

# Prototyping in Game Design: Externalization and Internalization of Game Ideas

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**Prototyping is a well-studied activity for interaction designers, but its role in computer game design is relatively unexplored. The aim of this study is to shed light on prototyping in game design. Interviews were conducted with 27 game designers. The empirical data was structured using qualitative content analysis and analysed using the design version of The Activity Checklist. The analysis indicated that six categories of the checklist were significant for the data obtained. These categories are presented in relation to the data. The roles of externalization and internalization are specifically highlighted.**

*Computer game design, Prototype, Activity theory.*

## 1. INTRODUCTION

Prototyping is a well-studied activity in the field of human-computer interaction and interaction design, but its role in computer game design is relatively unexplored. It is clear though that prototyping is an important part of game design (Fullerton 2008, Fullerton et al 2006, Glinert 2010, Salen & Zimmerman 2004 Schell 2008). New game technologies are rapidly developing, which means that new game design possibilities arise (Schell 2008). These possibilities can be explored in short iterations with prototypes. Games are furthermore, more than average software, a piece of art (Costikyan 2002, Smuts 2005, Tavinor 2009), although this issue has been heavily debated outside the academic field, (Moriarty 2011, Ebert 2010). These characteristics of game design puts prototyping in a different perspective when compared to prototyping in other software industries. These characteristics of game design may put prototyping in a new perspective when compared to prototyping in other software industries.

The aim of this paper is to shed light on prototyping in game design. This has been done by conducting interviews with games designers. Prototyping is here viewed as a tool that mediates the designers' activities

### 1.1 Prototyping in Interaction Design

Interaction designers often distinguish between rough low fidelity paper prototypes and detailed high fidelity computer prototypes (Walkers et al. 2002). The designer should have the audience and the desired focus in mind when choosing what kind of prototype to make (Holmquist 2005, Houde & Hill 1997, Johansson & Arvola 2007, Sellen et al. 2009).

The purpose of prototypes may also differ; they can prototype a role, an implementation or look & feel. The role is the function of the product in the users' life. The implementation is about the construction. The look & feel is about users experiences of the product. A prototype can explore one or several of these dimensions (Houde & Hill 1997). In this paper we will focus on putting the data collected in relation to activity theory.

To prototype experience interaction designers use for example enactments. Jeff Hawkins, the inventor of The Palm Pilot, has been said to walk around with small pieces of wood in his pocket to prototype a PDA and discover where and when he could make use of it (Sato & Salvador 1999). This kind of prototyping is also described as experience prototyping (Buchenau & Suri 2000). The idea when prototyping experience is that designers can explore by asking questions like "what would it feel like if...?" The focus is on how technologically mediated action is lived and felt (McCarthy &

Wright 2004). Interaction walkthroughs and improvised role-play are other examples of specific enactments of experience prototypes that interaction designers use (Arvola & Artman 2007). In game design, a focus on experience is at the core of the designers' work (Graneheim & Lundman 2004). Game designers perceive themselves primarily as experience designers (Schell 2008).

A fundamental characteristic of a prototype is that it is a manifestation or externalization of an idea. As such it represents something that the designer, or the design team, can reflect upon. In this reflection, the prototype is used as a sketch, which facilitates the simultaneous development of the design problem and its solution (Fällman 2003). It is also a filter that focuses attention on certain aspects of the design idea and on a specific region of a design space (Lin et al. 2008).

## 1.2 Prototyping in Game Design

Prototypes have an important role to play in game design. A challenge in design of games, electronic as well as analogue, is that they are rule based and that changes in rules produce emergent effects that are difficult to predict (Salen & Zimmerman 2004). This calls for short iterations and frequent prototyping. Early testing of game play and game ideas, on the first versions of a game, is recommended (Koivisto & Eladhari 2006). Electronic games share this emergent quality and have in addition all the complexities of software development, often at the brink of hardware and interface evolution. Prototypes are valuable tools in this process (Fullerton 2008).

