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Exploring the Nature of Immersion in Games to Enhance Educational Engagement

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Abstract: Student engagement is often considered one of the most important determinants of successful learning. An often cited argument for games in learning is their value to be 'immersive'. Beyond the rhetoric however, a model needs to be developed of immersion to identify the cognitive and affective factors involved and to tie it into existing theories relating to flow and narratology. This paper presents a model of immersion and details findings based upon the development and implementation of a range of levels in a 3D 'first person shooter' game which were evaluated according to criteria for immersion. A range of potential areas for research are suggested to strengthen the argument for immersion in educational technology.

Introduction

The debate about the benefits of games in education and training is one that has zealots on both sides of the argument. One game advocate, Marc Prensky in a suitably entitled presentation *Engage Me or Enrage Me*, has argued that engagement is more important than content and specifically cites games as tools to engage learners (Prensky, 2006). At the same time, the Australian learning landscape is being reshaped with a specific focus on developing national curricula, rather than setting standards for student participation in the learning process (Australian national Curriculum Board, 2008).

Such debates over form vs content are not new, but the focus on games provides a fresh impetus for the discussion because of their increasing prevalence in mainstream society. There is an increasing awareness of the potential of video games across a range of disciplines. In a recent Australian study, 73% of parents said games helped their children learn about technology, 68% said games help their children learn maths and 64% say games helped children learn to plan (Brand, 2007). One of the driving forces behind this growth has been their capacity to engage learners in ways that are often seen as more inherently rewarding than traditional educational experiences (Prensky, 2006). While there is still some debate about issues surrounding games such as addiction, even the negative research around games highlights their potential to provide compelling evidence for the contention of video games as highly immersive environments.

It cannot be assumed however, that simply using games is going to engage students more in learning. Nor is it true that all games are successful. As with films, perhaps the most similar medium in terms of industry and educational focus, the vast majority of games end sitting idly on shop shelves. The number of truly impactful games is quite limited. The issue of immersion therefore needs attention to ensure that that games designed for and used within an educational context live up to the hype attributed to them.

This paper outlines research that was conducted to explore the nature of immersion in games and to identify the key research areas within it that warrant further study. A theoretical model was developed

for immersion which was then applied to the design and evaluation of a number of games using a First Person Shooter (FPS) game engine. The games were trialled at an Electronic and Entertainment Expo in Western Australia, and the findings are discussed to highlight the emergent issues in designing immersive games

Literature Review

While much of the research in immersion has focused on the area of Virtual Reality and the immersive aspects of the interface (Sherman & Craig, 2008), this model sought to go beyond the sensory aspects of immersion to develop a psychological framework of the affects and cognitions involved in immersion. The model was developed through exploring motivational theory for the design of computer software. Keller's ARCS theory, for example, has been influential tool to guide the instructional design of interactive media through its focus on the four precepts of Attention, Relevance, Confidence and Satisfaction (Keller, 1987). Malone, on the other hand, defined motivation in terms of four key elements of Challenge, Control, Curiosity, and Fantasy (Malone, 1981).

At a deeper level, the cognitive aspects of immersion can be articulated through the concept of Flow Theory (Csikszentmihalyi, 1991). This sensation of 'optimal experience' where elements of challenge and skill are evenly matched is associated with range of criteria and benefits (Salen & Zimmerman, 2003).

Some of these describe the outcomes of flow such as an altered sense of time while others such as clear goals and feedback, and a task supported by a high level of control, can be integrated into elements of gameplay such as those suggested by Oxland (2004) as design criteria. Key to maintaining the sense of flow is ensuring a game that is balanced, neither becoming too frustrating or too boring (excessive or trivial challenge).

