How Mobile is Mobile Gaming? Contextual Influences on Mobile Player Experience – A Model Proposition

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ABSTRACT

In this paper we are discussing a new model of mobile gameplay experience with a special focus on contextual influences of play in ubiquitous environments. The model was developed based on prior general gameplay models which were extended and refined based on the results and personal experiences taken from several evaluative user field studies with mobile games. The experimental results point to two different playing contexts: home and mobile, which were evaluated with a gameplay experience questionnaire (GEQ). The GEQ showed significant difference in negative affect and immersion between mobile and home setting, which are moderated by several influencing contextual factors. This leads us to propose a contextual gameplay experience model that accounts for spatial, temporal, social, cultural, and psychological influences in an external context. The implications of the contextual gameplay model are discussed in light of future research.

Keywords

User Experience (UX), mobile gaming, evaluation techniques, quantitative methods, field study

INTRODUCTION

The question why players enjoy games has been around since the time people have first started to play. Designing a satisfactory player experience is one of the few fields and has hardly been touched by the growing body of game research with a few exceptions [15]. However, it is one of the most interesting research areas to be explored, because today digital games are among the favorite leisure activities of billions of people around the world [22]. In our daily life, digital gaming battles for a share of an individual's leisure time with plenty of other activities like reading books, watching movies, listening to music, or surfing the internet. As the game industry is predicted to keep on growing, new markets and a broader audience are coming into focus of developers and publishers.

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For example, with the introduction of the Nintendo Wii gaming console on the market, a growing shift of investigations in game research and industry has been happening toward human computer interaction (HCI) aspects of digital games. The same is true for studies using Apple's iPhone and other mobile phones as ubiquitous novel interaction and gaming devices [26] that allow new forms of play in the real world without physical boundaries and starting to integrate a variety of contextual information [18]. Additional industrial examples for this ubiquitous trend are Microsoft's Project Natal and Sony's use of Eye Toy as a video input tracking technology for novel game interaction.

Koivisto [12] argued that while mobile gaming will not change radically in 2010, casual games are more important than hardcore games for mobile gaming audiences to generate the lion share of revenue. She also argued that mobile phones will become more pervasive and are used as playing tools for children. She stressed the importance of snack size (i.e., casual) games that work in many kinds of contexts and allow for easy entry into and getting out of the game. Hall [10] hypothesized that gaming and communication will merge into a constant condition of machine-mediated social interaction with the advent of mobile gaming platforms. He also stressed the importance of the environmental context on game design, arguing that mobile games are generally designed for passing moments, where they cannot be the sole center of player attention.

Hence, in HCI research, digital games are recently being studied from a UX and user-centered evaluation perspective [19, 17]. Gameplay experience as such is currently evolving as a fundamental concept in an expanding field of work with a strong empirical research focus that applies methods from human-computer interaction, usability, computer science, neuroscience, media studies, and psychology to name a few. However, not many field studies are available that have analyzed gameplay experience in a mobile setting. This paper attempts to fill this gap by providing the methodology and results of two user studies concerned with mobile gameplay experience.

RELATED WORK

Different models of gameplay experience exist (see [15] for an in-depth review and discussion).

Fernandez proposed a gameplay experience model, which has its focus on temporal influences before, during, and after gameplay experience in player-game interaction [7]. The model regards *fun* as the chief component of player experience, being created as a part of emotional and cognitive player reactions. The model further proposes that game evaluation should concentrate on these reactions.

A different approach made by Sánchez et al. tried to map usability to playability for evaluating UX in games by deconstructing playability and integrating methodological considerations from game development practice [23]. The paper proposes six playability facets: *intrinsic, mechanical, interactive, artistic, intrapersonal/personal*, and *interpersonal/social playability*. Two limitations are apparent in the model: a) The derivative process of creating playability concepts from desktop usability definitions is not described; b) There is no empirical evidence or methodology for testing the proposed definitions, making this unsuitable for direct deployment in an industrial testing environment.

IJsselsteijn, Poels, and de Kort theorized that *immersion*, *tension*, *competence*, *flow*, *negative affect*, *positive affect*, and *challenge* are important elements of gameplay experience and developed a game experience questionnaire (GEQ) to assess these elements, which will be used in the user studies [11].

Korhonen & Koivisto [13] presented playability heuristics modules for *game usability*, *mobility* and *gameplay*. Their heuristics for game usability concern functional and audiovisual playability evaluation and relate to structural content of a game. The mobility heuristics address characteristics of mobile gaming contexts such as unforeseen interruption of the player by events in his mobile gaming environment, accommodation of the game with surroundings as well as quick and easy usage of the game, to allow for "snack" gaming. While the paper discusses typical constraints of mobile gaming it does not provide a framework to describe it holistically.