In the early ideation process, prototypes can take the form of game sketches made in, if not minutes, at least hours (Agustin et al. 2007). The aim of such early sketches is to open the design space for new alternatives (Buxton 2007). Early prototypes can be put together swiftly, preferably using existing technology, to get a feel of the idea. Both physical prototypes using paper, game boards, miniatures, or actors and software prototypes can be useful. When choosing prototyping method, game designers need to consider the purpose of the prototype, the game type, the project type and the phase of the project (Ollila et al. 2008).

In play-centric design, prototypes are used in cycles of formal play testing, similar to usability testing, from the earliest stages and continuously throughout the whole production (Fullerton et al. 2006). The early prototypes can include paper prototypes, storyboards and simple software mock-ups. Software prototypes can also be implemented for specific purposes like camera control, rudimentary game play and particle simulation.

Game jams, which are 24- to 48-hour workshops, can be described as "short-term, end-user focused experience prototyping that gain innovation momentum from concurrent development, cross-boundary collaboration within teams, time-boxing and by applying techniques for lightweight software development." (Musil et al. 2010). Such game jams provide an interesting approach to experience prototyping.

## 1.3 Research Questions

Previous research has presented ideas for how to make prototypes in game design. However professional game designers' actual prototyping practice has been unaccounted for in empirical studies. The research question for this study is accordingly: How do game designers work with prototypes and what roles do the prototypes play in the activity of games design?

## 2. THEORETICAL FRAMEWORK

Activity theory is the basis for analysis in this paper. Our data is thus related to a combination of three factors that we find relevant, which are foundations in activity theory: tool mediation, the social nature of humans and the concept of development through internalization and externalization. We specifically use *The Activity Checklist* developed by Kaptelinin, Nardi and Macaulay (Kaptelinin et al 1999) and expanded upon by Kaptelinin and Nardi (Kaptelinin & Nardi 2006). We will also pursue an analysis using the concepts of *internalization* and *externalization*.

The Activity Checklist is an instrument based on activity theory and is directly aimed at understanding design activities during early phases of design. The checklist consists of a set of statements, sorted in sections covering contextual factors that may influence the usage of tools (such as a prototype). These statements are a kind of "contextual design space" representing key areas of context specified by activity theory. It is a general tool meant to work in different design situations. The complete list is not meant to be used for every case but rather a selection of statements.

Internalization and externalization originates from Vygotskys thoughts on *higher psychological functions*. Humans use artefacts as psychological tools to mediate our relationship with the world. There is a distinction between physical artefacts (maps, pieces of art etc.) and symbolic systems (such as language, algebra etc.). And through experience physical tools can become internalized i.e. they are still mediated but by internal rather than external signs. Activity theory maintains that internal activities cannot be understood if they are analysed in isolation from external activities. These

concepts have clear connections to how prototypes are made and used. Important to note here is that internalization and externalization traditionally apply to the human mind in an activity. Here we also try to expand the view and take a standing point in the game. We view the prototype as an externalization of a part of the game.

## 2.1 Activity Theory and Game Design

Before going into the specifics of our research method a few basic concepts from activity theory need to be explained in connection to game design prototyping. They are labelled based on four The Activity Checklist sections which in turn are based on core activity theory concepts.

### 2.1.1 Means and Ends

Activity has a *hierarchical structure*. It can be analysed on the levels of *activities*, *actions* and *operations* in falling level of abstraction. The border between conscious and automated actions is drawn between actions and operations. Automated is in this context referring to actions that people typically are not aware of. The activity is the overall task, the design of the final game. The levels of actions can be decomposed into any number of sub-levels. To make a prototype is, as previously stated, to break out a part of the design, a specific design problem and work with that. The prototype focuses on a part of the design process, usually a specific design problem and becomes a lower level action in the activity hierarchy.

### 2.1.2 Environment

All humans live in a social and cultural world. They achieve their goals by active transformation of objects through activity. Prototyping serves as both a physical and a mental tool that is used on the object being designed. The object being prototyped is a potentially improved version of the game. Objects separate one activity from another. Hence, to fully understand the game design activity, the analysis of prototypes is important as they offer a clear distinction between different stages in the design process.

### 2.1.3 Learning, Cognition and Articulation

Physical, external artefacts mediate external activities. Internal activities are performed using only the mind, but still with some tool, a mental process mediated by culturally developed means, as for example the multiplication table. *Internalization* occurs when external activities are transformed into internal ones, *externalization* when internal activities are transformed into external ones.