Aligned with flow, but operating at an affective level is suspension of disbelief. This literary term, coined by Samuel Taylor Coleridge as a leap of 'poetic faith' (Coleridge, 1817) describes how we willingly sublimate our sense of selves into the world that has been created for us. This addresses the emotional aspect of immersion which, while less subject to empirical research is equally resonant in terms of the experiential quality of a game. David Freeman used the term 'Emotioneering' to describe the 'body of techniques created ... [to achieve] ... a breadth and depth of emotions in a game or other interactive experience' (Freeman, 2003, p. 7). The two primary means of evoking emotion that are stated are:

- Create characters that the audience will identify with
- Have the characters go through a series of affecting experiences

Freeman is therefore describing the narrative components of immersion where the player is able to invest in the world through story, characters, dialogue and so on. In this dimension, the player's identity becomes mutable and subordinate to the game experience. Wenger (1998) defines identity as being constructed from engagement with a socio-cultural context. In this sense it is a dynamic rather than stable construct. Sfar and Prusak (2005) abstract and extend from this research and others to propose the concept of a narrative identity. In this paradigm, identity is defined as a discursive construct and the authors go so far as to claim that it is formed and mediated through a process of storytelling. Therefore the loss of self-consciousness described in flow can also be considered in terms of an emotional connectedness, where identity is reframed within the game world.

The model developed from the research is shown in Figure 1 (McMahon & Ojeda, 2008). As can be seen the model consists of a series of concentric circles that form levels of immersion containing elements that are grouped according to the extent to which they demonstrate a cognitive or affective underpinning. At the most basic level, the motivational aspects as informed by Malone, Keller and others form the most simple and shallow form of engagement. These could relate to any form of learning, whether classroom based or via e-learning. The second level seeks to identify the elements of games that promote deeper engagement. The predominantly cognitive aspect of gameplay leads, when appropriately balanced, to flow. When Emotioneering is brought to bear on the narrative elements such as plot, characters, dialogue and the aesthetic rendering of the game world, there is the capacity for players to become involved in the world as a whole to the extent that they willingly suspend their disbelief. The perception of immersion is represented as a channel. This is to highlight the fact that it is not a static sensation but a zone of optimal experience that varies as the plot evolves and the gameplay enhances to meet the user's developing skills. The sensations of a sublimated identity, engrossment, concentration and an altered sense of time are ideals that are unlikely to be achieved throughout the whole game but provide a description of that optimal experience.

