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# Entertainment Computing

journal homepage: [ees.elsevier.com/entcom](http://ees.elsevier.com/entcom)

## Contextual influences on mobile player experience – A game user experience model

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### ARTICLE INFO

#### Article history:

Available online xxx

#### Keywords:

User experience  
UX  
Mobile gaming  
Player experience  
Game user research  
Game metrics  
Playability  
Field study

### 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.

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### 1. Introduction

Video games are starting to become a topic of interest for user experience (UX) designers and likewise more game researchers are turning towards UX for inspiration about game design and evaluation. However, both fields lack a conceptual understanding of the elements of player experience when discussing, analysing and designing games. While becoming an important topic for game research [28], game UX discussions have started to come out of the UX practitioner field [27] more recently. With games among the favorite leisure activities of billions of people around the world [22], we can see people from UX and game research coming together in the future to work on improving player experiences not only for games, but for casual and mobile applications as well. The research presented in this paper stems from human-computer interaction (HCI) aspects of digital games, which has recently seen an increased interest with Apple's iPhone, iPad, Google's Android phones and other mobile devices becoming the gaming platforms of choice for many people [26]. These devices allow new forms of play in the real world without physical boundaries and they integrate a variety of contextual information [18,29].

In 2006, 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 easy exit 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]. Player experience is currently evolving as a fundamental concept in an expanding field of work with a strong empirical research focus. However, not many field studies are available that have analyzed player experience in a mobile setting. This paper attempts to fill this gap by providing the methodology and results of two field studies concerned with mobile gameplay experience.

### 2. Related work

Different models of gameplay experience exist (see [15] for an in-depth review and discussion), but new ones were being added from different fields as we developed the one discussed in this paper. One most recent addition is the model of Ferrara [30], who like us takes inspiration from Garrett's layer model [9]. He orders five layers from motivation for playing to the perceived aesthetics of the experience (the surface of experience). The five frames are motivation, meaningful choices, balance, usability, and aesthetics.

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Viewing player experience through these lenses allows a design-centric approach that is rooted in a psychological understanding of users. The model also accounts for temporal aspects (short and long term aspects of experience) in each layer (except balance). Similar to Nacke's and Drachen's initial model [15], it falls short on accounting for contextual parts of player experience.

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 educational 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 a practitioner's design environment.

Ijsselstein, 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 in this paper [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.

### 2.1. 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 and Drachen [15] developed a gameplay experience model with three frames: game system experience, individual player experience, and framed context experience. They describe 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.

With the arrival of mobile augmented reality applications (e.g., Google's glasses project) and digital games using augmented reality, such as the Nintendo 3DS, 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 model ideas describing 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 provides a gaming context for mobile phones [10]. Hence, researching the influence of variable spatial contexts on player experience is a good starting point for this research. Nevertheless, the user studies were designed in a way that allows incorporating other contextual influences as well.

### 3. 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 German version of a game experience questionnaire (GEQ, see Appendix) [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.

### 3.1. Prestudies

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

### 3.2. Online Survey

We conducted an international online survey with Amazon's crowdsourcing 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 h, 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.

### 3.3. 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 pre-study 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:

#### 3.3.1. 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.

#### 3.3.2. 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).

#### 3.3.3. 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.

#### 3.3.4. 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 attempt to create privatized gaming areas within larger social and spatial contexts is in line with related literature on mobile gaming behavior [25].

### 3.4. 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 experi-



ence. However, we could not yet argue about the direction of this influence.

### 3.5. Design

We designed a  $1 \times 2$  between-subjects user study with spatial context as the independent variable, having two levels following our categorization developed in the prestudy (context: 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.

### 3.6. 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, 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 ( $n = 15$ ). The sample was balanced across all attributes. All participants owned an iPhone for no less than 1 month and had at least once played games on their iPhone.

### 3.7. Stimulus materials

As gaming device the iPhone 3GS was used, featuring a 3.5” widescreen Multi-Touch display with a resolution of  $480 \times 320$  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 ( $\iota$ ) that factors in adjusted ratings ( $\rho$ ), web popularity ( $\delta$ ) and sales of the 100 most popular iPhone games from 2008/2009 ( $\zeta$ ):  $\iota = \rho + \delta + \zeta$ . From the top 10 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 10 min. 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 Fig. 1).

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 Fig. 2).

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.



Fig. 1. Playing field of Bejeweled 2 (published by PopCap Games) [21].



Fig. 2. Super Monkey Ball (published by SEGA) level finish line [24].