Several models of usability for games have been discussed by Nacke [16], who developed a hierarchical model of game usability, which maps game testing in terms of its abstraction level ranging from concrete technology-focused testing to abstract community testing, where the social factors of gaming are taken into account. However, while contextual experience could also be located as an abstract form of player experience, community testing does not encompass all forms of contextual influence that are important for this kind of experience. Therefore, this model needs to be extended to include contextual influences.

Player Experience and Context

Context can be understood as any or all information that characterizes the situation of a certain entity, which could be a person, place, or object relevant for user-product interaction [4]. However, only a few theoretical models of player experience have explicitly accounted for contextual influences. For example, Nacke [15] developed a gameplay experience model with three frames, game system experience, individual player experience, and framed context experience. He describes the contextual experience of gameplay as the quality of player-game interaction in a given social, temporal, spatial, or other context.

Paavilainen et al. [18] note that the context affects the interaction between player and game and take a pervasive gaming approach to understanding and incorporating contextual influences into mobile gaming. They present four categories of context developed from a user study: environmental context, spatio-temporal context, proximity context, and social context. They proceeded to implement a mobile game, which makes use of contextual information in its game design. For example, they used environmental contextual information, such as temperature, weather and astronomy or location and time as spatio-temporal information. Their user study indicated that time might be the most interesting contextual information. However, they also noted that including this information in game design adds an additional layer of challenge for players.

Mäyrä [14] discusses a theoretical contextual game experience model. He explains that every gameplay experience is *"intimately linked with the immediate personal contexts of digital play"* and suggests a more holistic approach when describing gameplay experience, going beyond individual experience. Thus, his contextual model focuses on social and personal contexts. He describes gameplay experiences as *pre-defined*, *modified,* and *post-defined* events outlining the temporality of gameplay experience. It is then proposed that a deeper understanding of both, historical depth and socio-cultural spread of gameplay experience, can help directing research efforts. Although it is claimed that other influences – beyond social and personal context – may be important for gameplay experience, those influencing factors are not identified.

While research on player and gameplay experience is steadily growing, recent tools [11] have not yet been applied to mobile gaming. With the advent of mobile applications and digital games using augmented reality, geographic location data, or social networks as gameplay elements (e.g., Foursquare, Farmville), mobile gaming is set to become even more complex to design and evaluate. For developing high quality mobile games, we need to understand the characteristics of mobile contexts and their implications for players. Although related literature points to several attempts of creating models that describe contextual or mobile gaming experience [13, 15, 14, 18], we lack a comprehensive understanding of influences on mobile gaming.

The studies in this paper aim at extending the understanding of mobile gaming experiences. Every location is a possible gaming context with mobile phones [10]. Hence, researching the influence of variable spatial contexts on player experience appears like a good starting point for this research. Nevertheless, the user studies were designed in a way that allows incorporating other contextual influences as well.

USER STUDIES OF MOBILE PLAYER EXPERIENCE

This paper examines player experience with games on mobile phones and contextual influences on playing. Following from the discussion of influencing factors of the mobile gaming experience, we set out to create a mixed-methods study that investigates the impact of contextual influences on player experience in different settings. Our goal was to first frame contexts for playing with mobile phones according to qualitative results from an online survey. Then we set out to extend and validate our framing for contextual player experience using ad-hoc interview sessions and behavioral observations of players. This led us to design an empirical main study that investigated the influence of spatial context to player experience using a game experience questionnaire (GEQ) [11].

First, we are going to describe the two prestudies, an online-survey and ad-hoc interviews with ethnographic observations that led to our basic understanding of mobile gaming contexts. Next, we are going to present the follow-up main study, which builds on these initial findings and tries to explicitly evaluate different dimensions of player experience in diverse mobile gaming contexts.

Prestudies

The comprehensive main study was preceded by two smaller prestudies, which served as a primer to collect information about mobile gaming contexts.

Online Survey

We conducted an international online survey with Amazons crowdsourcing[4] web service Mechanical Turk [1]. The survey consisted of two closed yes/no questions (*Do you own a mobile phone? Do you regularly play games on your mobile phone?*) and three open questions (*Where are you usually when you play games on your mobile phone? Why do you play games on your mobile phone? What type of games do you play on your mobile phone?*). Three automated public Turing tests were added to tell computers and humans apart (CAPTCHAs) and filter out bots and scammers. The survey was placed on Mechanical Turk in two batches with a time discrepancy of 12 hours, to increase the probability of international participation. Both batches had a maximum limit of 50 participants. Each participant was rewarded 5US cent upon completion. Repeated participation was not possible.

