Modelling Experimental Game Design

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Abstract

This paper uses two models of design, Stolterman's and Löwgren's three abstraction levels and Lawson's model of designing, from the general design research to describe the game design process of an experimental pervasive mobile phone game. The game was designed to be deployed at a big science fiction convention for two days and was part of a research through design project where the focus was to understand which core mechanics could work for pervasive mobile phone games. The design process was, as is usual for experimental designs, very iterative. Data were gathered during the design process as entries in a design diary, notes from playtesting and bodystorming sessions, user interface sketches, and a series of software prototypes. The two complementary models of design were used to analyse the design process and the result is that the models give a good overview to an experimental game design process and reveal activities, design situations, and design choices which could have otherwise been lost in the analysis.

Keywords Game design, analysis, experimental game design, design research, pervasive games

1. Introduction

In [9] it is noted that in the current game design literature, not enough attention is given to the various kinds of activities and thinking involved in the actual process of game design. Instead, the books that were reviewed were rather focused on the content of design, games, with an emphasis on the mechanisms of entertaining gameplay. Kuittinen and Holopainen [9] argued that in order to improve our understanding of game design and to improve design methodologies, game design should be studied by using models of designing from the general design research. In this paper, we apply the research findings from the article to a concrete case: an experimental game design process of the game *No-one Can Stop the Hamster* (NOCSH).

The game was a multi-player competition where players obtained points by capturing "wormholes" represented by fiducial markers [3]. Fiducial markers are visual tags which can be used for tracking objects. The game was played with regular Nokia N95 cellphones, using cameras, marker recognition and 3G communications. Initially, the game was a treasure hunt, with searching and discovery as dominant features. There were 50 fiducial markers placed around the conference center: Most of the markers were just attached to white boards or hidden in flowerpots, but markers were also placed in game flyers, NOCSH staff T-shirts and on the convention closed loop TV reel. As the players learned the marker locations, the game changed from a treasure hunt to a tactical, physical memory game. Whenever player lost a wormhole, she got an announcement with the symbol of the lost marker, giving her a chance to revisit the marker and capture it back. Marker capture was done through a mini-game: waving the mobile phone back and forth (while keeping the fiducial marker on the screen) gathered power, and releasing the power with correct timing captured the node. Accurately captured wormholes were harder to take over by other players, as gathering power was made harder. Even though NOCSH was not an exergame, it was a physical game with light exercise.

The purpose for this article is to look at the game design process of NOCSH in light of two distinct, but complementing models of designing. This will allow us to both evaluate the suitability of the models for researching game design and improve our understanding of the design process itself. Instead of attempting to create a prescriptive model of game design that describes the activities a designer should do in order to arrive to a satisfactory result, it is more useful to come up with a model that describes and explains the activities designers actually do in real-world game design projects. By understanding how designers work and why they do what they do, it is possible to support their work with methodologies and tools that address their real requirements.

2. Theoretical background

The game design process is often[15, 8] described proceeding as an iterative spiral where the basic activities of the designers keep repeating until a satisfactory solution is reached. Another popular way [1, 8, 2, 13]of describing the process is to view it in terms of succeeding stages, usually described as concept design, pre-production, production, and post-production. Whereas these models can be used to describe the process itself, they appear to be hardly descriptive of *design* as an activity. Both models give accounts of the general characteristics of a game development process prescribing how the designers should proceed. The spiral model emphasises the role of testing and refining in iterative manner, while the stage model stresses the correct working order throughout the process. However, design is a much more complex phenomenon.

As pointed out by Kuittinen and Holopainen [9] research on game design is more focused in understanding the different aspects of gameplay than it is in understanding the nature of the activities of a game designer. The problem is better addressed in the field of design research in general where the design activities have been approached mostly from a cognitive framework [10, 14] or, more recently, from a linguistic standpoint [6]. However, understanding the designer offers only a partial view as it leaves out a large part of the complexity of the design situation. Understanding the reasons behind the designer's decisions requires taking into account also the process, the object of design and the context of the design [7]. The models used in this article were chosen due to their covering all of these factors.

2.1 The model of designing by Lawson

Emphasising the cognitive nature of designing, Lawson [10] describes design activity as a set of skills and thought processes commonly found in designing arranged into six categories. His model consists of activities defined as formulating, representing, moving, evaluating, bringing problems and solutions together, and reflecting. These categories do not necessarily have any kind of temporal order; they merely represent the different aspects of design thinking and can be overlapping and difficult to discern from each other.