### 3.8. 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 short 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 five questionnaire items in the full version (except the immersion dimension, which has six 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).

### 3.9. 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 ice-

breaker. 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 counter-balanced 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 10 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.

### 3.10. 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.

## 4. Results

### 4.1. GEQ results

For assessing seven dimensions of game experience, the GEQ was used [11]. The comparison of average scores is shown in Figs. 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.

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  $\times$  age (classified), setting  $\times$  gamer type and setting  $\times$  gender.

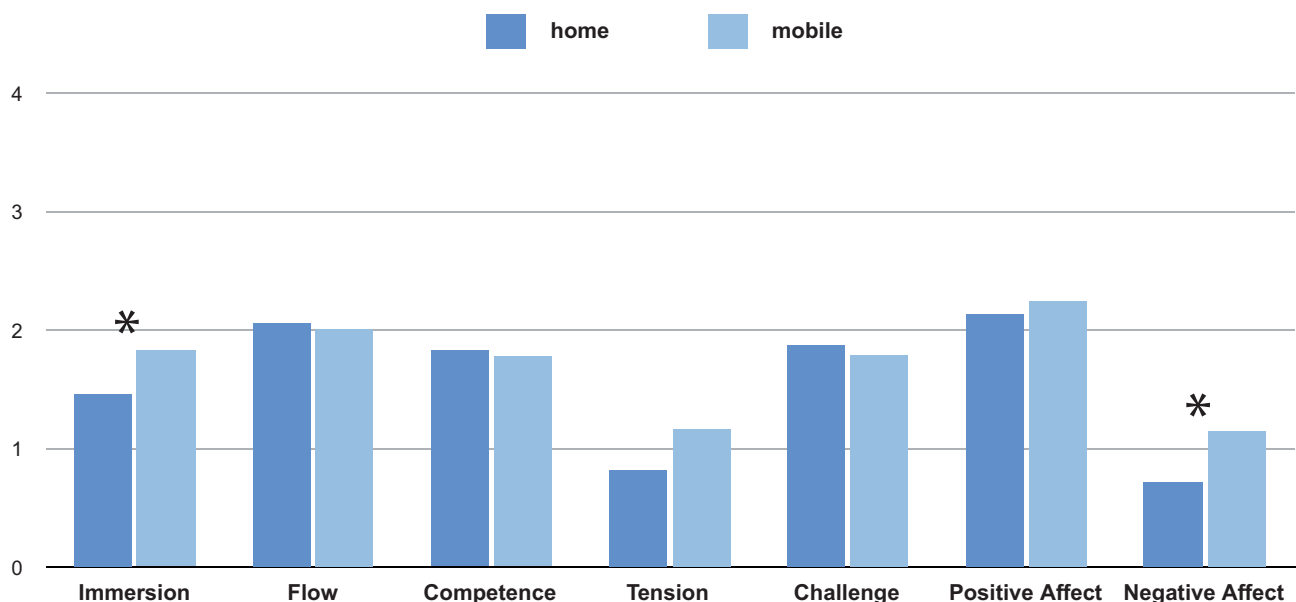


Fig. 3. GEQ results for Super Monkey Ball.