Ninety submissions could be used for later analysis. The open questions were analyzed intellectually through an iterative clustering process.

A total of 110 statements regarding mobile gaming contexts were identified. Most answers were formed as short one or two sentence statements. For example:

> P3: *"I usually play games while I'm in the bathroom or while I'm on the bus. It helps pass the time."*
>
> P6: *"I play while riding the trolley on my way to work. People see me playing and are less likely to try and start random conversations."*

All statements were divided into two context categories: *mobile* (71 statements indicated "on the go" contexts) and *home* (39 statements indicated "at home" contexts).

Typical usage scenarios for mobile gaming on the go were commuting and gaming while waiting for or during public transportation. Other situations mentioned included: At work, at school, in waiting rooms or generally in waiting situations. Typical gaming contexts at home were for example: On the couch while watching television or while relaxing, in bed before going to sleep, and also in the bathroom.

The majority of statements concerning the motivation for mobile gaming described it as a way to kill time. About one out of four statements explicitly addressed fun, challenge, or recreation as motivation to game on a mobile phone.

The online survey provided a fundamental understanding of two contextual categories: *mobile* and *home*. In addition, we found out only a few participants were motivated by challenge to play mobile games, but more by killing time (i.e., by on-demand entertainment). Therefore, the follow-up study did not only include participants who occasionally used mobile gaming as a time killer (i.e., casual gamers) but also people with a more competitive attitude (i.e., hardcore gamers), because they may value different elements of mobile gaming experience.

Ad-Hoc Interviews and Observations

For validation of these results, we conducted informal ethnographic studies over the course of one week. We observed people in typical mobile gaming contexts (e.g., public transportation, waiting room) and at home. We conducted ad-hoc interviews on the mobile gaming behavior of people using their mobile phones in these contexts.

The data of 16 participants in five German cities validated the two different gaming contexts that were identified in the online survey prestudy with mobile contexts as the dominant use case. Moreover, the interviews gave us a first insight into the complexity and the influencing factors of mobile gaming. The topics mentioned by multiple participants were for example:

Gaming Hardware: Mobile phones were found to be particularly suited for mobile gaming because of their size and availability. Other mobile gaming devices, such as the PlayStation Portable (PSP) or the Nintendo DS (NDS) were considered too bulky to be carried around conveniently. A mobile phone combines the functionality of multiple devices (e.g., camera, media player, gaming platform, PDA). Thus, casual players are not willing to carry another device solely for the purpose of gaming. A few participants stated, if their mobile phone has a low battery, they do not use it for gaming, because staying connected is more important for them than gaming. Here the mobile gaming hardware influences gaming behavior directly.

[4] Using a large group of people to contribute to a task.

Implicit and explicit constraints: Participants talked about situations in which they did not play on their mobile phones. They reported implicit or explicit constraints for mobile gaming. Explicit constraints can be *temporal*, such as available time, or *spatial*, such as a comfortable seat when gaming on the go. These constraints can also be *social* and *cultural* regulations. For example, it might be inappropriate to play in a certain environment (e.g., in a church) or presence of other people (e.g., at a funeral).

Motivation: Most participants described mobile gaming as an enjoyable way to kill time, valued especially for its ubiquitous availability and its instant entertainment for short time episodes. In mobile contexts, other forms of entertainment compete with mobile gaming such as reading a book, listening to music, or simply having a conversation. For some participants mobile gaming was only a last resort, if there is no other way to engage in diverting activities.

Reasons to avoid mobile gaming: Some interviewed individuals considered mobile gaming a waste of time, while others said they would enjoy a casual gaming session if the quality of available mobile gaming systems was better. Their criticism mainly addressed hardware issue, such as tiny screens and poky keypads, but they also criticized software in terms of bad games that they did not enjoy playing and poor graphics. A special complaint was also the bad user experience of buying and installing games.

We learned from this field research, that mobile gaming experience is subject to many influencing factors. Besides insights into gaming hardware and motivation for mobile gaming, we also observed how implicit and explicit constraints influence mobile gaming behavior. For example, we saw people moving around in public spaces looking for a way to sit, so that they would have an environment free from distractions and bystanders, usually involving sitting close to a wall or other sight-blocking objects. This observed attempt to create privatized gaming areas within larger social and spatial contexts is in line with related literature on mobile gaming behavior [25].

