick, M.): Constructionism in Practice: Designing, Thinking, and Learning in a Digital World. Lawrence Erlbaum, Mahwah NJ, 1996; pp. 25-35.

[BT00] Bilandzic, H.; Trapp, B.: Die Methode des lauten Denkens: Grundlagen des Verfahrens und die Anwendung bei der Untersuchung selektiver Fernsehnutzung bei Jugendlichen. In (Paus-Haase, I.; Schorb, B.): Qualitative Kinder- und Jugendmedienforschung: Theorie und Methoden: ein Arbeitsbuch. KoPäd Verlag, München, 2000.

[Do01] Dourish, P.: Where the Action Is: The Foundations of Embodied Interaction. MIT Press, Cambridge MA, 2001.

[FP08] Falcão, T. P.; Price, S.: Exploring Sound to Enhance Learning of Abstract Science Concepts. In Proc. 3rd Int. Workshop on Haptic and Audio Interaction Design, Jyvaskyla Finnland 2008. Springer, Heidelberg, 2008.

[HB09] Hashagen, A.; Büching, C.; Schelhowe, H.: Learning Abstract Concepts through Bodily Engagement: A Comparative, Qualitative Study. In (Garzotto, F.): Proc. 8th Int. Conf. on Interaction Design and Children, Como Italy 2009. ACM Press, New York, 2009; pp. 234-237.

[HH09] Hashagen, A.; Hajinejad, N.; Schelhowe, H.: Dancing Sound: Swarm Intelligence based Sound Composition through Free Body Movements. In Proc. 15th Int. Symposium on Electronic Art, Belfast Ireland 2009. In print.

[HP08] Hashagen, A.; Persina, R.; Schelhowe, H.; Volkmann, G.: "Der Schwarm – Körpererfahrung und Algorithmik". In (Herczeg, M.; Kindsmüller, M. C.): Mensch & Computer 2008. Oldenbourg, München, 2008; pp. 227-236.

[Hu04] Huizinga, J.: Homo Ludens: Vom Ursprung der Kultur im Spiel. Rowohlt Verlag, Reinbek, 2004.

[Pa94] Papert, S.: Revolution des Lernens : Kinder, Computer, Schule in einer digitalen Welt. Heise, Hannover, 1994.

[Pi01] Piaget, J.: The child's conception of physical causality. Transaction Publishers, New Brunswick, 2001.

[PI77] Piaget, J.; Inhelder, B.: Von der Logik des Kindes zur Logik des Heranwachsenden: Essay über die Ausformung der formalen operativen Strukturen. Walter-Verlag, Olten, 1977.

[Re87] Resnick, M.: Edutainment? No thanks. I Prefer Playful Learning. In: Associazione Civita Report on Edutainment, 1987; pp. 1-4.

[Re99] Reynolds, C.W.: Steering Behaviors for Autonomous Characters. In: Proc. Computer Game Developers Conference 1999, San Jose CA 1999. Miller Freeman Game Group, San Francisco CA, 1999; pp. 763-782.

[Ro08] Rosenthal, G.: Interpretative Sozialforschung: eine Einführung. Juventa Verlag, Weinheim, 2008.

[Ro04] Rosenthal, G.: Biographical Research. In (Seale, C.; Gobo, G.; Gubrium, J.F.; Silvermann, D., Hrsg.): Qualitative Research Practice (pp.48-64). Sage, London, 2004; pp. 48-64.

[SC91] Strauss, A.; Corbin, J.: Grounded Theory: Basics of Qualitative Research: Grounded Theory Procedures and Techniques. Sage, London, 1991.

[Wi71] Winnicott, D.W.: Vom Spiel zur Kreativität. Ernst Klett Verlag, Stuttgart, 1971.