

A methodology for psychophysiological player logging

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Abstract

This position paper discusses a methodology and the challenges for game research focusing on psychophysiological measurement of gameplay experience. We first present a counter approach, different to ours, focusing on qualitative investigations of game experience and social interaction. A discussion on the advantages and disadvantages of that approach leads us to present our quantitative, conclusive and empirical approach to studying gameplay experience. We present our method in detail, which uses the correlation of eye tracking, psychophysiological player logging and social science questionnaires to collect meaningful and objective player data. The presented method is discussed and a conclusion for how to best objectively investigate player experience is drawn.

Categories: Psychology (Game Experience) / Game Design

Introduction

The question why players enjoy games so much has been around since the time people have first started to play games. Designing a satisfactory player experience is one of the few fields and has hardly been touched by the growing body of game research; still it is one of the most interesting areas to be explored. Current game design is done rather intuitively or using approaches described in what we call “cookbooks” for junior game designers (Koster, 2005; Rollings & Adams, 2003). However, academia and industry are both very interested in a correct comprehension of verifiable methods, principles and tools that enable designers to create engaging entertainment experiences (Bernhaupt, Eckschlager, & Tscheligi, 2007; Bernhaupt, Ijsselsteijn, Tscheligi, & Wixon, 2008; Hunicke, LeBlanc, & Zubek, 2004; Lindley, 2004).

With a recently gained emphasis on new input devices and interaction techniques, like gestural movement (Shirai, Geslin, & Richir, 2007), eye tracking (Sennersten et al., 2007) and biofeedback (Dekker & Champion, 2007), designers of tomorrow will have to think far beyond what we call games in a classical sense today. Gameplay becomes a more immersive experience, a space of fun decoupled from the experience of using a computer. The benefit of using these new input devices is that they also enable precise and empirical measurement of gameplay. Thus, from an academic side it becomes more interesting to research the effect a game has on players than to focus on the game as an entity itself. By understanding how players experience games, we can then reflect and use this gained knowledge to enhance specific design aspects of games. This research has to be done with quantifiable method logging subjective (questionnaire) and objective (psychophysiological, input-game-logged) data. Our view is that only by using such an empirical approach it is possible to truly understand the factors, which drive gameplay and thus the experience of players.

Qualitative Investigations: The Counter-Approach

According to Marshall & Rossman (1998), qualitative studies use four methods to gather data:

1. They participate in the setting
2. They observe directly
3. They conduct in-depth interviews
4. They analyze documents and other materials

The essence of qualitative research has been adopted by many early game scholars using video capture and player interviews to conduct studies investigating especially social phenomena of gameplay (Chen & Duh, 2007). While this approach was certainly essential to spawn the debate about the cultural importance of digital games and to discuss the phenomena related to it, these studies essentially inform on hypotheses rather than testing them empirically. Early studies on game research have largely come from an area of humanist and cultural studies focused programs (Aarseth, 2003; Ermi & Mäyrä, 2005) and been using explorative studies to investigate gameplay phenomena. The early tendency here was a focus on social interrelations of players than on development and mechanics of game effects that govern experiences. This research has helped us to understand basics of the experience involved in gameplay, however they lack any kind of proof how to systematically create certain experiences. They can however be useful to identify factors of gameplay. For example, the use of video capture of game events of several play sessions within the same environment may lead to a hypothesis about the interplay of certain game mechanics.

Observing players repeating patterns of gameplay lead to a recipe-focused approach of game development (Björk, Lundgren, & Holopainen, 2003). While this holds great applicability on the one hand, it lacks more empirical proof on the other. When certain patterns of gameplay can be identified, it must also be possible to recreate them and test the impact they have on players of digital games. It is precisely this impact on the player that is essential for emergent gameplay, a factor of gameplay not intentionally created by the designer, but emerging from game mechanics and interaction of the player with the game or with other players in the game. As such, we could see the video analysis of players as a good cornerstone creating the basis for a more detailed look at what gameplay mechanics are quantifiable. The observation and recording of gameplay alone, without the critical discussion and proposals for quantifiable and observable phenomena, does not yield significant results in our opinion.