Main Study

Based on insights from the prestudies, we designed a main study to measure the influence of different spatial contexts on mobile player experience empirically. Our initial hypothesis was that different spatial context influences the subjective game experience. However, we could not yet argue about the direction of this influence.

Design

We designed a 1×2 between-subjects user study with spatial context as the independent variable, having two levels following our categorization developed in the prestudy (context: *mobile* as experimental group and *home* as control group). The mobile or "on the go" context used a public transportation circle line of an inner city tram, whereas for the home context, we used an office room redecorated as a living room. We used the GEQ dimensions: immersion, tension, competence, flow, negative affect, positive affect, and challenge as dependent variables [11]. The experiment was designed as a semi-structured game experience test, based on a quota sample and also included short interviews before, and after the interaction with the game stimuli.

Participants

We used a professional agency for participant recruitment. A total of 35 participants were screened for an equal distribution of the characteristics *gender*, *age*, and *gamer type* and *iPhone usage*. In total, 17 male and 18 female participants were recruited, aged between 18 and 46 ($M = 29$, $SD = 8$). We used three age groups 18-27 ($n = 14$), 28-37 ($n = 16$) and 38+ ($n = 5$). Furthermore, the participants were classified as casual gamer ($n = 20$) and hardcore gamer ($n = 15$)[5]. The sample was balanced across all attributes. All participants owned an iPhone for no less than one month and had at least once played games on their iPhone.

Stimulus Materials

As gaming device the iPhone 3GS was used, featuring a 3,5" widescreen Multi-Touch display with a resolution of 480 x 320 Pixel at 163 pixel per inch and an accelerometer, proximity sensor and ambient light sensor, as well as support for OpenGL ES 2.0, a library for real-time 3D rendering APIs. We chose two iPhone games as stimulus material based on a self-developed metric: We calculated an index (ι) that factors in adjusted ratings (ρ), web popularity[6] (δ) and sales of the 100 most popular iPhone games from 2008/2009 (ς): $\iota = \rho + \delta + \varsigma$. From the top ten games calculated with this index, we chose *Bejeweled 2* [21] and *Super Monkey Ball* [24], because they could be used for a test session no longer than ten minutes. In pretests Super Monkey Ball (SMB) was rated difficult, while Bejeweled 2 (BJ2) was perceived as easy.

Bejeweled 2: Bejeweled is a match-three, gem-swapping casual puzzle game (see Figure 1).

Figure 1: Playing field of Bejeweled 2 [21].

[5] This classification was based on their agreement to six different statements about their gaming habits (e.g., *"I spend most of my spare time playing games"* as hardcore gamer characteristic).

[6] Word count analysis of web resources on iPhone games.

Players must match colored jewels horizontally or vertically in lines of three to clear them from the board. Lines of four or five jewels are awarded with special gems that trigger unique jewel-clearing effects. For every cleared gem the player is awarded points. Playing the endless mode, the game ends, once there is no more gem-swap possible.

Super Monkey Ball: SMB is a skill game that uses the iPhone's integrated accelerometer as steering input for a monkey in a transparent ball by tilting and rolling through slopes and turns to a goal (see Figure 2).

Figure 2: Super Monkey Ball level finish line [24].

The player has to navigate obstacle courses within set time limits. If the ball falls down from one of the platforms forming the course, players lose a life. By collecting bananas along the way remaining lives can be increased. The game ends, once all 110 stages are completed or all lives are lost.

For BJ2 we used the "endless play" game mode and for SMB we used the default settings with the "baby" character as player avatar.

Experimental Measures

We used a Canon Digital IXUS 70 for video recording in both, *mobile* and *home* context setting. Additionally, an Olympus WS-100 Dictaphone for backup audio recording was employed. Field notes were gathered in a notebook: After testing a participant we wrote the most important statements and observations on sticky notes for later analysis.

To assess game experience we used the German version (33 items) of a game experience questionnaire (GEQ) [11], which combines several game-related experiential measures. The questionnaire was developed based on focus group research [20] and investigations among frequent game players. It consists of seven dimensions: *flow*, *challenge*, *competence*, *tension*, *negative affect*, *positive affect* and *sensory and imaginative immersion*. Each dimension is measured, each using 5 questionnaire items in the full version (except the immersion dimension, which has 6 items). Each item consists of a statement on a five-point scale ranging from 0 (not agreeing with the statement) to 4 (completely agreeing with the statement).

