ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/228626547

Characterising and Measuring User Experiences in Digital Games

Article · January 2007

CITATIONS
225

READS
3,174

5 authors, including:

Wijnand A Ijsselsteijn
Eindhoven University of Technology
353 PUBLICATIONS **14,658** CITATIONS

SEE PROFILE

Yvonne De Kort
Eindhoven University of Technology
198 PUBLICATIONS **8,245** CITATIONS

SEE PROFILE

Karolien Poels
University of Antwerp
156 PUBLICATIONS **7,756** CITATIONS

SEE PROFILE

Audrius Jurgelionis
16 PUBLICATIONS **446** CITATIONS

SEE PROFILE

All content following this page was uploaded by Audrius Jurgelionis on 30 May 2014.

The user has requested enhancement of the downloaded file.

Characterising and Measuring User Experiences in Digital Games

Wijnand IJsselsteijn
Eindhoven University of Technology
Game Experience Research Lab
Den Dolech 2
5600 MB Eindhoven
+31 40 2474455
w.a.ijsselsteijn@tue.nl

Yvonne de Kort
Eindhoven University of Technology
Game Experience Research Lab
Den Dolech 2
5600 MB Eindhoven
+31 40 2475754
y.a.w.d.kort@tue.nl

Karolien Poels
Eindhoven University of Technology
Game Experience Research Lab
Den Dolech 2
5600 MB Eindhoven
+31 40 2474210
k.poels@tue.nl

Audrius Jurgelionis
University of Genoa
Biophysical and electronic engineering department
Via Opera Pia 11a, 16145 Genoa
+39 010 3532780
jurge@elios.unige.it

Francesco Bellotti
University of Genoa
Biophysical and electronic engineering department
Via Opera Pia 11a, 16145 Genoa
+39 010 3532780
franz@elios.unige.it

ABSTRACT
In this paper, we describe the challenge of adequately characterizing and measuring experiences associated with playing digital games. We discuss the applicability of traditional usability metrics to user-centred game design, and highlight two prominent concepts, flow and immersion, as potential candidates for evaluating gameplay. The paper concludes by describing the multi-measure approach taken by the Game Experience Research Lab in Eindhoven.

Keywords
Digital game experience, game design, measurement, theory, flow, immersion, usability, user-centred design, human factors.

1. INTRODUCTION
It is exceedingly hard to adequately describe and measure a gaming experience. For one, we are not talking about *one* experience, but many. There is a great variety in gaming genres and games, and consequently the kinds of experiences people will have when engaged in playing these games will differ greatly. Is the fun you can have from blasting your way through a 3D village full of zombies the same *kind* of fun that may result from managing a soccer team? And of course, *my* idea of fun may not be another person's idea of fun, as is testified, for instance, by individual differences in play styles (see, e.g., Richard Bartle's categorisation of playstyles; [1]), differences in game preferences between men and women, or differences between Western and Eastern cultures [11].

Another, perhaps more profound reason, is that the experience of being entertained in itself is based on an unconscious process, which complicates introspective access. That is, if I have to reflect on the experience while being in the middle of it – if I have to take it apart to analyse it – it will break the spell. Relatedly, reporting on a gaming experience afterwards is also quite hard since we lack a common, shared vocabulary that allows us to verbalise the intricacies of experience (the ones we *can* access, that is). We are limited to using more or less generic terms, such as 'fun', 'engagement', or 'involvement', which are not particular to the subtleties of one's experience as it unfolds during the game, nor are they sensitive to the multi-layered context (in-game, social, and physical) in which the experience is created. The lack of a common vocabulary or experiential taxonomy is not just a struggle for gamers or game reviewers, but equally affects game design professionals and usability engineers. Bruce Phillips, a user research engineer at Microsoft Game Studios, aptly characterises the problem of talking about gaming experiences during the design process:

"I often find myself unsure of what users are experiencing when they play our games. I have a secret longing for the confidence in purpose that I imagine my colleagues working on productivity applications must feel. Their goals seem communicable and measurable – mine don't. The video game industry does not have a broadly accepted, generally agreed upon framework for describing the experiences our products are intended to create.[….] Our inability to adequately describe video-game experiences makes for development environments that can be quite different from the productivity space. It is not uncommon for members of a game-development team to have different views about the experience they are working to create. This is not because of bad management, but because it is a challenge to talk about this material. Discussions about what it will be like to play