Externalization is often necessary when an internalized action needs to be "repaired" or scaled. Take for example the role of a prototype in game design: If something in the game is found to be

problematic, this is prototyped, externalized. When the problem is resolved the parts of the game that were prototyped are internalized into the evolving final game.

### 2.1.3 Development

All practice is a result of certain historical developments under certain conditions. Activities undergo constant developmental transformations. Game design, as it is being performed today, is rapidly changing, gaining professionalism (though still young and experimental) (Dymek 2010) and is thus fast at adapting new ways of thinking around technology compared to more established fields.

## 3 METHOD

Interviews were conducted with 27 respondents, 16 game designers, ten game design students and one game design teacher. All of the respondents work primarily with digital games. Each interview lasted one to two hours. They were semi-structured focusing on issues such as ideation, documentation, communication, inspiration, game experience, design methods, the role of prototypes, kinds of prototypes and quality criteria for prototypes. The ambition was to connect to their actual practice as far as possible. The interviews were recorded and transcribed. Some were transcribed in their entirety, whilst others only select sections of interest were transcribed. The empirical material was analysed with qualitative content analysis (Graneheim & Lundman 2004) and interpreted using activity theory and The Activity Checklist (Kaptelinin & Nardi 2006), to identify core points of interests in game designers' prototyping activities.

### 3.1 Participants

Eight of the 16 game designers were from AAA-game developers (six different companies, five in Sweden and one in Poland) and eight from indie game developers (four different companies, two in Sweden and two in Poland). They were all lead designers except for one participant who was a junior designer but was interviewed jointly with a senior designer at that company. No designer at the AAA-companies had any specific game related education. Most of them were autodidact and had no university degree. At the indie-companies, five had game related university degrees (all in Sweden) and three were autodidact in the game field. All respondents were male and between 25 and 40 years old.

Four of the game design students study game design at a university and six in more practice-oriented school settings. The university students all study 3-year bachelor programs, the six at the practice-oriented all study 2-year programs. All students study in Sweden. The teacher interviewed

worked at a practice-oriented school. All respondents were male and all in their twenties, except for the teacher who was in the mid-thirties.

### **3.2 Analysis**

In the qualitative content analysis, the data had been formed into implied content units and categories. In the subsequent analysis where The Activity Checklist was used, the implied content units served as the source for the analysis. Raw data was also traced back and viewed when needed.

The statements in The Activity Checklist were compared to the implied content units. There are two versions of The Activity Checklist, one for evaluation and one for design (Kaptelinin & Nardi 2006). For this analysis the design version of The Activity Checklist was used. The checklist consists of a set of statements, describing different aspects of the object being examined. The design version has 44 such statements. The idea was, in short, to work through all of them to find the ones relevant and then to continue working with the relevant ones. The 44 statements were sorted in four groups, based on the core concepts of activity theory: Means and Ends; Environment, Learning; Cognition and Articulation; and Development. Tool mediation is not a group of statements in its own. It is instead applied throughout the list in combination with the other four concepts.

## **4 RESULTS: THE ACTIVITY CHECKLIST**

The data will now be presented and exemplified. First in relation to the six categories in the checklist that stood out as particularly important in the analysis. Then in relation to the concept of Internalization and externalization

### **4.1 Goal Setting**

Design work is done in iterations and game design work is performed in particularly short iterations, according to our participants. This iterative process is initialized by new sub-goals, prototyping drives it to new steps. Participants indicate that iterations are shorter and more frequent, as is prototyping, during the first half of the design of a new game. One participant states that the entire first year of development consists of prototypes.

So the first year is really when the game is created. You build prototypes. And then, you realize, 'okay, now we need 4000 buildings'.

(A Single Player Lead at an AAA-developer)

According to him the actual game design work is done in prototypes. The rest is mostly production and other forms of design (art, sound etc.) and not

so much game design. In relation to design goals, new goals are set. Design goals often reflect ideas connected to desired player experience.

We assumed that it would be quite difficult to achieve, but still it was something that... we would like the player to feel this rather than just see it... throw yourself between roofs of buildings and such.