2.1.1 Formulating

Whenever confronted with a design situation, the designer must be able to define and describe the elements in such a way that a representation can be made. The typical complexity of the design situation often forces the designer to work on a select set of elements. Understanding and developing the relations between the elements requires applying design knowledge and expertise. This activity Lawson [10] calls *identifying* as opposed to *framing*, which is the skill of actively looking at the situation from different viewpoints and focusing on a select set of elements.

2.1.2 Representing

Designer works mainly through representations. After formulating a design situation, an externalisation of it helps the designer to see it in an explicit form and helps both as an output and an input to the designer's thought process. This allows the designer to identify new aspects of and create solution ideas. A representation itself can take many forms, ranging from quick textual sketches to elaborate prototypes.

2.1.3 Moving

Creating solution ideas, or moving, is a central activity for a designer. According to Lawson [10], designers often create early solutions to problems that they have not yet even understood. This mechanism is called the *primary generator*, in which the designer has a simple but central handle to the design situation allowing her to make moves based on it.

Designers typically work by creating experimental moves and seeing how they work out. Interestingly, it seems that elemental design moves often take a form of surprises where a novel or creative solution may emerge suddenly while working on the design situation [5, 16].

2.1.4 Evaluating

During the design work, a designer is constantly applying implicit and explicit evaluations to all aspects of the design work. The ability to make and suspend judgements is clearly a crucial designer skill.

2.1.5 Bringing problems and solutions together

For Lawson [10], one of the central notions of designing is that problems do not necessarily precede solutions, but designers often generate solutions without clearly understanding the problems. More so, these solution possibilities often reveal new aspects of the original problem and create new problems. Lawson prefers to speak of problems and solutions as two aspects of the design situation instead of opposing concepts.

2.1.6 Reflecting

The ability to reflect upon one's actions is a critically important aspect of design thinking. Schön distinguished between *reflection-in-action* and *reflection-on-action* [16]. The designer is constantly reflecting on the current design situation in light of her prior experiences and creating new understanding of it [16]. This reflection-in-action is already contained in the acts of formulating, moving and evaluating, whereas reflection-on-action constitutes a higher level activity where the designer looks at the process instead of the actions.

Designer's own personal set of values, or design philosophy, which Lawson [10] calls the "guiding principles" affect and, in turn, are affected by each individual design project. Designers also often gather reference material and precedents turning them into design knowledge that can be applied to their own design processes. These factors typically have heavy influences in representations and solution ideas.

2.2 Three levels of abstraction by Löwgren and Stolterman

The model of designing by Löwgren and Stolterman [11] also concerns design thinking but gives a more thorough account of the design process than Lawson. Löwgren and Stolterman describe design primarily through the notion of abstractedness. Similar to Lawson, the designer works by gradually turning abstract ideas into more concrete descriptions through a process of externalisation of the design situation. However, this does not mean a simple linear process, but often constant leaping between different levels of abstraction, finally leading to the final artifact.

Löwgren and Stolterman [11] categorise design process by three levels of abstraction: *vision*, *operative image* and *specification*. The designer starts out with one or more visions that are often vague and can sometimes be contradictory and even elusive by nature. Even though a vision may have many forms, it always functions as a first organising principle helping the designer to structure the design situation through some desired properties

In the next abstraction level, the operative image, the designer gives an explicit form to the vision. While on this level, the designer works on the idea by creating new representations of the vision and solution possibilities. These can range from rough sketches to more detailed prototypes depending on the design situation. The important thing is that the operative image gives the designer and other stakeholders a more concrete understanding of the vision. As the designer works on the operative image, it will gradually be specific enough to act as a specification for the final artifact.