Procedure

Before the start of a test session, participants filled out a short survey about their gaming behavior. Afterwards they were briefed about the procedure of the experiment. Then the first part of the interview was conducted, which mainly served as an icebreaker. It was used to gather information on prior mobile gaming experiences and typical mobile gaming contexts. Next, the participants were introduced to the games that served as stimuli. Participants were then assigned to either the *mobile* test setting or the *home* scenario. The stimuli were presented in a counterbalanced order.

Home: Participants were walked into a redecorated office room, which usually functions as a usability laboratory. The room was embellished to mimic a living room (for achieving ecological validity) and participants were asked to sit on a couch. The iPhone was then loaded with one of the two games and handed to the participants. Next, they could play the game as long as they want to. The moderator then left the room to avoid influencing the game experience by his co-presence. Once the participants did not want to play any longer, they called for the moderator, or after a maximum of ten gameplay minutes, the moderator returned and asked the participants to fill out the game experience questionnaire. On completion of the GEQ the same procedure was repeated with the second game stimulus.

Mobile: In the mobile test context the general procedure was the same as in the stationary test setting. During the test, participants and moderator were riding a tram. The participants were allowed to sit wherever they wanted. During game sessions the moderator positioned himself outside the participants' field of view and operated the camera.

In both test settings the sessions closed with an interview, where participants were asked to recall their experiences during the game sessions. We also questioned them on any disturbances they felt during the game sessions and for differences between the test situation and their usual mobile gaming experiences.

Data analysis strategy

We transcribed the audio and video recordings for every participant. Then, reoccurring statements and observations were identified. Additionally, the sticky notes that we labeled to gather the most important impressions after every game session were used complementarily to visualize emerging patterns of mobile gaming behavior. The survey data together with the data from the game experience questionnaires were analyzed using SPSS.

RESULTS

GEQ Results

For assessing 7 dimensions of game experience, the GEQ was used [11]. The comparison of average scores is shown in Figure 3 and 4. In SMB and BJ2, immersion was higher in the *mobile* setting than in the *home* setting. Surprisingly, negative affect was also higher in *mobile* settings for both games. Additionally there were higher scores in *mobile*

settings for tension with SMB and unexpectedly for flow with BJ2.

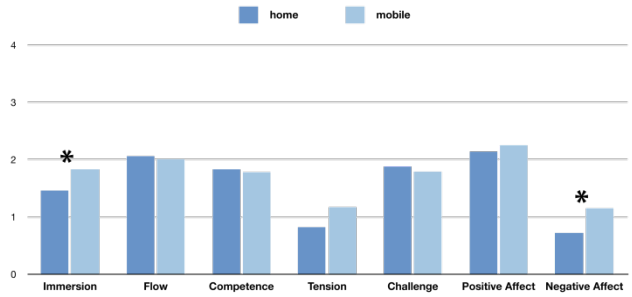

Figure 3: GEQ results for Super Monkey Ball

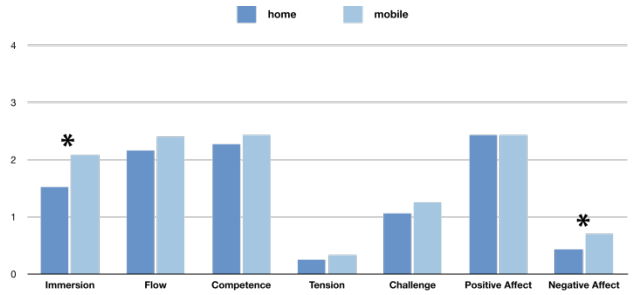

Figure 4: GEQ results for Bejeweled 2

Before conducting analyses of variance (ANOVAs), a Kolmogorov-Smirnov (KSM) test for Gaussian distribution and a Levene variance homogeneity test in SPSS were used to check the requirements for parametric analysis. Because of significant results for the dimension tension ($M = .24$, $SD = .41$, $Z = 1.78$, $p < .05$) for BJ2 in the *home* scenario with the KSM test, as well as significant results for challenge ($F = 4.37$, $p < .05$) and positive affect ($F = 4.8$, $p < .05$) with the test of variance between the *mobile* and the *home* scenario, no parametric tests could be conducted for these dimensions. Instead, a non-parametric Wilcoxon-Mann-Whitney test was used, but showed no significant results.

For all other dimensions ANOVAs were conducted in SPSS using the test setting as between-subject factor and gender, age and gamer type as co-factors. The results indicate higher GEQ scores in the *mobile* setting for the dimensions *immersion* and *negative affect* for both stimuli.