(A Lead Designer at an AAA-developer)

There is a strong bias towards what the player feels (often tested within the team though) and that information is often the basis for new sub-goals. Several respondents talk about the importance of prototypes in finding out how the game experience works, whether it works as intended and whether it is fun. One designer talk about prototypes as something that test the moment of play, how it actually plays out.

You can have different goals with your prototype, but the most common, one might say, is to get what is going on during most of the playing. I mean, second to second. What is it that you do when you're playing the game? That is what you often want to find out through your prototype.

(A Game Director at an AAA-developer)

### **4.2 Decompositions of Goals**

Target goals, or visions for the game design, are formulated early in the design process. One participant describes how they, based on the main idea, build a prototype as soon as possible to test and verify this idea.

[in a prototype] you try to put together your loosely shaped ideas, to make them playable in some way

(A Game Director at an AAA-developer)

Participants spoke almost without exception about project-wide visions and people responsible for keeping these and developing them. In the process of redefining the target goals, they are decomposed into sub-goals which to a different extent influence the modified target goals. Many designers point out the usefulness of focusing on one specific function of the game in a prototype.

You can have... effect prototypes were you just have something that... is triggered again and again, just to see how things look...'that looks too bad to be our demolition system' maybe isn't good enough or something like that... and then you get to see what one... want to focus on or how to solve it.

(A Lead Designer at an AAA-developer)

Here it is clear that the prototype plays an important part in the process of evolving the target goal through sub-goals. A game consists of several mechanics. Prototypes can test them one by one.

A game usually consists of several different mechanics and different features and a prototype can be good in this. Instead of trying to get everything to work, get everything in place, one chooses to look only on one thing. You make a prototype for a specified mechanic. Because one doesn't really know, this is difficult, one has to kind of feel the idea to see whether it may work or not.

(A Game Director at an AAA-developer)

### **4.3 Simulations of Target Actions**

Possibilities for simulating target actions, or intended design choices, before their actual implementation were discussed by several of the participants. In particular the possibility to pinpoint certain functionalities that need to be tested and "felt", as several designers explained it. As in the example concerning the intended feeling of movement the player is supposed to have:

...to see how to, eh, well, tested the first prototypes, for example: 'how would it feel if a character has acceleration?' like in a rally game... so that she didn't run full speed right away.

(A Lead Designer at an AAA-developer)

This is also something game designers do as a way of moving forward in their own design process (see Self-Monitoring below). The complexity of computer game design makes it hard to foresee effects of design choices. Prototypes are needed to check the current design against the design vision.

And we did some tests with prototypes where one could jump in first person, because we're talking about the feeling again, so... things we really wanted to mediate was like... we had seen movements in other games... like where our character could be able to do stuff like jumping up on walls and things you don't usually see in first person games.

(A Lead Designer at an AAA-developer)

In both these cases the designer is focused on the experience generated by the actions the player may take in the game.

### **4.4 Self-Monitoring**

Prototyping is a form of self-monitoring through externalization. Participants talk about the notion of feeling, but more in the sense that they need to feel the idea rather than functions, as one designer says.

When you do a prototype, I guess it is connected a bit to...one start to prototype, not always but often, when you're doing your concept discovery and you want to start to feel the things right away.

(A Game Director at an AAA-developer)

The participants mention paper prototyping, though this seems not to be used to a great extent. Several participants also talk about using prototypes as a sketching board to refine their ideas before going to the team. Or as a place where high flying ideas meet reality.

Another designer discusses the prototype in terms of reality checks; something that forces you to realize what can and cannot be done. He argues that a prototype forces vague ideas to become playable.

### **4.5 Shared Representations**

Participants talk about the importance of communicating the idea of the game. Prototypes often serve that purpose within the team they work with. This is, for example stressed in the following excerpt from the interviews.

The vision holder's idea, to get others to understand it, is almost the most important thing one can work with... maybe one can make a short film. To avoid programming, just make a short film using simple prototyping tools, so that when everyone watch it; 'aahh, that's what we are supposed to recreate. So that the programmers will understand. This is much better than 300 pages of text.

(A Single Player Lead at an AAA-developer)

It has also been pointed out that a bad prototype can cripple an originally good design idea because of what it fails to communicate.