The crucial notion of the model is that designers usually work with multiple lines of design in parallel and that each of these lines can be in different level of abstraction. The process does not proceed in a straight line, but instead sur-

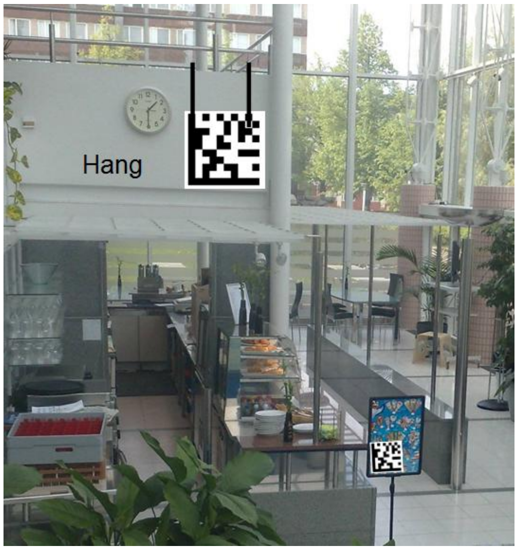

Figure 1. Photograph from the event site with an annotation and added datamatrices.

prising situations often lead the designers to more abstract ways of looking at the problem.

3. Method and data sources

This section describes the forms of documentation used as data and the method of the analysis. Several documents were created during the design and development process of NOCSH. In the first batch of documentation were the descriptions of the first nine concepts which each were required to be one page in size. The main form of design documentation was the design diary of one of the designers. The design diary was updated in such a way that it was easy to identify the design context for each new entry. The design diary also contained detailed descriptions of design meetings and playtesting sessions.

Other forms of documentation included 285 photographs taken at the event site, some of which were used by placing data matrices on the images and adding annotations (Figure 1). The source code of the game was recorded at different times in the development, resulting in 39 versions of the client and 33 versions of the server. Whiteboard sketches resulting from meetings were recorded as photographs (Figure 2).

First this data was inspected closely in order to have a detailed view of the design process. We then coded the design diary using Lawson's activity categories as the code book. Each paragraph in the diary was tagged for all the elements found in it. This was done by two researchers separately. The coded data was then analysed in light of the full data so that we could include also the contextual aspects of the design situation into the analysis. We had intended to also use the abstraction levels by Löwgren and Stolterman as a code book, but soon realised that they were unsuitable for our purposes. The main reason was that the vast majority of the data would have been coded to the operative image level. The only interesting switches were jumping back to the vision level when the evaluations at the operative image level proved that we had to change the direction radically in order to meet our design goals. Thus

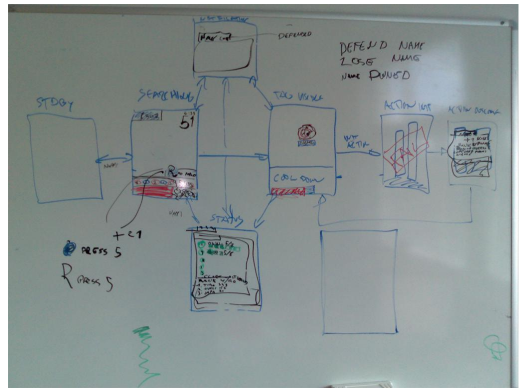

Figure 2. Photograph of a whiteboard from a design situation.

fully coding the data using Löwgren and Stolterman would have been a waste time.

Our research approach was mainly exploratory in nature. One of our research aims was to assess the suitability of using models such as described here as a game design research tool so we were trying not to be too rigorous in our methodological approach.

4. Analysis

This section describes the context and the dynamics of the design process for NOCSH based on the analysis of the data and the experiences of the designers themselves. It should be also noted here that two of the researchers doing the analysis of the design process were also the designers of the game.

4.1 Design Starting Points

There were two major starting points for the design: firstly, we had the opportunity to run a prototype game at Finncon/Animecon 2008 (www.finncon.org), one of the largest science fiction and fantasy conventions in the Northern Europe; secondly, we had a series of research questions left over from IPerG project (www.pervasive-gaming.org), such as activity blending and using physical objects and mobile phones for interaction, which we considered worthwhile to pursue further.

Finncon/Animecon 2008 was held at a big convention center, Tampere-Talo (www.tampere-talo.fi), 26th to 27th of July 2008, and the estimated number of guests was around 7000 during the two days. The audience was suitable for our exploratory game prototype. As is typical for such conventions there are usually several parallel tracks of presentations in addition to a myriad of other activities available at the same time. This also provided us further design constraints as the players should be able to easily switch between playing and not playing. The nature of these conventions is such that a playful framing is easier to achieve than in, for example, trade shows or scientific conferences. The atmosphere is sometimes even carnivalistic leading to a natural playful framing of the situation.