Statistical significance for the factor test setting was achieved for immersion in BJ2 ($F(1, 19) = 4.57$, $p < .05$), immersion in SMB ($F(1, 19) = 4.57$, $p < .05$) and negative affect in BJ2 ($F(1, 19) = 5.01$, $p < .05$). Using no other co-factors and only conducting ANOVAs for the between-subject factor test setting, significant results were also achieved for negative affect in SMB ($F(1, 33) = 2.67$, $p < .05$). This suggests that the participants had a more immersive game experience in the *mobile* test setting, although they felt stronger negatively affected compared to the *home* setting. Unfortunately, no significant results could be found for other dimensions.

The multivariate ANOVAs revealed some interesting interactions between *setting* × *age (classified)*, *setting* × *gamer type* and *setting* × *gender*.

We found some surprising interactions for *setting* × *age (classified)* for the dimensions challenge in BJ2 ($F(1, 19) = 7.48$, $p < .05$) and negative affect in BJ2 ($F(1, 19) = 20.26$, $p < .01$). The age group 18-27 shows the highest scores in the *home* test setting, followed by the age group 28-37 and 38+. In the *mobile* test setting this distribution is reversed, with the groups 38+ and 28-37 achieving the highest scores, whereas 18-27 stays at the level of the *home* test setting results, or even drops below that level. This indicates that age modifies the response intensity.

A similar interaction was found for *setting* × *gamer type* for the dimension immersion in SMB ($F(1, 19) = 5.27$, $p < .05$) where hardcore gamers report lower scores in the *home* test setting than casual gamers, which also reverses in the *mobile* test setting. Therefore, we assume that hardcore gamers are less prone to distractions in mobile gaming environments.

Additionally for *setting* × *gender* we found an ordinal interaction for the dimension negative affect in BJ2 ($F(1, 19) = 15.04$, $p < .01$) as shown in Figure 5. Male and female participants show similar results in the *home* setting. These results change considerably in the *mobile* setting, where male participants show significantly higher scores than female participants.

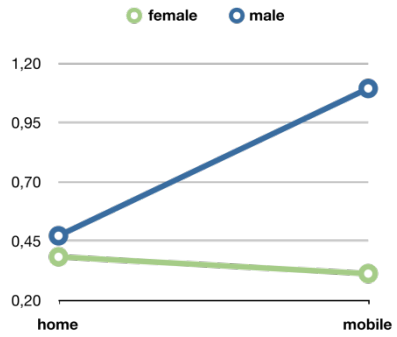

Figure 5: Interaction effect of *setting* × *gender* for negative affect with Bejeweled 2

Interview and Observation Results

Through our iterative observation analysis process we identified several main themes, which we hypothesize to have an influence on mobile gaming behavior and player experience. We describe these controlling themes as *spatial*, *temporal*, *social*, *cultural*, and *psychological* influences. It is important to point out that all of these influencing factors are somehow interconnected and thus cannot be seen as isolated phenomena.

Spatial influences: In a broader sense, spatial influences describe the physical environment, in which the player interacts with the game system. These include not only the absolute position of the player (e.g., at home in bed, sitting in a bus), but also elements such as weather conditions,

lighting conditions and noise level. Moreover, they describe the direct surroundings of the player, like the seating availability, the player's physical body position, and available space to operate the gaming hardware.

Temporal influences: The effect of time on mobile gaming behavior is twofold. First, different times of day and their unique meaning for players influence mobile gaming experience (e.g., gaming to fully wake up in the morning, gaming before going to sleep at night). Furthermore, the available time for mobile gaming in a given situation influences mobile gaming itself (e.g., "Do I have enough time to start gaming? Can I do something else, when I have more time to kill?").

Social influences: Social factors, like all other influences mentioned here, are subject to individually different interpretation. They describe the relationship of players to their peer group and their role in all social environments they encounter. Social influences can manifest as situational and spontaneous relationships between multiplayer activities as either teammates or enemies in a co-located or separated gaming environment (see [3] and [8] for a discussion of the influence of social setting on player experience). In addition, social influences are experienced by presence (or absence) of other people in the gaming environment (e.g., people that are known to the player, people that are unknown to the player, people that are involved in the gaming activity, or bystanders).