If you have a super duper idea that you try to explain to your team, but don't manage to do so in a good way, and they think it's a boring idea, then the idea is still good but the prototype is bad.

(A game design student at a practice-oriented school)

Again this refers to prototypes as a form of communication and implies prototypes as a natural way of communicating ideas within the team. Shared representations are, according to our participants, often used to support collaborative work. Several different tools are used, such as white rooms (i.e. prototyping in the game engine).

Let's say you want to test for example... a thing... do we have enough moves or have we stringed together enough things to make it fun to progress upwards. Then you can make a prototype, or a white room of a level for example, where we only place... almost everything is cubes.

(A Game Director at an AAA-developer)

Another type of tool, which is viewed as a prototype in itself, is a scalable visualization. Parts of the

visualization are easily modifiable based on the game parameters that are tested.

For example if you are making a car game or something... and you want to see how much detail you have to put into the surroundings for example... We do a prototype where travel as a small ball through the thing in 250 mph for example so we can see... how much detail is needed at different speeds... that is a kind of prototype that doesn't need to be playable.  
(A Lead Designer at an AAA-developer)

In order to solve the design problem concerning detail in surroundings a specified function in the game is highlighted by a prototype and shared with others in the design team.

#### **4.6 Mutual Learning**

Many of the participants talk about the struggle to come up with something new all the time. The game industry is also quick to embrace new technology. In the wake of this speed of change, professional language develops, but this is not always enough. Prototypes catalyse the development of this communication

Well, like, 'you've getted the pic?' What is that? Really?... yeah, but to find a common language is to a large extent what you are trying to do in a prototype I think.  
(A Game Director at an AAA-developer)

Participants stress that mutual learning between the content of the work and the possibilities of the technology is important in the process. In the following excerpt, a designer describes how they tried to make the feeling of movement realistic, but ended up having to tailor every move separately to get it to work. Many new situations come up that need to be understood and solved. One designer talks about the relation between game play, delay and realism.

Before that, when one only have a prototype, where one is testing acceleration or things like... the way we, as players, want to have things delayed, when it comes to jumps for example. Or do we want definite... instant response... and how... in that case, if we want instant response, how do one get her to act natural when she makes the jump, and lots of stuff like that.  
(A Lead Designer at an AAA-developer)

### **5 RESULTS: EXTERNALIZATION - INTERNALIZATION**

Ideas connected to internalization and externalization are found throughout the data. Which we will focus more on in the discussion, but first some views based on the data. The prototypes

are viewed as a way to externalize a specific part of the game that is made it conscious to the team.

...the most important thing in a prototype is of course that it communicates the idea of something.  
(A game design student at a practice-oriented school)

Externalization also fulfils an important role when a team works together since activities need to be performed externally to be coordinated (Kaptelinin & Nardi 2006). Game design is in most cases a collaborative effort. The interviews show many accounts for this and for prototyping as a form of communication.

But, now days, and on the hole, if one has resources and if things are done right, one should never document for documentations sake, so it's much more, like, write as little as you can and show as much as possible by using images and prototypes.  
(A Lead Designer at an AAA-developer)

The externalization of a function or an idea facilitates coordination and communication in the design process. Activity theory also states that externalization is often necessary when an internalized action needs to be "repaired" or scaled (Kaptelinin & Nardi 2006). This is an almost exact description of the role a prototype fulfils as an activity in the designing of games, although most designers tend to define it as the testing of an idea or feature that has been brought to attention in the design process.

[prototypes are] almost always made just for the team, or to test and be certain on an idea. It may be something in a level, some event or something else one is uncertain about, that one wants to test, and then one make a prototype for that.  
(A Lead Designer at a AAA-company)

## **6 DISCUSSION**

Game design prototypes have, as we have seen, many purposes. They mediate and shape the way game designers interact with the game ideas that they externalize. The ideas are reshaped through the prototyping process and then fed back into the design process. An idea that has been incorporated into the design and no longer exists separately, is internalized and becomes a part of the object (the developing game). For a designer of the game, a prototyped function then ceases to exist separately as it melts into the game.