Qualitative studies with quantitative influences on a larger scale (Yee, 2006) tend to have more significance due to the statistical data obtained. However, the conclusions drawn based upon the analysis of subjective questionnaires alone may not be very objective and present biased data in contrast to the large number of participants. According to Zimbardo & Ruch (1979) 80% of human actions are subconscious and thus the results of self-reports and questionnaires have to be regarded as biased. The only way to overcome this bias is to apply analytical methods that are more objective. Measuring physiological responses using psychophysiological measurement techniques would allow us to draw a more objective picture of players. However, as van Weert (2006) points out, these

psychophysiological techniques are more obtrusive to the player. Nevertheless, the degree of objectivity in using EEG, EMG or EKG measurement is very high.

Our approach to psychophysiological study of gameplay experience

We value the statistical data that can be collected with social science questionnaires; therefore we employ this technique before and after each of our experimental conditions. However, the subjective answers are then cross-correlated with the psychophysiological data that is collected. This data consists of eye-tracking (such as the saccades and fixations on the screen as well as the dilation of the pupil at a given point), facial EMG (measuring activity of three facial muscles indicating emotional valence), EEG (using a 32 electrode cap), galvanic skin response (measuring sweat concentration as an indication of arousal) and EKG data (measuring heart-rate). Only collecting this data during random play sessions would not enable a thorough analysis, therefore we design specific stimulus games around gameplay mechanics that help us understand the feedback circle between design intentions and player reception. In contrast to usability studies of regular software, in games it is more important to look at factors of interaction and enjoyment when conducting gameplay analysis. Our method to conduct psychophysiological player analysis in detail uses the following steps:

1. When designing a level events have to be logged that could be of importance for improving gameplay within the level. Such events could be the number of player deaths (Kim et al., 2008), but also lighting conditions at specific places in a level or locations in which designers are uncertain how the player will master the designed challenge. Invisible trigger mechanisms need to accurately log the time a player spends within such an area.
2. In a system that we designed for Half-Life 2 (Valve Corporation), we can already log such data directly to our psychophysiological recording system (Stellmach, 2007), so that we can correlate these events with biofeedback data. We can then hypothesize how specific in-game events trigger emotional (Ravaja, Turpeinen, Saari, Puttonen, & Keltikangas-Jarvinen, 2008) or cognitive reactions.
3. Using the knowledge we have gained from analyzing psychophysiological responses from players, we can apply this evaluation to the game design process.
4. Through iterative repetition of designing and testing new features in the way described above, we have a new measure of quality for gameplay and a very objective feedback on the perception of gameplay features.

Analyzing gameplay experience in this way goes far beyond a mere quality assurance as it also enables the creation of adaptive games. By integrating measurement techniques as direct feedback systems into digital games, gameplay becomes reactive to the player. Emotional reactions can be amplified or cognitive effects can be precisely measured (the latter being specifically interesting for the rising trend of learning and serious games).

This feedback loop still needs to be explored in more detail as not all psychophysiological responses can be precisely mapped to emotions or thoughts. Another future challenge will be the real-time deletion of artifacts occurring in the recording process. With the falling cost of psychophysiological measurement tools and interaction technology (for example eye trackers), these tools become more interesting for a mass market and the knowledge on how to create meaningful entertainment experiences with them is valuable knowledge for future game designers.

Conclusion

In conclusion, the main interest of ongoing game research in this field is to classify the different measurement approaches that can be used to assess the player experience. While the method we presented here is certainly a very novel and comprehensive approach to gameplay analysis, there are many other methods used in industry and research today that will need to be compared this approach. The question that remains is whether or not an integration of all game measurement approaches makes sense. It might also be good to create guidelines for explaining which methods are most appropriate for which game designs..

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