The convention setting, research questions from IPerG, and that the aim of the project was exploratory game design provided the first framing [10] of the design situation. Löwgren and Stolterman [11] describe this as the designers being "thrown into" the design situation, being confronted with the design task at hand and the environment where the design takes place, thus forming the very first and vague vision [11].

4.2 Concepting

These somewhat loose design constraints were the starting points for the first concepting round. Our designers ideated a portfolio of nine different concept descriptions all satisfying some of the constraints. This early concepting and ideation phase created several parallel and even contradictory versions of the vision [11].The concept representations [10] at this stage were brief one page descriptions of the main gameplay features. There were altogether nine different concepts created at this stage.

The concepts were: Ticket to Walk, a game where players gain points from walking from a place to another, while avoiding crossing paths with other players. Tourist Story Experience, where players would either create stories based on photographs taken at certain locations, or travel from photo to photo in order to experience those stories. In Hitchers and Rider Spoke meets BTID and Semacodes, players create, pick up, and drop "Hitchers" from bluetooth enabled devices or data matrices. MegaMäjäys is about players collecting cards from various sources, including data matrices, and creating alliances in order to create powerful card combinations to win points. In MMBlockPuzzle players play multiple block puzzle games against each other at the same time but also gain special modifiers by scanning data matrices they find in the real world. In Bet the Picture, players take pictures and bet in-game currency on them, hoping that other players will take pictures of the same or similar object. Bomb Cities is a game about battling other players with flying cities created by scanning data matrices to collect buildings. In Hide and Seek, players collect points by hiding in data matrices or bluetooth id's for a chosen duration. Own an Id is a variation of Hide and Seek, where players gain points for holding control over certain data matrices. All of the concepts support at least 20 simultaneous players.

Each of these concepts embodied one or more moves [10], which sharpened the initial vague vision into something more concrete. The concepts were then ranked by the designers themselves and mobile game experts outside the project. This evaluation [10] was based on subjective feelings of the evaluators.The concept that was chosen for further development was a version of hide and seek. The main reason was that in order to make the game playable in the chosen setting it has to be as simple and intuitive as possible. Even though only one concept was selected they all were part of framing the design situation from different points of view.

After the initial concept was chosen we refined the main research questions for the prototype to:

1. How should the game world be designed in relation to the actual physical location?
2. How should the interaction with physical game objects work?
3. How does the gaming experience differ from the gaming experience of traditional mobile games
4. What are important game design features when gaming is a secondary task for the players?

Refining the main research questions for developing the prototype was not only necessary for the research through design approach but also helped to frame [16] the design situation in a certain way and identify [10] the main elements, components, and problems for the design.

4.3 Bodystorming and Sketching

These questions framed as design constraints together with those entailed by the venue were the starting points for the next design phases: bodystorming [12] and very quick and dirty user experience sketching [4] to try out different interaction and game mechanics. Here the vision as the selected concept was guiding the creation of several operative images [11] of specific parts of the whole design. in the bodystorming phase the physical enactments of possible interactions were one kinds of representations of the design situation in the operational image abstraction layer [11].

At this point the physical objects were to be tagged with data matrices and interaction would have consisted from recognizing these data matrices using the phone camera. We chose to do bodystorming both at the real venue and in the laboratory. The real venue allowed us to get the feeling of how the people would move around the space, what kinds of places the game objects could be placed, and we were able to test things such as how different lighting conditions affected the data matrix recognition. In the laboratory setting we started refining the basic interaction and game mechanics with designers themselves and people outside the project as test players. Bodystorming was used both as a creativity technique and to very quickly test ideas for game mechanics. Several operative images as quick and dirty interaction sketches of specific design situations were created during the bodystorming phase. Leaping between the vision and operative images through constant moving, representing, and evaluation [10] the concept got gradually more and more concrete.