Tools are preservers of knowledge (Kaptelinin & Nardi 2006). Prototypes are used as tools when designing games. Games are designed experiences (Schell 2008). Thus the game

prototypes are also preservers of experience during the design process. The preserved experience is structured and constantly transformed during prototyping. In this way the prototypes accumulate knowledge that transforms the design work.

When a function in the game is to be modified, a prototype of that distinct part of the game is created. Focus is deliberately shifted to that function and it is, conceptualized, externalized and made conscious. A new sub-goal is then created and the activity of prototyping continues until the prototyped function is internalized. The transformation between the internal and the external is dialectic and they cannot be analysed separately.

Externalization also fulfils an important role in collaborative work. The activities need to be performed externally to be coordinated. Game design is in most cases a collaborative effort. The externalization of a function or an idea facilitates coordination and communication in the design process.

Data has also shown indications on how game prototyping, due to mainly two factors in combination, is unique in relation to other design prototyping. There is a main interest from the designer towards the experience of the user and there is an element of unpredictability not only caused by the unpredictability of software development but also the unpredictable nature of game systems (Salen & Zimmerman 2004). However, many of the communicational values of a prototype seem to be equal to other design practices way of using prototypes.

### **6.1 Reflections on Using The Activity Checklist**

Some areas in the data stressed by the respondents were difficult to link to The Activity Checklist (Kaptelinin & Nardi 2006, Kaptelinin et al. 1999). In particular two areas were difficult to manage.

- Errors and mistakes and their positive and negative consequences.
- The notion of users' experience, or designer's intended experience for the users.

Errors and mistakes, good or bad, are something you cannot easily plan for. The notion of users experience on the other hand is something that game designers discuss early in the design process and it becomes a part of the discussion around prototypes and prototyping.

The way The Activity Checklist has been used here is somewhat a reversed engineering process. It is

originally intended to be used when designing, not when analysing a designer's reflections upon earlier work. This may explain why errors and mistakes were difficult to link to The Activity Checklist.

Somewhat surprisingly users' experience was also difficult to link to the checklist. A reason could be that activity theory in itself does not focus on the subjects' experiences of the object of the activity.

Despite these problems, the checklist worked well on this material by supporting the interpretation of the data and facilitating categorization, comparison and conclusions. It facilitated seeing themes in the analysis.

The Activity Checklist has four sections in which the 44 statements are sorted. When applying the data to the list there was a clear weight of importance to the third section of statements in The Activity Checklist: Learning, Cognition and Articulation. This is interesting since this section originates in the concepts of internalization and externalization. Though not a surprising result, it does emphasize that these concepts in activity theory are central when analysing prototyping.

### **6.2 Relation to Previous Research**

One of the most important functions of a game design prototype is to serve as a shared representation to support communication and collaborative work. Other research has emphasized the importance of constructing the correct prototype type. The purposes of the prototype, the game type, the project type and the phase of the project have been suggested as important considerations to be taken (Ollila et al. 2008). The same line of argument has been used in interaction design (Houde & Hill 1997, Johansson & Arvola 2007, Sellen et al. 2009). The results of this study indicate that the interpersonal aspect is important when discussing what type of prototype to use.

Game design is at the forefront of technology but also in the front line of conceptions of technology use. Game designers we met often talked about the feeling of the experience and the importance of getting hold of this feeling through experience prototypes. Although they talk about the experience and the feelings, theorizing this is important to facilitate "a re-orientation among designers, users, and observers. Not just any re-imagination, but one that is practically, experientially, and ethically rewarding, and that is oriented toward how technologically mediated action is lived and felt" (McCarthy & Wright 2004).

Another aspect in the mediated activity of game design prototyping is self-monitoring through

externalization. This is also a result that supports earlier research (Ollila et al 2008). There is among some scholars a distinction between a prototype and a sketch (Buxton 2007), but to the designers participating in this study, prototypes seem to serve a sketching purpose. Prototypes have also been conceived in a similar way earlier in human-computer interaction research (Fällman 2003).

Game design prototypes also facilitate mutual learning between participants. This is particularly important seen in the light of the rapid technological development that provides new game possibilities (Schell 2008). Furthermore, if games, as a final product, are conceived more as pieces of art than the average software (Costikyan 2002), games under development become something even the developer is inexperienced in. It is therefore not surprising to find many statements in the data, that concerns the work process, emphasize the importance of the mutual learning between content production and technological possibilities. The creative process is something that typically involves new areas of knowledge or activity and some form of reflection along the way.