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.
ACE Conference'07, June 13–15, 2007, Salzburg, Austria.
Copyright 2007 ACM 1-58113-000-0/00/0004…$5.00.

the game often end up taking a backseat to meetings about tasks and goals – concepts that are easier to communicate. For similar reasons, I have never worked on a game that had a production milestone related to progress creating a fun experience" [10], p. 22/23.

Phillips argues for the use of metaphor, simile and analogy to describe gaming experiences, much like a wine critic can describe a wine experience in terms of the taste of strawberries or the smell of smoke. The importance of finding a shared language, a common experiential taxonomy should not be underestimated. First, for any field of science to progress, there needs to be a basic agreement on the definition of terms. Of course, the video game industry is relatively young, and apart from a number of studies in the eighties (see, e.g., [8]), academics have only recently turned their attention to the psychological effects and experiences related to gaming, which may partially explain the lack of a commonly agreed upon vocabulary. Secondly, once a number of basic game-related experiences have been sufficiently characterised and agreed upon, the problem of measurement can be addressed. Reliable, valid and sensitive measures of gaming experiences will provide a valuable tool to theorists and game developers alike. However, measuring experiential dimensions such as 'fun' is more elusive than measuring more traditional performance metrics, such as time on task or number of errors, which have been successfully applied to productivity applications. Thirdly, game development is a fiercely competitive business, where anything that may give a design studio a competitive edge will be heartily embraced. Being able to more realistically and reliably describe and subsequently measure the user's experience will aid developers in introducing those design elements in a game which are known to elicit the most engaging experiences. The use of standardised tests will also allow for benchmarking games against the competition, or to compare ratings for successive versions of an in-development game, ensuring that proposed changes to the game's design do not negatively affect the gaming experience. Fourth, once relevant experiential dimensions have been identified, and reliable, valid and sensitive measures have been developed, such measures can be applied to *dynamically* change the in-game content, leading to an exciting new genre of experientially adaptive games. To enable such dynamic adaptations the relevant indicators would have to be sensed and interpreted in real-time, and in an unobtrusive manner, i.e., not interfering with the game experience as such. An early exploration of such work can be found in Sykes and Brown [14].

2. BEYOND USABILITY

The traditional way of optimising experiences in HCI is through user-centred design, an iterative process of requirements formulation, prototyping and evaluation that is aimed to ensure usability of an interactive product or system. Indeed, in order to improve the user experience of games, traditional 'productivity' metrics, such as effectiveness, efficiency, learnability or memorability, have successfully been applied to games as well. Usability problems can be serious showstoppers to interacting with a game, and can thus be regarded as a gatekeeper on the fun of a game. The goal of iterative user-centred testing on games is to remove the obstacles to fun. Many issues of concern in games are similar to those identified in other application areas, as obstacles to fun and obstacles to productive work share a number of common determinants (e.g., slow system responsiveness, use of unnatural or difficult-to-learn interface mappings, etc.).

However, for measuring the in-game experiences, it does not suffice to focus exclusively on usability-related metrics. Originally developed for evaluating applications in business and industry (e.g., word processors, spreadsheets, groupware), these metrics typically reflect an emphasis on optimising the user's productive output. In application areas where productivity is not a key goal in itself, such measures may not be the most appropriate to focus on. The user's own goals when playing a digital game are not adequately captured by metrics such as 'time spent on task', or 'number of tasks successfully completed'. Productivity and gaming applications clearly serve very different goals.