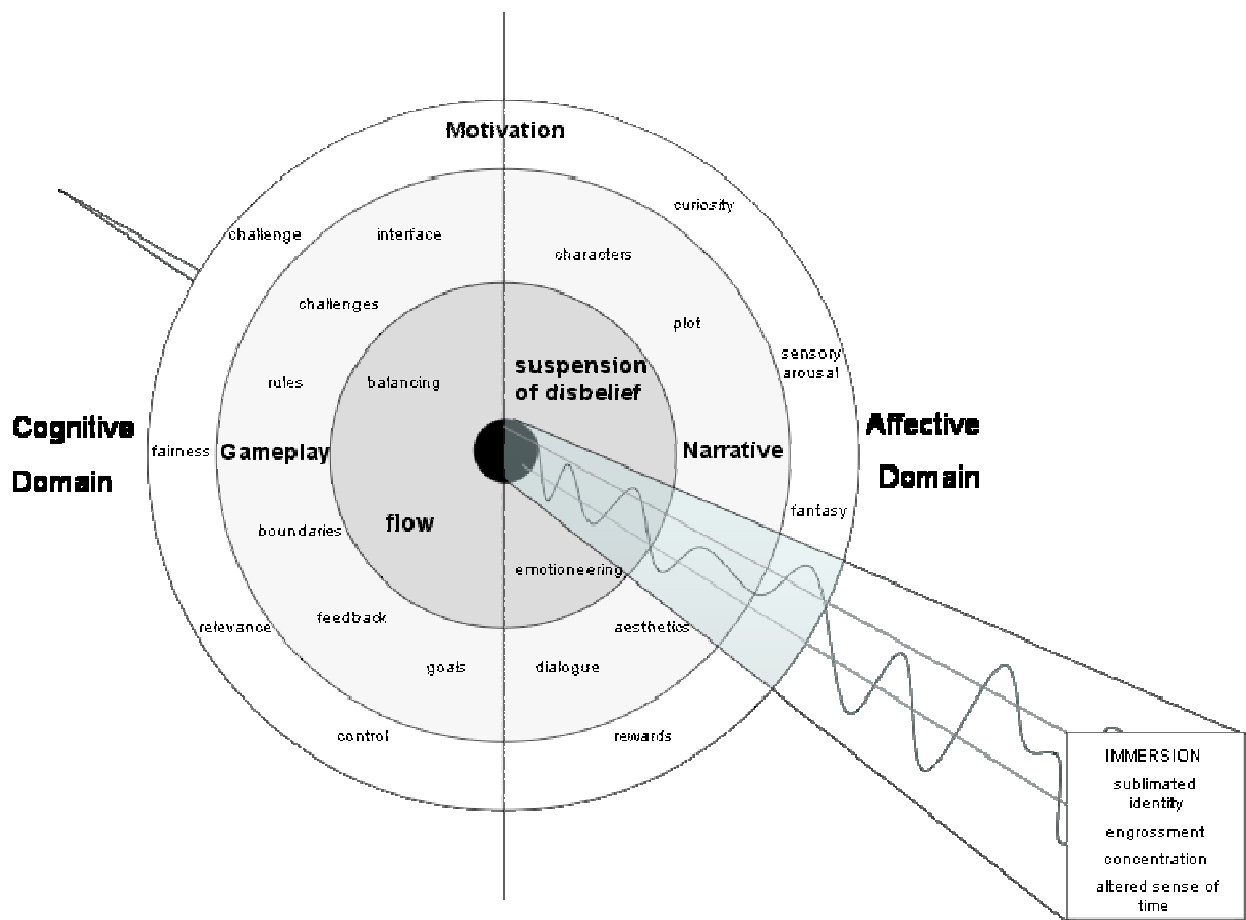


Figure 1: A psychological model of game immersion (McMahon & Ojeda)

Method

In order to identify the issues that surround the above model and the potential avenues for research, the model for immersion was instantiated into a number of games using the open source game engine Sauerbraten. Sauerbraten was selected as an easy to use tool that supports the development 3D games within the FPS genre. Its main feature is an in-game level editor that allows designers to create worlds and edit them within the game itself rather than a separate application. It also benefitted from being a predominantly GUI-based product.

Pressing the ‘e’ key at any time during gameplay places the environment in edit mode. The user is then able to select parts of the environment within a grid and then use the scroll wheel to push the geometry of the world ‘in’ or ‘out’, thus building walls, ceilings, tunnels and so on. Other elements of the world design are equally easily accessible. Keyboard modifiers combine with the scroll wheel to allow the designer to modify textures, round corners of the geometry and so on. Menus are available to select assets that can be placed in the world at any time. These include materials such as water, lava and glass. They also allow for the selection and placement of gameplay elements. These elements include the nature and availability of weapons and ammunition, the placement of monsters that seek to kill the player, and the provision of health armour and ‘teleports’ to move to various levels within the game.

The development of the games formed part of a teaching and learning exercise within Edith Cowan University. Undergraduate students were given the task of creating a game that was as immersive as

possible while using the existing features of the Sauerbraten Engine. The activity was framed around a competition where the game which was perceived as the most immersive would win a prize.

The nature of the game engine placed some boundaries on the game design that could be used as a counterpoint when analysing the features of the product that were modified within the game. Sauerbraten, for example, does allow the user to create their own models in a 3D modelling package, and bring them into the product. It is feasible that a dedicated game designer may choose to create a game that looks nothing like the original engine, with new textures, characters, weapons and animations. Integrating Sauerbraten with general purpose 3D packages, however, is a complex process and was not undertaken in this research. Similarly the source code of the product is available to be modified, but at a configuration level, editing element properties by modifying text files and at the code level, involving rewriting game using the C++ programming language. Students of Game Design and Culture at ECU do not cover game programming in this course, so they predominantly developed the game using the graphical user interface. This still had a lot of flexibility. For example, lights could be used to add mood, obscure monsters, provide navigational cues and so on. Nevertheless, there were expected similarities within all of the games relating to:

- The game genre as an FPS combat game.
- The visual depiction of the monsters and their intelligence
- The background music of the game and the sound effects
- The range of assets provided within the game such as trees, switches, doors and so on.

Four games were selected from the ones submitted to be used in the research based upon their ability to meet selected criteria relating to the technical coherence and length of the game level.

Along with the game development, a survey instrument was developed. This took the form of a series of statements identifying each of the main components of the model for immersion, and grouped according to the extent by which they demonstrated affective elements, cognitive elements, or the broader perception of immersion. The statements took the form of a five point Likert scale that assessed the extent to which the participants agreed or disagreed with the statements.