### **6.3 Future research**

Prototyping in the game industry is not a well-researched field, with much left to investigate. There is, for example, no generally accepted definition of game prototyping and even though prototyping in general is well defined, the specifics of game prototyping are lacking. A big variety of prototyping approaches exist in the software field, which has been investigated in a number of works. A study where they, and their respective strengths and weaknesses are put in relation to game development would be valuable.

The connection between externalization-internalization and the prototyping process has in our study been identified as an interesting field. Further investigation into this relation is recommended. Here other concepts of activity theory may be fruitful too.

It has been made evident that prototypes play an important role in communication during the design process. Further investigation of this quality, including the rhetoric of a prototype, negotiation analysis and perhaps conversation and discourse analysis may prove successful.

A study focused on prototypes would form an interesting complement to this study. When designing, the object of the activity is the final game. When a game designer is prototyping, the prototype becomes the object for the designers' actions. The prototype has an objective, which often is to communicate and test modified functions

and ideas. Analysis of objects is necessary since they are prospective outcomes that motivate and direct activities, around which activities are coordinated and in which activities are crystallized in final form when the activities are complete.

It would also be of interest to further investigate the unique and shared properties of game prototyping and game prototypes in comparison to other prototyping activities.

### **6.4 Conclusion**

Game production is a volatile business with high staff turnover where professionals frequently move between companies and in and out of free-lance positions. Conditions and prerequisites change rapidly, standards are still lacking and the target technology is constantly evolving. In this situation it is important to have awareness of the development processes in the field and the development of the field itself.

We have in this study shed light on how game designers conceive prototyping activity based on their own experience. Prototypes have been found to function as a communicational tool. It is a preserver of knowledge that enables interaction and development of ideas, both individually for the designer and collaboratively within the design team. This takes place in a process of externalization and internalization.

The results from this study will serve as foundation for further investigations into game prototypes, how game prototyping is being done and how it supports the game design process.

### **7 ACKNOWLEDGMENTS**

We would like to acknowledge Ulf Hagen for his assistance in gathering the empirical material, Victor Kaptelinin for comments on an earlier draft, Maria Wolrath Söderberg for valuable feedback in later drafts and our respondents for participating in our study. The research has been sponsored by The Baltic Sea Foundation

### **8 REFERENCES**

- Agustin, M., Chuang, G., Delgado, A., Ortega, A., Seaver, J. & Buchanan, J.W. (2007) Game sketching *Proc. of the 2nd international conference on Digital interactive media in entertainment and arts* Australia.
- Arvola, M. & Artman, H. (2007) Enactments in interaction design: How designers make sketches behave. *Artifact*, 1 (2) p.106-119.