Pagulayan, Keeker, Wixon, Romero and Fuller [9] discuss in detail a number of differences between entertainment and productivity oriented applications. First, whereas in productivity applications constraints are eliminated as much as possible, obstacles are purposefully created in games in order to challenge the player. Second, in games, the process of play is its own, intrinsic reward, and not dependent on outcome-based rewards that prevail in productivity-oriented applications. Third, whereas applications in the productivity space strive to be as consistent as possible, there is a drive towards creating a variety of experiences in the realm of digital games. Fourth, and relatedly, there is a wider variety of input devices to interact with games (think of steering wheels, aircraft yolks, simulated guns, computer vision input like Sony EyeToy or acceleration and position sensing such as the Nintendo Wii) than in productivity applications which typically only use keyboard and mouse. Fifth, the use of sound and graphics in productivity applications serves to communicate function, whereas in games it serves to create an engaging environment, that supports the narrative of the game, and the user's sense of immersion.

In short, games are a very diverse class of applications, that clearly serve a different goal than productivity applications. As a consequence, in order to adequately assess the impact of design decisions on gaming experiences, a broader gamut of user experience measures needs to be taken into account as traditional usability metrics do not address all relevant aspects of a gaming experience.

Two related concepts, flow and immersion, emerge from literature on digital gaming, and both appear relevant to characterise and potentially measure the somewhat holistic yet important concept of 'gameplay' that both game designers and game reviewers frequently refer to when discussing the interactive experience of a game in relation to its content and interface.

3. FLOW

Csikszentmihalyi [3,4] studied what makes experiences enjoyable to people. He was interested in people's inner states while pursuing activities that are difficult, yet appear to be intrinsically motivating, that is, contain rewards in themselves – chess, rock climbing, dance, sports. In later studies, he investigated ordinary people in their everyday lives, asking them to describe their experiences when they were living life at its fullest, and were engaged in pleasurable activities. He discovered that central to all these experiences was a psychological state he called *flow*, an optimal state of enjoyment where people are completely absorbed in the activity. He found that this experience was similar for everyone, independent of culture, social class, age or gender. The

flow experience is characterised by the following elements ([4], pp. 48-67):

(a) A challenging, often rule bound activity that requires skills

(b) A task that has clear goals and offers immediate feedback

(c) An ability to concentrate on the task at hand

(d) A perceived sense of control over actions, and a lack of a sense of worry about losing control

(e) The merging of action and awareness, i.e., a state of deep and effortless involvement

(f) A loss of self-consciousness or preoccupation with self

(g) The transformation of time

Enjoyment arises when the opportunities for action perceived by the individual are equal to his or her capabilities. Thus, flow can be regarded as a state of balance between challenge and skill. This positive state of mental absorption certainly sounds familiar to frequent players of computer games. Digital games provide players with an activity that is goal-directed, challenging and requires skills. Most games offer immediate feedback on distance and progress towards the (sub)goals, through, for instance, score keeping, status information (e.g., health indicator), or direct in-game feedback. When a game is effective, the player's mind enters an almost trance-like state in which the player is completely focused on playing the game, and everything else seems to fade away - a loss of awareness of one's self, one's surroundings, and time. Sweetser and Wyeth [13] have adopted and extended Csikszentmihalyi's conceptualisation of flow in their 'GameFlow' model of player enjoyment, formulating a set of useful design criteria for achieving enjoyment in electronic games – see also [7].

The flow model of enjoyment clearly illustrates the importance of providing an appropriate match between the challenges posed and the player's skill level. Challenge is probably one of the most important aspects of good game design, and adjusting the challenge level to accommodate the broadest possible audience in terms of player motivation, experience and skill is a focus of current digital games research. Most games allow for self-selected differentiation of difficulty level at the start of the game (e.g., easy-medium-hard) or automatically adjusted difficulty levels according to how good a player performs. In addition, some games have progressive difficulty from level to level, as one advances through the game. As the player's skill level increases during the game, so do the challenges the player is faced with. Thus, flow may gradually increase over the course of the game in a homeostatic positive feedback loop, until either the challenge becomes too great (frustration) or the player's skill outpaces the challenges the game can offer (boredom). One of the major challenges in game design is to create difficulty levels and advancement models that will keep the player in flow for as long as possible.