The games were demonstrated over a period of four days at the GO3 Conference and Electronic Entertainment Expo in Perth. The participants were not constrained by age or gender but represented a broad cohort Western Australians who may have an interest in electronic entertainment and gaming. Each level was designed for approximately 5 minutes of gameplay. Participants were asked to play then level then complete the survey to be in the draw for a prize (an iPod Shuffle).

Findings

A summary of each game is presented in Table 1. In total 111 people participated. Only 42 did not fit the profile of being male and between the ages of 20-30. 11 were female, of the others, the main age group was between the age of 30 and 40. This figure tends to reinforce the perception of game players as predominantly male and young. Certainly there are indications that more women are playing games, however the low number here may suggest that these may better be described as casual gamers rather than the ones that are likely to attend game expos. It was also intriguing to note the predominance of adult gamers, which reinforces notions of the average age of gamers rising (Brand, 2007).

Table 1: Total participants and overall scores for each game

Map	1	2	3	4
Respondents	33	35	16	27
Average Total	66	71.4	70	70.5

The average total was formed by totalling the scores from each research statement and averaging them across the number of participants. This suggested that Map 2 was the most successful game, though only marginally ahead of 3 and 4. Map 1 was the weakest of the four. A more detailed chart identifying each item and the average response for each game is presented in Figure 2.