Cultural influences: Habits, fashionable activities and trends are all factors of cultural influence. Many implicit rules have to be interpreted by players. Questions, whether it is culturally accepted to use mobile phones for gaming in certain situations arise (e.g., "Is it ok to play with activated speaker sound in public transportation? Does my significant other care if I play while chatting with her/him? Is it appropriate for my public presence to be recognized as a gamer?").

Psychological influences: On a psychological level we can describe players' motivation for playing games (e.g., relieving boredom, experiencing challenge, enjoying rest and relaxation, having fun), their attitude toward gaming and their past experience as well as their expectations. Most of the other influences trigger psychological influences (e.g., noise level of a gaming environment interfering with cognitive capacity of players, or presence of bystanders causing fear of failure and physiological reactions).

Our observations and interpretations of the interviews regarding influencing factors on mobile gaming just scratch on the surface of the complexity involved in player experiences and behaviors. We feel that there is a demand for a holistic model of game experience allowing an integration of previous research results, while leaving enough room for future extensions. Thus, we next propose a contextual gameplay experience model.

THE CONTEXTUAL GAMEPLAY EXPERIENCE MODEL

Previous models of gameplay experience have used time [4, 7] and abstraction [9, 6] as taxonomical dimensions. It has been argued, that gameplay experience can be seen in three different layers of abstraction [15, 16]. Based on this groundwork of abstract layers of gameplay experience, which describe game system, player, and context as different interaction layers, and following from the results of our surveys and field study, we developed our contextual gameplay experience model.

One critique of existing gameplay experience models is that they define context in a general way, describing it as a black box of unknown processes. Yet our field studies showed that the concept of context could be broken down into a set of different and interlinked characteristics.

Dourish [6] argues that context per se is non-existent. He assumes instead that something is of contextual relevance to an individual or not. Context is described as an occasional and relational property that dynamically arises from an activity based on the interpretation of different factors or entities. When we talk of context, we therefore must consider that a specific context cannot be defined in advance, because it is *"relevant to a particular setting, particular instances of action and particular parties to that action"* [6]. Reconsidering existing game experience models we suggest further specification of the existing understanding of what has been called context so far. We recommend replacing the term context by different dimensions of influence on the player and we have described some of these influences and their correlations. We should do this, because the interpretation of these influencing factors leads to player action and/or behavior affecting gameplay experience. This description of interlinked internal and external influences therefore provides a more comprehensive and more general idea of gameplay experience.

Our model (Figure 7) represents three layers of abstraction (following the ideas in [15, 16]) describing the game system's *playability*, the *player experience* emerging through the interaction with the game system and the *contextual gameplay experience* formed by the interpretation of internal and external influences.

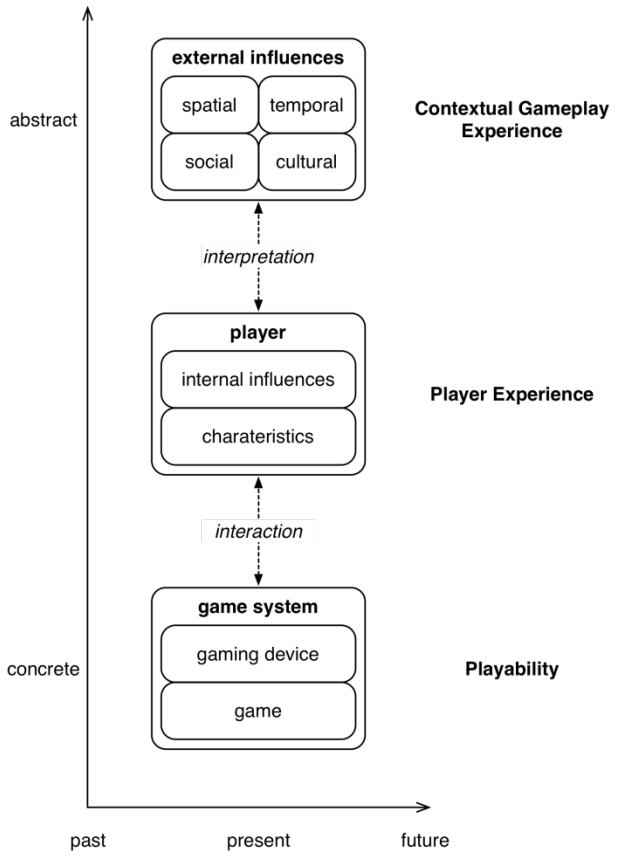

Figure 7: The contextual gameplay experience model

On the bottom layer, the game system represents the gaming device (e.g., console, PC, mobile) and the game itself (i.e., genre, complexity). Through functionality, rules, form factor, controls, game mechanics, and other means it influences the player interacting with it [15]. We summarize these mainly functional and basic aspects of gaming with the term *playability*.