At this point we decided to make the first playable software prototypes and after a few days we had the first playable version with almost exactly the same game mechanics for testing. The major difference was that we forfeited the data matrices and started using fiducial markers. We were able to obtain suitable software modules for recognizing and tracking the markers using the reacTIVision approach [3] so that the software could be implemented in python on both client and the server side. Recognizing the fiducial markers was considerably faster and we could also track the position, orientation, and the size of the marker on the camera view finder in real-time. The first play test with the software prototype revealed that the core mechanics of hide and seek just were not adequate for the intended user experience. The gameplay quickly deteriorated into players running after each other and capturing markers in a mechanistic fashion. Thus, we decided to scrap the hide and seek game concept and selected another concept, "Own an ID" (OID), from the initial portfolio because of the similarities between the core mechanics. In OID the players can capture markers for their own and generate resources or points over time until someone else captures the same marker. In this stage the problems in core mechanics were revealed on the operative image layer, which then forced us to move back to the vision layer and in the end change the whole concept. The activities according to Lawson [10] consisted of first making the representation of a subset of the whole design as a software prototype and evaluating it with a play test. The bad results from the play test forced the designers to reformulate the design situation and make changes (moving) also in the vision layer. This time we already had the software components in place so we moved directly into quick and dirty iterative software sketching.

4.4 Early Playtesting

During the first couple of test rounds we still did not have adequate game mechanics in place so the test players were the designers themselves. This allowed us to quickly try out changes in game mechanics and especially in how the information is presented to the players. At this stage the game did not have a theme and the graphics consisted of text, numbers and rectangles and ellipses in different colours. The poor audiovisuals and the missing theme helped first us as the designers to concentrate on what matters: the game mechanics.

In the later test iterations we observed the same during the test player interviews; by omitting the theme and keeping the audiovisuals as simple as possible forced the test players to keep the focus on the gameplay itself and in the later brainstorming sessions the test players were open to suggest changes to game itself and propose what the final theme would be like. The feedback gathered from these sessions forced us to, for example, reconsider how the players were informed about what other players were doing and what kinds of progress indicators were suitable in which situations.

One more thing to consider was to discourage players to remove the markers from their positions. We changed the scoring system in such a way that the player owning the marker does not get points until other players use their mobile phone cameras to check the marker (in other words, when the other players' phones recognize the marker).

4.5 Fine Tuning the Interaction and Game Mechanics

At this point the core mechanics of capturing and controlling markers to gain points were almost the same as in the final game. One thing which was still unsatisfactory was the capturing mechanism. In the first versions the capturing was done by pressing a button at the correct time determined by a fast moving progress bar at the bottom of the screen (Figure 3). Both the designers and the playtesters considered that there was something lacking, that there was a disconnection between the physicality of moving around to find the markers hidden in the environment and then just pressing a button. We started bodystorming focusing on the capturing mechanism. We finally settled on a mechanism where the user first builds up "energy" by shaking the device and then presses a button as near as possible to the release point. In the final version, moving the camera around while still keeping the marker visible would build up the energy. This mechanism retained the physicality even in the most basic interaction mode of the game and did not require any additional components from the device. As an additional benefit, it kept the players eye on the screen at all times, thus avoiding players having to refocus on the mobile phone screen after shaking.

Figure 3. Screenshot showing the main view of the game with a marker detected.

5. Discussion

It was clear from the analysis that using the two models from design research provided more insights into experimental game design as a design activity than the iterative or the linear stage models. The models from design research, Löwgren and Stolterman's three levels of abstraction and Lawson's model of designing, highlighted how sometimes even chaotic design activity still does have a structure: it is possible to classify different design situations and decisions according to the models. The designers of NOCSH were not aware of the models at that time they were designing the game but the analysis revealed unexpected things about their own design activity. The models can be used as a way of raising the designers' own awareness of how they are doing the design itself. Both the iterative and stage game design models treat the design activity itself as a black-box and the design research models presented here seem to capture the nuances of that design activity in a useful and complementary way.

6. Conclusions

Bodystorming, sketching, and prototyping methods were used in an iterative manner, allowing us to test out different interaction modes and mechanics in a dynamic fashion. It was important to have the design constraints and the research questions clear for all members of the team, even though they did change during the design process when we were able to identify paths not worth exploring any further. The decision to keep the theme of the game abstract as far as possible was another major advantage. This allowed the designers and the early test players to focus on the interaction and the game mechanics without getting sidetracked or fixated by the theme. The two complementary models of design were used to analyse the design process. The models give a good overview to an experimental game design process and reveal activities, design situations, and design choices which could have otherwise been lost in the analysis.

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