Gilleade and Dix [6] distinguish between at-game and in-game frustration, where at-game frustration essentially involves a struggle with the user-interface, for example a non-responsive input device, drawing attention away from the game and towards the interaction tools. Such at-game frustration obviously breaks the flow, and should be remedied by applying user-centred design principles to game interface design. The second type, in-game frustration, arises from a failure to know how a challenge can be completed. The complexity of the game dialogue or the size of the game world could be contributing factors in this case. In-game frustration is somewhat more subtle though, as some level of frustration does appear to add to the catharsis at the end of the game, when, despite significant obstacles and challenges, the player has prevailed and succeeded. This can be regarded as *pleasurable frustration*. The challenge for game designers is to predict when this level of frustration will become unacceptable, and detrimental to the overall game experience. Indicators of player arousal based on real-time psychophysiology [12] or behavioural indicators [14] could potentially provide the game engine with the information it would need to adjust dynamically to changes in player frustration.

4. IMMERSION

In the gaming domain, immersion is mostly used to refer to the degree of involvement or engagement one experiences with a game. Sweetser and Wyeth [13] use the concept of immersion in their GameFlow model to denote the "deep but effortless involvement, reduced concern for self, and sense of time" that is characteristic for the flow experience. Using such a conceptualisation, a potential distinction between immersion and flow becomes unclear. Based on an analysis of children's gameplay, Ermi and Mäyrä [5] have proposed the SCI model of immersion, where immersion in the game world is differentiated in three forms: Sensory immersion, challenge-based immersion, and imaginative immersion. Sensory immersion refers to the multi-sensory properties of a game – the extent to which the surface features of a game have a perceptual impact on the user. Challenge-based immersion involves immersion in the cognitive and motor aspects of the game that are needed to meet the challenges the game poses, and is reminiscent of the challenge-skill balance that is needed to reach a state of flow. Finally, imaginative immersion refers to the immersion within the imaginary world created through the game, and depends on the richness of the narrative structure of the game.

In the absence of any agreed upon definition, Brown and Cairns [2] performed a number of interviews with gamers to find out what they mean when talking about immersion. They analysed their data using grounded theory, and found that to most players, immersion describes the degree of involvement within a game. Brown and Cairns describe a progression of three stages of immersion, indicating increasing levels of involvement: Engagement, engrossment, and total immersion (or presence). The level of immersion appears to depend on the path of time and is controlled by barriers that need to be removed before the next level of immersion can be experienced. Engagement, the lowest level of involvement, is dependent on the gamer's willingness to invest time, effort and attention in the game. Interviewees expressed the feeling that the effort invested in a game should be equal to the rewards of success As the gamer loses track of time, however, a feeling of guilt may emerge for having wasted time. At the second level, engrossment, the game features combine into a coherent experience that appeals to the gamer at an emotional level. Given the level of emotional investment, some people mention feeling "emotionally drained" when they stop playing. The gamer becomes increasingly less aware of his or her environment, and less self-aware. The final stage, total immersion,

is described as an experience where people feel cut off from reality and detached such that the game is all that matters. Some user comments clearly refer to the presence experience, which is commonly associated to experiences of high-end virtual environments: "When you stop thinking about the fact that you're playing a computer game and you're just in the computer" or "You feel like you're there" (p.1299). There is the possibility, however, that the interviewees were being metaphorical in their description of the experience. Empathy with the in-game characters as well as atmosphere created by the graphics, plot, and sounds were mentioned as important factors to get totally immersed. The descriptions offered by Brown and Cairns for the levels of engrossment and total immersion clearly share a number of important features (focused attention, diminished sense of self, losing track of time) with the flow experience.

5. CONCLUSION: A WAY FORWARD

It will be some time before the game industry will be able to boast a "broadly accepted, generally agreed upon framework for describing the experiences [digital games] are intended to create" [10]. A standard for game experience assessment, like the well-know ISO usability standards (ISO 13407 and ISO 9241-11) is not likely to emerge any time soon. This is partly due to the relative youth of game research as an academic discipline. Originally deemed frivolous, digital games have only recently been identified as a topic worthy of scholarly investigation. Additionally, as discussed, games are a tremendously varied set of applications, defying a one-size-fits-all approach. Even a broad and relevant concept such as flow falls short of capturing all classes of game experience, being less applicable, for instance, to games that are not so much challenge-oriented but rather have a strong social component. Moreover, adequately measuring experiential dimensions such as flow or immersion is more elusive than measuring more traditional HCI performance metrics.