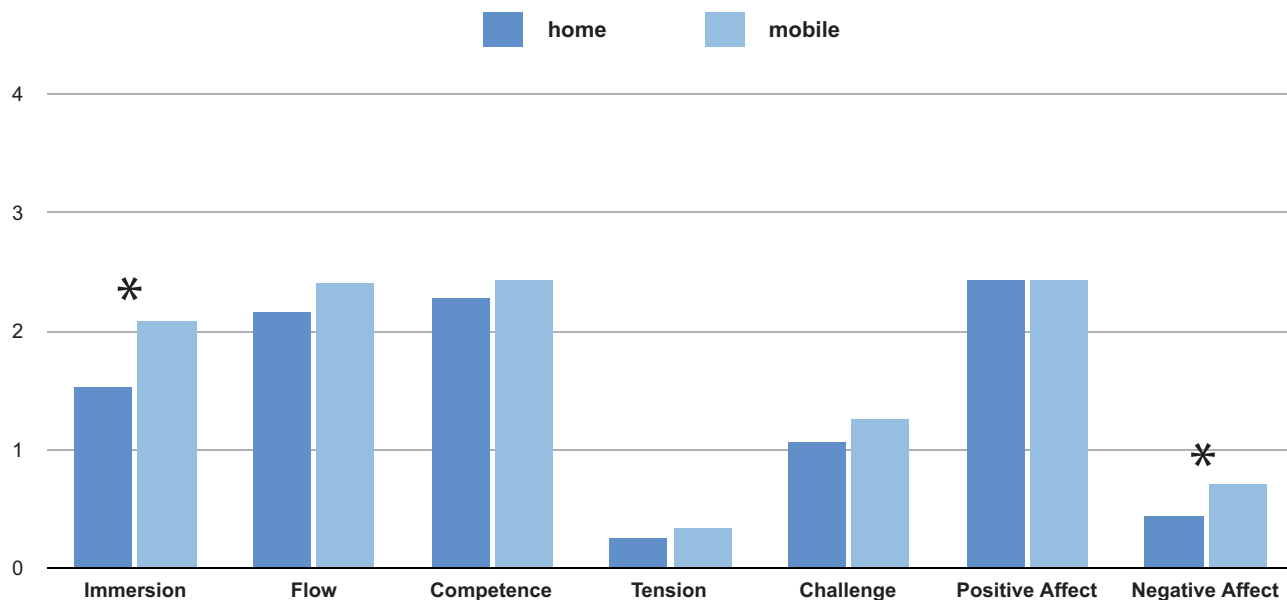


Fig. 4. GEQ results for Bejeweled 2.

We found some surprising interactions for setting  $\times$  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  $\times$  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  $\times$  gender we found an ordinal interaction for the dimension negative affect in BJ2 ( $F(1,19) = 15.04, p < .01$ ) as shown in Fig. 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.

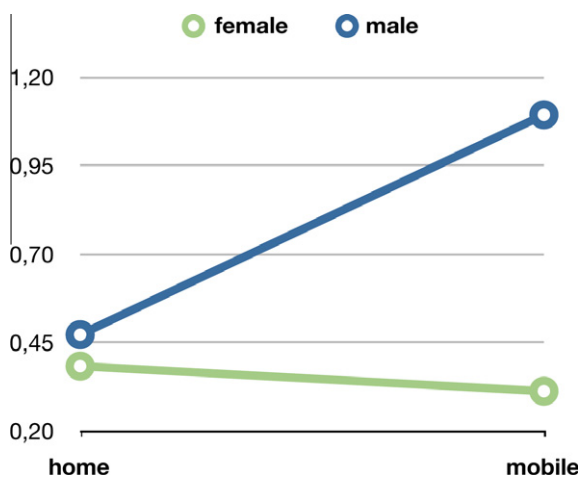


Fig. 5. Interaction effect of setting  $\times$  gender for negative affect with Bejeweled 2.

#### 4.2. 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.

## 5. 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 (Fig. 6) 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.

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.

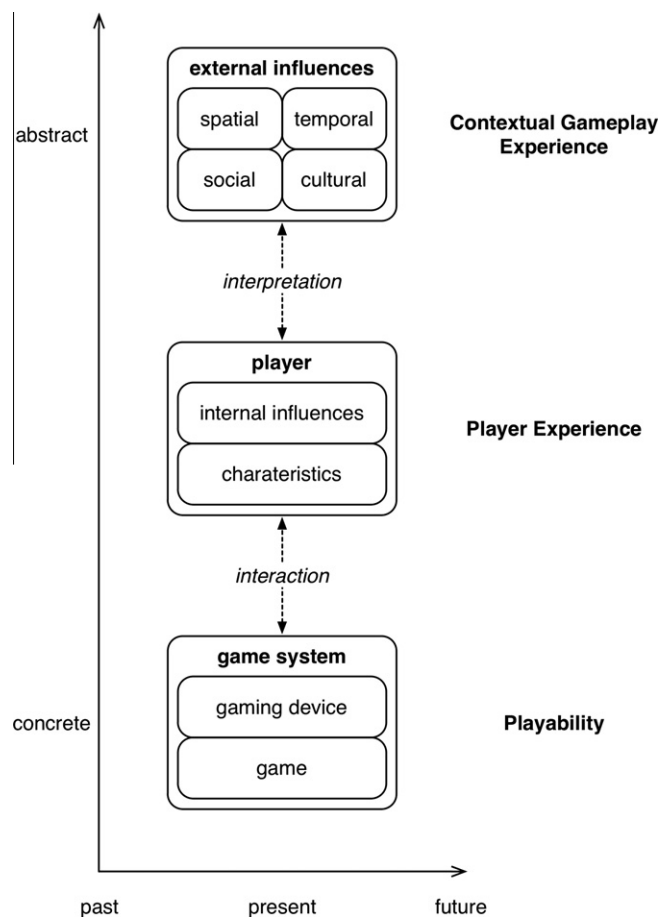


Fig. 6. The contextual gameplay experience model.