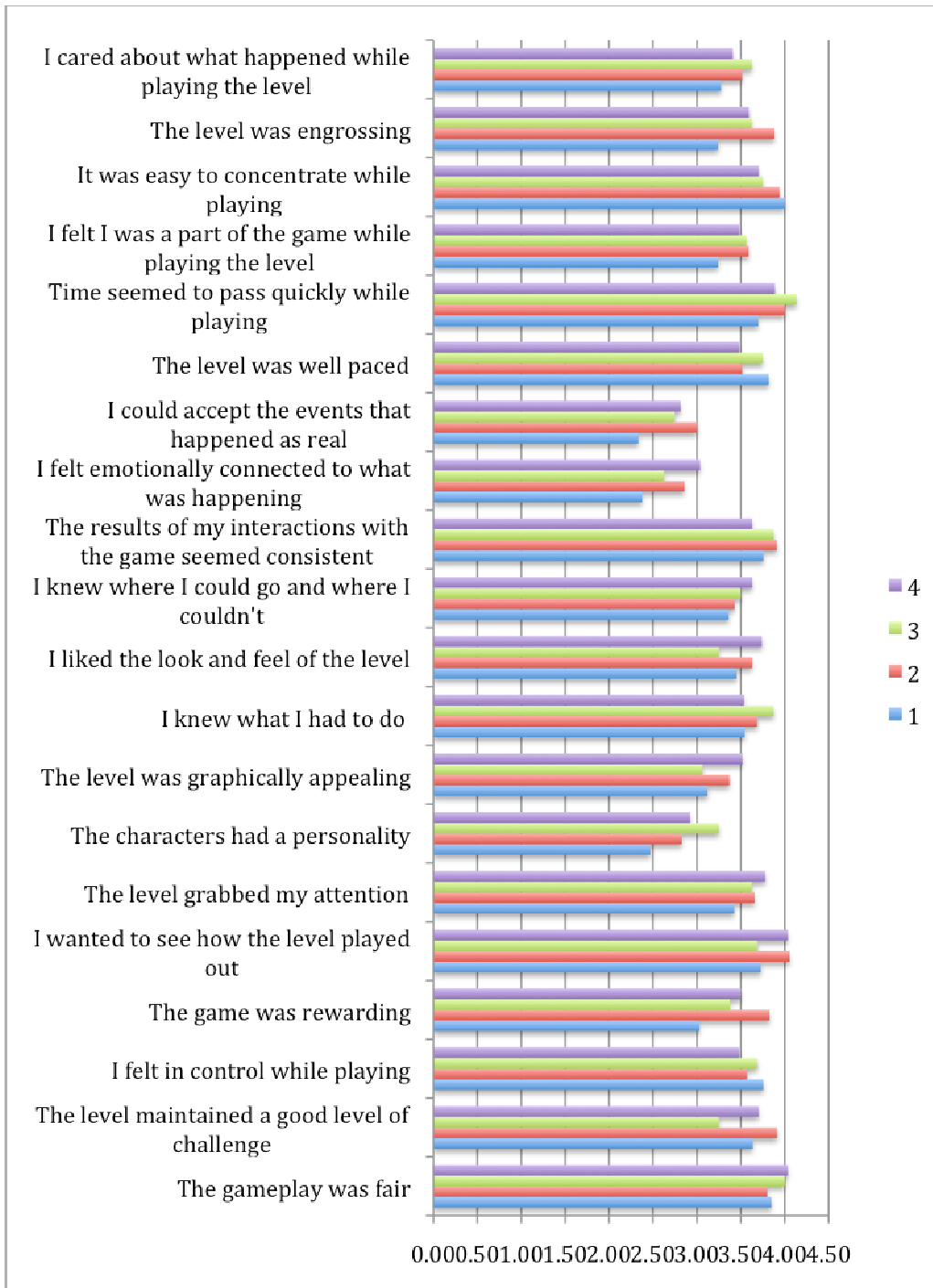


Figure 2: Averaged Survey Results for Maps 1-4

As can be seen above, the results are fairly consistent within the game for a lot of the criteria. For example, the contention that they could accept what was happening as real, felt an emotional connection, and felt that the characters had a personality achieved only mild agreement for all of the games. Conversely the sense of fairness and consistency was high for all of them.

The above results point to trends that can lead to a series of questions or hypotheses. In particular these relate to some of the consistencies and incongruities in the data when compared to the games

themselves and the affordances and limitations of Sauerbraten. These are presented here and discussed in turn.

1. What is the role of genre in defining the nature of immersion?

One finding that was highly consistent throughout the study was that some of the strongest scores related to the gameplay aspects of immersion. Issues such as the pacing, the fairness, the control, and the challenge are all relevant to the generation of flow. The weaker responses related to participants' abilities to suspend disbelief. It is unlikely that this is fixed to the visual aspects of the environment as there was some variance in their ability to accept what was happening as real. Nevertheless, the results were consistently lower across all games. A rather evident finding is that different games promote different elements of immersion. This may be true, but a more interesting aspect of that is what are the elements specific to different genres. Games are strongly linked to genres, and the most successful games are those that work best within a genre, particularly if they can extend on that rather than break the generic constraints. It would be more likely for example that an adventure game would score stronger for characters and emotional connection than an FPS. While both promote a sense of agency, the FPS is more grounded in game control than the ability to take on a role.

2. To what extent are both cognitive and affective elements required for immersion?

On the whole the games were immersive. The vast majority of participants felt that they were engrossed and that time passed more quickly while playing the game. This was at the same time that the participants were much more muted in their responses to the affective elements of the model. As has been mentioned, the participants as a whole were not strongly emotionally connected, nor did they consistently accept what happened as real. Similarly the extent to which the characters had a personality was limited. Yet on the whole they did care about what happened while playing the game. This suggests that even without having strong Emotioneering a sense of emotional engagement was still present. If they did not care about the other characters it did at least appear that they cared about *themselves* and could respond to the gameplay on an emotional level. This highlights two things. The first is that perhaps one doesn't need both strong cognitive and affective elements within a game for it to be immersive. Examining a game like Tetris, for example, shows that it can be as equally engaging as a good book or story. Both operate at different levels and can create immersion. An extension of this is where the gameplay and narrative bleed into each other. Players of Tetris can form an emotional antipathy to the L block. Conversely a strong narrative can challenge the player, such as where they have to deal with moral ambivalence in the choices that they make in gameplay.

3. What elements of the model of immersion have the most impact?

While there were strong similarities among most of the games in the results presented, there were a range of differences too. For example the weakest scoring of the four games was lower than the others in terms of the affective elements such as characters' personality and emotional connection. However it scored the best in terms of pacing, and the users' ability to concentrate suggesting that the balance of challenge to skill was well matched over time. This was in contrast to the strongest of the four levels, which scored less strongly in terms of fairness of gameplay and knowing where the player was and what was going on. The interplay between these elements deserves further exploration. It would appear that players are still willing to accept some uncertainty in goal achievement as part of the gameplay. To what extent such variance is an advantage and at what point it becomes a 'deal breaker' would be an important aspect of that game's acceptance by the player.