The second layer describes players with their unique characteristics (e.g., gender, age) and internal influences (e.g., motivation, past experience). The player interacts with the game system forming what we call *player experience*. So far, the model is basically a refinement of the ideas present in [15].

On the third and most abstract layer we describe external influences that are interpreted by players, thus altering their gaming behavior and therefore also their gaming experience. We call this comprehensive layer the *contextual gameplay experience.* It describes contextual influences that can appear as an interlinked mixture of spatial, temporal, social [8], or cultural factors (another approach of breaking down contextual experience influences which inspired us was the one taken in [2]). Together with the game system these factors form what we call external influences as opposed to internal influences inherent to the player as described on the second layer.

The contextual framing of gameplay experience to include subsets of player experience, which in turn includes playability, is a promising advance of the ideas described in [15]. Rather than providing a methodological frame for player evaluation, our model attempts to frame experience with special regard to the overarching contextual influences that can affect each subset of gameplay experience.

DISCUSSION AND FUTURE WORK

Using the GEQ we were able to show that different spatial contexts (*mobile* and *home*) have an influence on the dimensions *immersion* and *negative experience* for mobile gaming experiences. For both games, there were significant higher scores in the *mobile* scenario than in the *home* scenario. We believe that the multitude of influences constraining mobile gaming in our test setting led to an increased effort to focus on the gameplay in order to filter out the surroundings. This may lead to a stronger awareness of immersion during gameplay, while external constraints of mobile gaming context result in less positive gaming experience compared to the *home* setting. That also brought to mind the concern for contextual influences on gameplay experience in general, which were later manifested in an extended gameplay experience model.

The different interactions we found with significant different effects of the *mobile* and *home* setting for *gender*, *gamer type* and *age* show the highly individual character of mobile gaming experience. This indicates that a combination of internal influences (e.g., gender, age, player type, experience, motivation) and external influences (e.g., spatial, temporal, social, and cultural surroundings) affect players and subsequently their general gameplay experience.

The different interactions could be explained as follows: For setting × gender, we could assume that mobile contexts lead to more negative experiences for men than for women (however, a relationship between game type and gender might also be assumed, as only few females will classify themselves as hardcore gamers). Our interviews also indicate that female players focus on the experience with the device itself, not so much on the game [5], which could mean that they are not driven by the competition in a game and less desire to win the game than males. Thus, we could hypothesize that external factors have less influence on a female's gameplay experience than that of a male player. A male player might however be less prone to environmental influences, since he will try to win a game even in an uncomfortable environment, because his sense of competition is stronger than his need for a pleasant gaming environment.

For the interaction effect of setting × gamer type, we could assume that hardcore gamers are not influenced much by mobile contexts and are more easily immersed in the game [3]. This is in line with our assumptions for male players and their embracing of competition as a main driver of player experience. The question remains whether this sense of competition does also facilitate immersion in a game. A different idea might be that at home hardcore players have different consoles or stationary gaming devices. They serve as a reference frame for them, which could make gaming in

home settings less immersive because it is instantly compared to these quasi references.

For the interaction effect of setting × age (classified) for negative affect and challenge, we could assume that the age affects the ability to filter out the surroundings in mobile gaming settings. While younger players can cope with these influences in mobile contexts, older players seem to be easily affected. Thus, they could perceive the game as more challenging and the overall experience as negative in comparison to more quiet and relaxed home environments where age seems to have no influence on these dimensions.

The multitude of the contextual influences on gameplay experience led us to the contextual gameplay model, extended from the ideas in [15], which integrated contextual influences and accounts for the possibility that they may affect other forms of gameplay experience which are not directly related to context (such as player experience and playability). We believe that this comprehensive contextual gameplay experience model can serve as a starting point for more empirical studies that investigate the different influence types present in mobile and other gaming environments.

Finally, many paths for future work open up from this research. On the theoretical side, we are trying to create a framework that can be used in practice and research, which means that it needs to be understandable for both industry and science, so that it can be applied to the design and evaluation of games as well as research. While this is a rather complex field, we believe that our model can be used as a basis for more detailed explanation of gameplay experience. On the practical side, we have shown a methodology to evaluate mobile gameplay experiences that has yielded results supporting our initial thoughts of contextual influences on gameplay experience. We believe that by accumulating more mixed-method data on player experience in different settings, an empirically founded refinement of our model is feasible in the future.

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