
Can Context Awareness and Affective Computing inform Mobile Games User Research?

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Abstract

Mobile games can be used anytime and anywhere, therefore user context and behavior are important variables for evaluating the gameplay experience. In addition, the emotions that arise during gameplay constitute an important aspect in mobile game user research. This paper presents the position that it is possible to collect information on both, by leveraging on the data available through mobile phone sensing, thus providing a non intrusive and versatile solution for automatic evaluation of contextual game user experiences. In the following, a conceptual framework to automatically collect and analyze information about context and user emotions is presented, with the purpose to study techniques for automatically inferring gameplay experience metrics such as flow, immersion and presence. This represents a work-in-progress study to demonstrate the feasibility of this research direction.

Author Keywords

user experience; ubiquitous computing; affective computing;

ACM Classification Keywords

H.5.2. [Information interfaces and presentation]: User Interfaces; I.2.1 [Applications and Expert

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Introduction

Smart phone has become an extremely popular gaming platform due to, amongst other things, the easy-to-use and user friendly modalities, the empowered processing capabilities (which afford more and more advanced games), the sophisticated graphical and audio capability, and its size (which is convenient for carrying it on the body in an unobtrusive manner) [1]. On the other hand, with a wide variety of embedded sensors and enhanced computational power, smart phones have opened a new chapter in mobile applications and services domain, providing immense possibilities through activity recognition, context awareness, and user behavior analysis. In order to make mobile games more engaging, researchers working on pervasive and mobile games have started developing new user experience evaluation methods or adapting the existing ones. Unfortunately, available qualitative investigations methods, such as telemetry and psycho-physiological approaches are still incomplete since the first are typically unable to capture real life data, and the second are intrusive and often not applicable outside of the laboratory settings [2]. The motivation for our research also stems from a low, but increasing, number of user studies in mobile applications which consider real life context [3]: the research in non-game domains has provided promising results in using context information for improving the design [4]; yet, context information is usually not considered for inferring gameplay experience metrics. Furthermore, to the best of our knowledge, no study has exploited automatic ways of user emotions recognition (i.e. domain of affective computing) for assessing the experience in

mobile games. We believe that the automatic analysis of user emotions and context can be used to inform user metrics, to better understand user experience and, in general, to enrich the Mobile Games User Research.

Current Work

Our current research on Smart phone sensing is conducted along two directions: 1) inferring various parameters related to user activities/context (such as speech [7], spatial settings among subjects [9], physical activities [10], and indoor location [11]), and 2) human behavior analysis through data mining (such as mood variations [9], and individuals' behavior in social context [8]). We plan to use our research results and also exploit the best practices from other areas (and in particular the affective computing domain) as the foundation for the study of a more versatile analysis of mobile game user experience, which is further described in the following section.

Context Awareness and Affective Computing for Mobile Games User Research – Our Approach

In order to analyze the mobile games user experience with respect to the user context and his/her emotions, we will apply the methods of automatic acquisition of the relevant parameters. In contrast to the previous methods based on telemetry or psycho-physiological approaches, our approach will aim to capture real life responses while being invisible and unobtrusive from the user perspective. The goal is to attain the highest possible spontaneity of the behavior in players, which is typically a challenging problem regarding data collection.

Context Awareness

Games in mobile phones are played in various occasions and contexts such as in waiting rooms, in buses, in the moments of leisure at home, or short breaks at workplace, both in indoor and outdoor environments. By its nature, mobile phone is a multi-purpose device, thus the gaming interruptions can be triggered by an external event at random times and due to various reasons. In such situations, evaluation of the game experience is often left without the knowledge of what potentially caused an unexpected game ending. Therefore the context can strongly influence the interaction between the user and the game. However, acquiring contextual information typically relies on the user feedback (e.g. through diaries, self-reports or interviews) which may be cumbersome procedure from the user's perspective while the output often suffers from memory dependence.

We will rely on our already proven approaches of capturing contextual information through mobile phone sensing mechanisms. In particular, we will focus on:

- i) Environmental parameters (indoor and outdoor location, presence of nearby people, sound, and light),
- ii) Activities (participation in social interactions, moving activities such as walking, running, driving, and so on).

By fusing all the sensed information, we will infer the user context and establish the daily routines of individuals. To this aim, our approach is to continuously sampling contextual data during the daily activities and during the games with an adaptable sampling rate (for instance, accelerometer data will be sampled with higher rate during the games in order to capture movements with a finer granularity). The experimentation will be based on games both chosen by the user, and selected for

the purpose of experimentation. Continuously gathered contextual data and game logs will be analyzed afterwards to explore the correlations between the abovementioned contextual parameters/user daily routines and other quantitative measures (such as the time of activating certain games, length of play, game ending/pauses, and so on). The goal will be to better understand the association between the context and the player experience and different game designs.

Affective Computing

Playing games is closely bounded with provoking both positive and negative emotions in players. However, the respective phenomena are mostly investigated through questionnaires and there are only few studies that took the advantage of affective computing to investigate emotions during gaming in an automatic way [2]. Yet, to the best of our knowledge, there is no study which used automatic analysis of emotions to evaluate the experience in mobile phone games. Our investigation is built on the concepts proposed by Lee et al. [5] and Gao et al. [6]. The former is based on using mobile phone sensing to unobtrusively recognize user's emotions: through machine learning techniques and by using the sensed behavioral patterns and the context, the authors recognized the current emotional states (happiness, surprise, anger, disgust, sadness, fear and neutral). The later one is based on the analysis of finger-stroke features (on touch-screen) during gameplay, and the authors reported the accuracy between 69% and 77% for the emotional states of excited, relaxed, frustrated and bored. Recognizing emotions in this way is certainly a challenging task, however playing games creates a specific opportunity to analyze patterns of typing / touching the screen, reacting to games elements, and *device shake count*, as demonstrated in [5] and [6], thus we believe that it

provides sufficient information to distinguish positive and negative affects. Our focus is on the analysis of emotions evoked during the game; by making the correlations between the game logs and the inferred emotions, we will provide a heat map of the places in games which provoke positive/negative emotions. In addition, the goal will be to demonstrate a more profound analysis of game designs, indicating the game concepts which induce neutral emotions and the ones that provoke intensive emotions; moreover, we will explore the emotions as the main driver to prolong play or to end it. In this regard, we will aim to demonstrate the feasibility of such psychological method in player experience research outside of the laboratory

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settings by relying on a novel approach of an automatic emotion analysis.

Conclusion

Building on our current research and the best practices from affective computing domain, we propose an approach of using automatically acquired user contextual and emotion related data to infer mobile game user pattern and, in general, to inform game user research . Through applying a non-disruptive and non-obtrusive user experience analysis method, the goal is also to achieve the highest possible level of natural experimental conditions and players spontaneity.

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