4. What is the role of gender in immersion?

An emergent aspect of the research was the impact of gender on the results. While the number of female players was too small to be significant, this in itself raised a question. With a supposed 40% of females now game players, their lack of attendance at GO3 and participation in the survey was marked. There are a range of sub questions that need to be addressed here. One of them is the perception of females as casual rather than 'hardcore' gamers. The fact that GO3 had a predominantly male attendance suggests

that while females now play games, they are not part of their culture or overall range of interests. This suggests that games will need to be very accessible and easy to use because females may be less likely to seek them out. The nature of the game too, warrants further exploration. It is a truism that females have a leaning towards games that involve nurturing characters or socialising, while males are more combat and strategy oriented in their approach. If games are to be used validly for serious purposes then accommodation must be made of the interests of different genders to the extent that they do not exclude people because of the nature of the game.

Discussion & Conclusion

The nature of gameplay is one that is well understood by gameplayers at a visceral and subconscious level, however it would seem that there are many cognitive and affective factors at play. For games to be successfully adopted in areas such as higher education, a greater understanding of what makes games work is required. Games need more than the label to prove successful, as is demonstrated by the paucity of high quality games available, particularly in the education sector.

This paper has attempted to provide a theoretical framework for immersion, one of the holy grails of games its often stated benefit over traditional forms of learning. As shown, though, immersion in games is as complex as learning itself. The extent to which cognitive and affective components are required, the role of genre in managing expectations, the individual elements' relationship to the whole, and perhaps most importantly the characteristics of the player him or herself and their expectations are areas that need to be explored more thoroughly.

References

- Australian National Curriculum Board (2008). 'Our work', Australian National Curriculum Board. 2008, Retrieved 16 January, 2010, from http://www.ncb.org.au/our_work/our_work.html.
- Brand, J.E. (2007) *Interactive Australia: Facts about the Computer and Video Game Industry*. Eveleigh: Bond University/Interactive Entertainment Association of Australia.
- Coleridge, S.T. *Biographia Literaria*. Retrieved 20 January 2010 from <http://www.gutenberg.org/etext/6081>.
- Csikszentmihalyi, M. (1991). *Flow: The psychology of optimal experience*. New York: Harper Perennial.
- Freeman, D. (2003). *Creating emotion in games: The craft and art of emotioneering*. Indianapolis: New Riders.
- Noyes, K. (2007). Docs Retreat From 'Video Game Addiction' Diagnosis. Tech News World June 25, 2007, Retrieved 16 January, 2010, from <http://www.technewsworld.com/story/58014.html>.
- Keller, J. M. (1987). Development and use of the ARCS model of motivational design. *Journal of Instructional Development*, 10 (3), issue 3, pp. 2-10.
- Malone, T. W. (1981). 'Towards a theory of intrinsically motivating instruction.' *Cognitive Science*, Vol. 4, pp. 333-369.
- McMahon, M. & Ojeda, C. A Model of Immersion to Guide the Design of Serious Games. In G. Richards (Ed). *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, pp. 1833-1842. Chesapeake, VA: AACE.
- Oxland, K (2004). *Gameplay and Design*. Essex, UK: Addison Wesley.
- Prensky, M. (2006). 'Engage Me or Enrage Me', Edu.blogs.com: Social participative media, education and the future. Retrieved 8 January, 2010, from http://edu.blogs.com/edublogs/2006/05/marc_prensky_ke.html.
- Prensky, M. (2006). *Don't Bother Me Mom—I'm Learning. How computer and video games are preparing your kids for 21st century success and how you can help!* St Paul: Paragon House.
- Salen, K. & Zimmerman, E. (2003). *Rules of play: Game design fundamentals*. Cambridge, Mass: MIT Press.
- Sfard, A. & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher*, 34(4), pp. 14-22.
- Sherman, W. R. & Craig, A. B. (2006). *Understanding virtual reality: Interface, application, and design*. San Francisco: Morgan Kaufman.

Wenger, E. (1998). *Communities of Practice. Learning, Meaning and Identity*. Cambridge: Cambridge University Press.