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 presented by Nacke and Drachen [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 by Nacke and Drachen [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.

## 6. Discussion and future work

Using the GEQ we were able to support the notion 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  $\times$  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  $\times$  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  $\times$  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, 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 academia so that it can be applied to the design and evaluation of games as well as re-

search. 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.

### Acknowledgement

The authors would like to thank SirValUse Consulting GmbH for their support and cooperation during this study, which covered participant recruitment, incentives, and the permission to use their usability laboratories, amongst other things.

### Appendix A. Game experience questionnaire (modified German version, 33 items)

Indicate on a scale from 0 (not at all) to 4 (extremely) how much you agree with the following statements (Bitte geben Sie anhand der Skala für jede der folgenden Aussagen an wie Sie sich während des Spielens gefühlt haben).

1. Ich fühlte mich zufrieden
2. Ich habe mich geschickt gefühlt
3. Ich interessierte mich für die Handlung des Spiels
4. Ich konnte über Sachen im Spiel lachen
5. Ich war völlig gefesselt
6. Ich habe mich glücklich gefühlt
7. Ich habe an andere Dinge gedacht
8. Ich fand es ermüdend
9. Ich fühlte mich sicher
10. Ich fand es schwierig
11. Das Spiel war ästhetisch ansprechend
12. Ich habe alles um mich herum vergessen
13. Ich habe mich gut gefühlt
14. Ich war gut
15. Ich habe mich gelangweilt
16. Ich habe mich erfolgreich gefühlt
17. Ich kam mir einfallreich vor
18. Ich hatte das Gefühl Dinge erforschen zu können
19. Ich hatte Spaß
20. Ich habe die Spielziele schnell erreicht
21. Ich habe mich verärgert gefühlt
22. Ich war reizbar
23. Ich habe mein Zeitgefühl verloren
24. Ich fühlte mich herausgefordert
25. Ich fand es beeindruckend
26. Ich habe mich sehr auf das Spiel konzentriert
27. Ich fühlte mich frustriert
28. Das Spiel bot eine reichhaltige Erfahrung
29. Ich habe die Verbindung zur Außenwelt verloren
30. Ich musste mich beim Spielen sehr anstrengen
31. Ich habe Zeitdruck verspürt
32. Es hat mich in eine schlechte Stimmung gebracht
33. Ich habe mich unter Druck gefühlt

### References

- [1] Amazon.com, Inc. Amazon Mechanical Turk Website. Amazon Mechanical Turk Website, 2010. <https://www.mturk.com/mturk/welcome>.
- [2] L. Arhippainen, M. Tähti, Empirical evaluation of user experience in two adaptive mobile application prototypes, MUM 2003. Proceedings of the 2nd



