Measuring the Experience of Digital Game Enjoyment

Wijnand IJsselsteijn[1], Wouter van den Hoogen[1], Christoph Klimmt[2], Yvonne de Kort[1], Craig Lindley[3], Klaus Mathiak[4], Karolien Poels[1], Niklas Ravaja[5], Marko Turpeinen[6], and Peter Vorderer[7]
[1] *Eindhoven University of Technology, Eindhoven, The Netherlands, w.a.ijsselsteijn.tue.nl*
[2] *Hochschule für Musik und Theater, Hannover, Germany*
[3] *Blekinge Institute of Technology, Karlshamn, Sweden*
[4] *RWTH Aachen University, Aachen, Germany*
[5] *CKIR, Helsinki School of Economics, Helsinki, Finland*
[6] *Helsinki Institute for Information Technology, Helsinki, Finland*
[7] *CAMeRA, Free University of Amsterdam, Amsterdam, The Netherlands*

The area of digital games constitutes a tremendously varied set of applications, with a wide range of associated player experiences, defying a one-size-fits-all approach to its conceptualization and measurement. One of the main challenges facing the gaming research community is a lack of a coherent and fine-grained set of methods and tools that enable the measurement of entertainment experiences in a sensitive, reliable and valid manner. Much like the six wise (but blind) men touching the elephant, no single methodological perspective can be said to provide a comprehensive understanding of digital gaming. Following this insight, the FUGA project, funded under the EU FP6 NEST 'Measuring the Impossible' initiative, takes a critical view towards the exclusive reliance on any one single indicator for measuring player experience. In the FUGA project, we explicitly strive towards a multi-method, multi-measure approach whereby we anchor and cross-validate various measures (e.g., self-report, psychophysiological, behavioural, neural) via their simultaneous application to a certain standardized set of games, and correlating the results thus obtained. Assessing the basic psychometric properties (sensitivity, reliability, validity) of all measures developed in the project is one of the defining characteristics of FUGA.

As a significant first step, we have developed and validated the Game Experience Questionnaire (GEQ), which reliably distinguishes between seven different dimensions of player experience: Sensory and Imaginative Immersion, Tension, Competence, Flow, Negative Affect, Positive Affect, and Challenge [4][6][7]. The GEQ is freely available in Dutch, English, German, Swedish and Finnish. Translations in other languages, including French, are in progress. At the moment, the GEQ is being applied in a number of experimental research studies within the FUGA project, and results testify to the measure's test-retest reliability and construct validity. Further to self-report measures, the FUGA project is investigating a number of implicit and objective measures of player experience. Overt (e.g., facial expressions) and covert (e.g., pressure exerted on an interaction device) expressions of behaviour are being investigated for their potential to validly and reliably tap in on certain dimensions of player experience, such as boredom, flow and frustration. First results are encouraging, showing a positive correlation between pressure exerted on the left ('fire') button of the computer mouse, the amount of bodily movement a player exhibits, and several player experiences, including frustration [3]. Psychophysiological recordings (e.g., EEG, facial EMG, EDA) show particular promise in distinguishing player emotions along the dimensions of arousal (exciting vs. dull) and valence (positive vs. negative emotions) [8]. In addition, various studies have been carried out that investigate the effects of collaboration vs. competition [9][10], something that differentially affects the experience of male and female players. Moreover, there are initial indications that results obtained in the laboratory do not differ significantly from results obtained in the field, which bodes well for the external validity of psychophysiological measures [9]. An implicit association test [1] was successfully developed and applied to detect identification processes in games, exploring theory-consistent implicit cognitions that link game character attributes to the player's self perception [2]. Furthermore, functional Magnetic Resonance Imaging (fMRI) has been applied to investigate the neural correlates associated with particular player experiences [5], while in the process developing innovative procedures for executing a think-aloud protocol while being in an fMRI machine.

We believe that a large range of measures, from reflective (subjectively controllable) to fully reflexive (uncontrollable) responses, enables a fuller characterization of the game experience than any single isolated measure, thus sensitizing us to the rich gamut of experiences associated with digital games. Moreover, limitations particular to one measure may be overcome or compensated by using corroborating evidence emerging from another measure. The combination of multiple measurement modalities can thus reduce uncertainty associated with measuring a single modality, resulting in increased validity, robustness and wider applicability of the total set of measures.

Finally, to the extent that a number of these measures allow for *real-time* measurement of player experiences, they can potentially be applied as continuous input data to a game engine, allowing the game's AI to appropriately adjust to the player's experiential (affective) state at any point during gameplay. Such a closed loop between player experience and game dynamics could help create an exciting new genre of emotionally adaptive digital games, and would allow for highly personalized optimization of such games. Under FUGA, several prototypes of such emotionally adaptive games have been created.

References

1. Greenwald, A. G., McGhee, D. E., & Schwartz, J.L.K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, **74** , 1464-1480.
2. Hefner, D., Klimmt, C., & Vorderer, P. (2007). Identification with the player character as determinant of video game enjoyment. *Proceedings of ICEC 2007, 6th International Conference on Entertainment Computing*, 39-48.
3. van den Hoogen, W., IJsselsteijn, W.A., de Kort, Y.A.W., Poels, K. (2008). Towards real-time behavioral indicators of player experiences: Pressure patterns and postural responses. *Proceedings of Measuring Behavior 2008 (Maastricht, The Netherlands, 26-29 August 2008).*
4. IJsselsteijn, W.A., de Kort, Y.A.W., & Poels, K. (n.d.). The Game Experience Questionnaire: Development of a self-report measure to assess player experiences of digital games. Manuscript submitted for publication.
5. Klasen, M., Weber, R., Mathiak, K.A., Zvyagintsev, M., & Mathiak, K. (2008). Think aloud-method during fMRI to

determine neuronal correlates of subjective experience of video game playing. *Proceedings of Measuring Behavior 2008 (Maastricht, The Netherlands, 26-29 August 2008).*

6. de Kort, Y. A. W., IJsselsteijn, W. A., & Poels, K. (2007). Digital games as social presence technology: Development of the Social Presence in Gaming Questionnaire (SPGQ). *Proceedings of PRESENCE 2007, The 10th International Workshop on Presence (Barcelona, Spain, 25-27 October 2007),* 195-203.
7. Poels, K., de Kort, Y.A.W., & IJsselsteijn, W.A. (2007). "It is always great fun!" Exploring dimensions of digital game experience using focus group methodology. *Proceedings of the 2007 Conference on Future Play (Toronto, Canada, 14-18 November 2007),* 83-89.
8. Ravaja, N. & Kavikangas, M. (2008). Psychophysiology of digital game playing: The relationship of self-reported emotions with phasic physiological responses. *Proceedings of Measuring Behavior 2008 (Maastricht, The Netherlands, 26-29 August 2008).*
9. Ravaja, N. & Kavikangas, M. (2008). Psychophysiology of digital game playing: Effects of competition versus collaboration in the laboratory and in real life. *Paper presented at ICA 2008 (Montreal, Canada, 22-26 May 2008).*
10. Ravaja, N., Turpeinen, M., Saari, T., Puttonen, S., & Keltikangas-Järvinen, L. (2008). The psychophysiology of James Bond: Phasic emotional responses to violent video game events. *Emotion*, **8**, 114-120.