- Buchenau, M. & Fulton Suri, J. (2000) Experience prototyping *Proc. of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques*, United States 424-433.
- Buxton, B. (2007) *Sketching User Experiences – getting the design right and the right design*. Focal press. Morgan Kaufmann Publishers, San Francisco CA .
- Costikyan, G. (2002) I Have No Words & I Must Design: Toward a Critical Vocabulary for Games In: Ed. Mäyrä, F. *Proc. of Computer Games and Digital Cultures Conference* Tampere: Tampere University Press. P.9-33.
- Dymek, M. (2010) *Industrial Phantasmagoria – Sub Cultural Interactive Cinema Meets Mass Cultural Media of Simulation*. Doctoral Thesis, Royal Institute of Technology, Stockholm.
- Ebert,R(2010)video\_games\_can\_never\_be\_art.htm I Chicago Sun Times, Eberts Journal April 16, 2010. Including comments. 2011-03-29.
- Fullerton, T. *Game Design Workshop, (2008) Second Edition: A Playcentric Approach to Creating Innovative Games (Gama Network Series)* Morgan Kaufmann.
- Fullerton, T., Chen, J., Santiago, K., Nelson, E., Diamante, V. & Meyers (2006) A. That Cloud Game: Dreaming (and Doing) Innovative Game Design. In *Proc. of Sandbox Symposium 2006*. ACM Press,
- Fällman, D. (2003) Design-oriented human-computer interaction. In *Proc. of the SIGCHI Conference on Human Factors in Computing Systems CHI '03*. ACM, p.225-232.
- Glinert, E. (2010) Rapid Iterative Prototyping, *igda Webinar*.
- Graneheim, U. H. & Lundman, B. (2004) Qualitative content analysis in nursing research: concepts procedures and measures to achieve trustworthiness. *Nurse Education Today*, 24(2) p.105-112.
- Hagen, U. (2010) Designing for Player Experience - How Professional Game Developers Communicate Design Visions. *Nordic DiGRA*.
- Holmquist L-E. (2005) Prototyping: generating ideas or cargo cult designs? *interactions*, v.12 n.2,.
- Houde, S. & Hill, C. (1997) What Do Prototypes Prototype? In Helander, M. & Prabhu L. T. P. (Eds.) *Handbook of Human-Computer Interaction (2nd ed.)*. Amsterdam: Elsevier Science.
- Johansson, M. & Arvola, M. (2007) A case study of how user interface sketches, scenarios and computer prototypes structure stakeholder meetings. In: Ball, L. J., Sasse, M. A., Sas, C., Ormerod, T.C., Dix, A., Bagnall, P. & McEwan, T. (Eds.) *People and Computers XXI: HCI... but not as we know it, Proc. of HCI 2007, The 21st British HCI Group Annual Conference, Volume 1* The British Computer Society p.177-184.
- Kaptelinin, V. & Nardi, B. (2006) *Acting With Technology*. MIT Press.
- Kaptelinin V., Nardi B. & Macauley C. (1999) The Activity Checklist: A Tool for Representing the “Space” of Context, *Interactions*, July/August, p.27-39.
- Koivisto E. M. I. & Eladhari M. (2006) Paper Prototyping a Prevasive Game. *ACE '06: Proc. of the 2006 ACM SIGCHI international conference on Advances in computer entertainment technology*, ACM.
- Lim, Y-K., Stolterman, E. & Tenenberg, J. (2008) The anatomy of prototypes: Prototypes as filters, prototypes as manifestations of design ideas. *ACM Transactions on Computer-Human Interaction (TOCHI)*, v.15 n.2 ACM p.1-27
- McCarthy & Wright. (2004) *Technology as Experience*. Cambridge: MIT Press.
- Moriarty, B. (2011) An Apology for Roger Ebert. LECTUER given at GDC11.
- J. Musil, A., Schweda, D., Winkler, & Biffi, S. (2010) Synthesized Essence: What Game Jams Teach. About Prototyping of New Software Products. In: *Proc. of the 32nd International Conference on Software Engineering*, ACM.
- Ollila E. M. I., (2008) Suomela R. & Holopainen J. Using prototypes in early pervasive game development *Computers in Entertainment (CIE)* , Volume 6 Issue 2.
- Salen, K. & Zimmerman, E. (2004) *Rules of Play*. MIT Press.
- Sato, S. & Salvador, T. (1999) Methods & tools: Playacting and focus troupes: theater techniques for creating quick, intense, immersive, and engaging focus group sessions, *interactions*, v.6 n.5, ACM p.35-41.

Schell, J. (2008) *The Art of Game Design – A Book of Lenses*. Morgan Kaufmann Publishers, Burlington MA.

Sellen, K. M., Massimi, M. A., Lottridge, D. M., Truong, K. N. & Bittle, S. (2009). A. The people-prototype problem: understanding the interaction between prototype format and user group. *Proc. of the 27th international conference on Human factors in computing systems*, Boston, MA, USA.

Smuts, A. (2005) Are Video Games Art. In *Contemporary Aesthetics Volume 3*.

Tavinor, G. (2009) Videogames, Interactivity and Art. In *APA Newsletter on Philosophy and Computing, Volume 9*.

Walkers, M., Takayama, L., & Landay, J. (2002) High-fidelity or low-fidelity paper or computer medium. In *Proc. of the Human Factors and Ergonomics Society 46th Annual Meeting (HFES'02)*. p.661—665.