- International Conference on Mobile and Ubiquitous Multimedia Linköping University Electronic Press 2003 (2003) 27–34.
- [3] Y.A.W. De Kort, W.A. Ijsselsteijn, B.J. Gajadhar, People, places, and play: A research framework for digital game experience in a socio-spatial context, in: Proceedings of the 2007 DiGRA Conference, (2007).
- [4] A.K. Dey, Understanding and using context, *Personal and Ubiquitous Computing* 5 (1) (2001) 4–7.
- [5] H. Dixon, V. Mitchell, S.D.P. Harker, Mobile phone games: understanding the user experience, in: D. McDonagh, P. Hekkert, J.V. Erp (Eds.), *Design and Emotion*, CRC Press, Boca Raton, 2004.
- [6] P. Dourish, What we talk about when we talk about context, *Personal and Ubiquitous Computing* 8 (1) (2004) 19–30.
- [7] A. Fernandez, Fun experience with digital games: a model proposition, In *Extending Experiences: Structure, Analysis and Design of Computer Game Player Experience*, Lapland University Press, Rovaniemi, Finland, 2008. pp. 181–190.
- [8] B. Gajadhar, Y. de Kort, W. Ijsselsteijn, Shared fun is doubled fun: player enjoyment as a function of social setting. Fun and games, in: *Second International Conference, Eindhoven, the Netherlands, October 20–21, 2008*, Proceedings, Springer Berlin/Heidelberg (2008), 106–117.
- [9] J.J. Garrett, *The Elements of User Experience. User-Centered Design for the Web*, New Riders, Berkeley, CA, USA, 2003.
- [10] J. Hall, Future of games: mobile gaming, in: J. Raessens, J.H. Goldstein (Eds.), *Handbook of Computer Game Studies*, MIT Press, Cambridge, MA, 2005. pp. 47–55.
- [11] W. Ijsselsteijn, K. Poels, Y. de Kort, The game experience questionnaire. in: *Development of a self-report measure to assess player experiences of digital games*. TU Eindhoven, Eindhoven, 2008.
- [12] E.M.I. Koivisto, Mobile games 2010. in: *Proceedings of the 2006 international conference on Game research and development*, Murdoch University (2006), 1–2.
- [13] H. Korhonen, E.M.I. Koivisto, Playability heuristics for mobile games. in: *Proceedings of the 8th conference on Human-computer interaction with mobile devices and services*, ACM (2006), 9–16.
- [14] F. Mäyrä, The Contextual Game Experience. On the Socio-Cultural Contexts for Meaning in Digital Play, *Proc. of DiGRA 2007* (2007) 810–814.
- [15] L.E. Nacke, A. Drachen, Towards a framework of player experience research. in: *Proceedings of the Second International Workshop on Evaluating Player Experience in Games at FDG'11, Bordeaux, France, (2011)*. <http://hci.usask.ca/publications/view.php?id=230>.
- [16] L.E. Nacke, From playability to a hierarchical game usability model. in: *Proceedings of the 2009 Conference on Future Play on @ GDC Canada, ACM (2009)*, 11–12.
- [17] L. Nacke, C. Lindley, Affective Ludology, Flow and Immersion in a First-Person Shooter: Measurement of Player Experience, *Loading 3* (5) (2009).
- [18] J. Paavilainen, H.J. Korhonen, H. Saarenpää, J. Holopainen, Player perception of context information utilization in pervasive mobile games. in: *Proceedings of DiGRA 2009, DiGRA (2009)*.
- [19] R. Pagulayan, K. Steury, Beyond usability in games, *Interactions* 11 (5) (2004) 70–71.
- [20] K. Poels, Y. de Kort, W. Ijsselsteijn, “It is always a lot of fun!”: exploring dimensions of digital game experience using focus group methodology. in: *Proceedings of Future Play 07, ACM (2007)*, 83–89.
- [21] PopCap Games, Inc. Bejeweled® 2 Official Site - PopCap Games - iPhone/iPod touch. Bejeweled 2 Official Site - PopCap Games - iPhone/iPod touch, 2010. <http://www.popcap.com/games/iphone/bejeweled2>.
- [22] PriceWaterhouseCoopers. *Global Entertainment and Media Outlook: 2007–2011*. PriceWaterhouseCoopers LLP, New York, NY, 2007.
- [23] J.L.G. Sánchez, N.P. Zea, F.L. Gutiérrez, From usability to playability: introduction to player-centred video game development process. in: *Proceedings of First International Conference, HCD 2009 (Held as Part of HCI International)*, Springer (2009), 65–74.
- [24] SEGA Corporation. Super Monkey Ball iPhone. Website. Super Monkey Ball iPhone Website, 2010. <http://www.sega.de/games/super-monkey-ball-iphone/>.
- [25] C. Szentgyorgyi, M. Terry, E. Lank, Renegade gaming: practices surrounding social use of the Nintendo DS handheld gaming system. in: *Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems*, ACM (2008), 1463–1472.
- [26] M. Zyda, D. Thukral, S. Jakatdar, et al., Educating the next generation of mobile game developers, *IEEE Computer Graphics and Applications* 27 (2) (2007) 92–95. 96.
- [27] J. Ferrara, *Playful Design*. Rosenfeld Media (2012), ISBN: 1933820144.
- [28] M. S. El-Nasr, H. Desurvire, L. Nacke, A. Drachen, L. Calvi, K. Isbister, R. Bernhaupt, Game user research. in: *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems Extended Abstracts*, Austin, Texas, USA, (2012).
- [29] K.G. Stanley, I. Livingston, A. Bandurka, R. Kapiszka, R.L. Mandryk, PiNiZoRo: a GPS-based exercise game for families. in: *Proceedings of the International Academic Conference on the Future of Game Design and Technology*, Vancouver, British Columbia, Canada, (2010).
- [30] J. Ferrara, The Elements of Player Experience. In *UX Magazine (online)*, (2011). <http://uxmag.com/articles/the-elements-of-player-experience>.