In the Game Experience Research Lab at the Eindhoven University of Technology, working in close collaboration with a number of other European labs, we take a multi-method, multi-measure approach whereby we anchor and cross-validate various measures (e.g., self-report, psychophysiological, behavioural) via their simultaneous application to a certain standardised set of games, and correlating the results thus obtained. 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 robustness and wider applicability of the total set of measures.

As a significant first step, we are in the process of developing the Game Experience Questionnaire (GEQ) which covers a range of digital game experiences that have been identified through reviewing theoretical accounts of player experiences (e.g., [5,13]) as well as focus group explorations with both hardcore and casual gamers. The GEQ is currently being tested in a large scale field trial.

We believe that a large range of measures, from reflective (subjectively controllable) to fully reflexive (uncontrollable) responses, enables a fuller characterisation of the game experience than any single isolated measure, thus sensitizing us to the rich gamut of experiences associated with digital games.

6. ACKNOWLEDGMENTS

We gratefully acknowledge support from the following EU FP6 projects: Games@Large, FUGA and PASION.

7. REFERENCES

[1] Bartle, R.A. Hearts, Clubs, Diamonds, Spades: Players who Suit MUDs. *Journal of MUD Research Vol. 1,* 1 (June 1996) http://www.mud.co.uk/richard/hcds.htm.

[2] Brown, E. and Cairns, P. A grounded investigation of game immersion. In *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '04)*. ACM Press, New York, NY, 2004, 1297-1300.

[3] Csikszentmihalyi, M. (1975). *Beyond Boredom and Anxiety.* Jossey-Bass, San Fransisco, 1975.

[4] Csikszentmihalyi, M. *Flow. The Psychology of Optimal Experience*. Harper & Row, New York, 1990.

[5] Ermi, L. and Mäyrä, F. Fundamental components of the gameplay experience: Analysing immersion. In: S. de Castell & J. Jenson (eds.), *Changing Views: Worlds in Play*. Selected papers of the 2005 Digital Games Research Association's (DiGRA) Second International Conference, 2005.

[6] Gilleade, K.M. and Dix, A. (2004). Using frustration in the design of adaptive videogames. *ACM SIGCHI International Conference on Advances in Computer Entertainment Technology (ACE '04)*. ACM Press, New York, NY, 2004, 2004, 228-232.

[7] Holt, R. and Mitterer, J. (2000). *Examining video game immersion as a flow state*. Paper presented at the 108th Annual Psychological Association, Washington, DC.

[8] Loftus, G. R. and Loftus, E. F. *Mind at Play: The Psychology of Video Games*. Basic Books, New York, 1980.

[9] Pagulayan, R.J., Keeker, K., Wixon, D., Romero, R.L., and Fuller, T., User-centred design in games. In: J.A. Jacko & A. Sears (eds.), *The Human-Computer Interaction Handbook*, Erlbaum, Mahwah, NJ, 2003, pp. 883-906.

[10] Phillips, B. Talking about games experiences – A view from the trenches. *Interactions, 13,* 5 (2006), 22-23.

[11] Rauterberg, M. Enjoyment and entertainment in east and west. In: M. Rauterberg (ed.), *Entertainment Computing* – ICEC 2004. Lecture Notes in Computer Science vol. 3166. Springer Verlag, Berlin, 2004, pp. 176-181.

[12] Ravaja, N., Saari, T., Turpeinen, M., Laarni, J., Slaminen, M., and Kivikangas, M. Spatial presence and emotions during video game playing: Does it matter with whom you play? *Presence: Teleoperators and Virtual Environments, 15* (2006), 381-392.

[13] Sweetser, P and Wyeth, P. GameFlow: A model for evaluating player enjoyment in games. *ACM Computers in Entertainment, 3*, 3 (2005), 1-24.

[14] Sykes, J. and Brown, S. (2003). Affective gaming. Measuring emotion through the gamepad. *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '03)*. ACM Press, New York, NY, 2003, 732-733.

View publication stats