Space of Possibility and Pacing in Casual Game Design – A PopCap Case Study

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Figure 1: PopCap logo and, clock-wise from top-left, hit casual games Heavy Weapon,
Peggle, Bejeweled, Plants vs. Zombies, Shuzzle and Zuma

Abstract

This paper intends to investigate the design principles related to casual game development. Because the subject of casual game design is far too vast to be discussed in a work of this magnitude, only the aspects relevant to Pacing will be emphasized, paving the way to follow-up works that are able to connect all other elements of electronic game design related to this matter. The emblematic titles from independent developer PopCap Games will be analyzed for their market relevance and critical acclaim.

Keywords: game design, casual gaming, pacing, space of possibility

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1. Introduction

The latest years have brought significant changes to the paradigm of the international games industry. It is the first time that expressions like "accessibility" and "family-friendly" have been used so frequently since Nolan Bushnell understood, around 1970, that Spacewar was too complex for the general audience and decided to bet on Pong's simple concept. Nintendo is one of the main catalysts of this rebirth, but they are far from being the only ones. It is possible to find several accessible, pick-up-and-play and family-friendly games in the online networks of both Xbox 360 and Playstation 3, and PC has found a new identity with downloadable games and new audiences.

Still, we are yet to see a serious approach to how these so-called "casual" games are designed – a specific approach for the fundamentals of building a casual game. Works like the upcoming "A Casual Revolution", from Jesper Juul [2009, to appear], and the lectures and articles from Casual Connect [2006] started to show up here and there along the latest years, but a quick search for design articles involving casual games shows that the subject still needs to be thoroughly explored.

A common argument is that this "revolution" is nothing more than a reboot – a "back to basics". In this perspective, the study of the design principles for casual games has already been made. We stand in front

of new "Tetris" and new "Pac-men" that are way simpler than what we are developing today, so we already know everything we need about them. This idea is not completely incorrect – casual game design really does borrow several elements from games past – but a quick Peggle session after playing the classic version of Tetris shows that there is, indeed, a lot to be learned.

Independent developer PopCap Games [2000] leads the PC casual gaming market, looking down on all other designers trying to make something of notice, and this work (and its follow-ups) aims to understand what makes their games so special.

2. Related Work

John Rose [2008] wrote a very interesting article, published on games industry community site Gamasutra, about how the space of possibility relates to player experience. Also, William Willing [2006] has been writing several articles of notice on casual game design at his online blog.

3. This Paper is About Casual Games

Before moving forward towards the design matters *per se*, it is vital to establish a firm notion of what types of games are being talked about when the expression "casual games" is used. The Casual Games SIG/Whitepaper available on IGDA's Wiki website [Casual Games 2009] states that casual games are "games that generally involve less complicated game controls and overall complexity in terms of gameplay or investment required to get through the game". While this definition is way more useful than others, since it does not make use of the slippery term "casual gamer" to prove its point, it falls in disagreement with the concept that this work proposes.

Casual games are not necessarily of smaller complexity – not in their mechanics, nor in production. The last title released by PopCap, Plants vs. Zombies, becomes considerably complex in little time. In the same way, a game like Rayman Raving Rabbids, from Ubisoft, has huge production values, no matter how you look at it.

For the purposes of this work, "casual games" will be considered the games that offer the possibility of "pick up and play", and experiences that can be enjoyed in small bursts and interrupted by the player without penalty or perceived penalty. Putting it simply, the key element is not the complexity of the system and its mechanics, but how this complexity is presented to the player. It is, in fact, through a complex interaction [Zimmerman 2008] of smaller objects in the system that the casual game builds its own kind of "complexity". Through the course of this work, more will be said about the responsibilities that Pacing has in creating these complex interactions inside of a system that can offer both pick up and play and small gameplay bursts, and still be enjoyable for long-term play.

4. What This Paper Is Not About

Like all things related to design (and not just game design), this work is about principles, not rules. It is about helping to create a critical vocabulary and fundamentals that can be applied to new games and new discussions, not to create a recipe for a good casual game.

PopCap Games may have paved the way to the whole casual gaming industry when they released Bejeweled back in 2000, and they may have contributed to the creation of the Small Game market and $10 independent games in the early days of Xbox Live Arcade, but their process is not magical or formulaic. PopCap's success is due not only to superb Pacing – the subject of this work –, but also to offering fun and polished core mechanics, impeccable interface design, good balancing, great attention to detail to offer remarkable visual and sound feedback in all significant actions, and, overall, a process of QA and iterative design that is visibly well-established after almost 10 years of maturing and is applied to all their products. Peggle may look like a simple game, but its development process was composed of about nine months of playing and prototyping, followed by one year of full-scaled production and another nine months of polishing [Takahashi 2008].

5. Establishing A Critical Vocabulary

To talk about Pacing throughout this article, it is imperative that some concepts are well-defined beforehand. It is not the goal of this work to deeply discuss the concept of Pacing, nor to offer in-depth description of the vocabulary and its originators, but to make a clipping of the concepts that are necessary to the communication of the ideas contained here, making use of studies and definitions from other authors.

5.1 Pacing

In Game Design, "Pacing" is a concept related to the overall rhythm of the game, the relative speed at which the different moving parts of the system are put in motion. By indirectly crafting the player experience – through mechanics, aesthetics and dynamics – to create relaxation, tension and repetition, the designer "paces" the game.

5.2 Related Concepts

It will be necessary to establish four concepts related to Pacing: Movement Impetus, Tension, Threat and Tempo [Davies 2009]. These four elements happen inside the Lower Arch of Pacing (that of a level or of a specific play session), and the Upper Arch of Pacing,

that represents the long-term relation between the player and the game, and how much time he is willing to invest before becoming frustrated or bored and abandoning play.
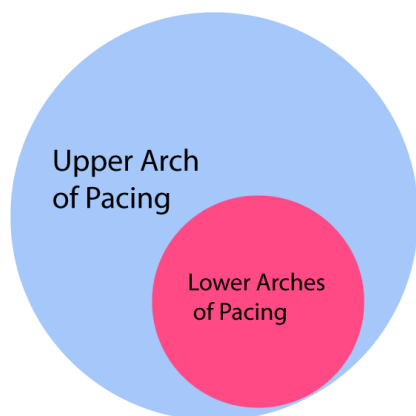

Figure 2: All the Lower Arches of Pacing are contained within the Upper Arch.

This work does not consider the definition, proposed by Davies [2009] in his original work, of Threat and Tension as two cognitive elements, since one of the key concepts of this work, as demonstrated below, is "perceived danger" overcoming the "real danger" that the player can detect in play. This work understands that Davies' description of Threat as a "sense of peril the player believes that he is under" belongs to the realm of perception, while the "real" threat is mechanical and generated by the direct conflict between player(s) and system or player(s) and opponent(s).

This paper understands conflict as a contest of powers [Zimmerman and Salen 2004], and as such, Threat is generated on the level of game mechanics, existing as the power struggle tips in favor of the system or the player's opponent(s). For the purposes of this work, "Tension" is the perceived danger that a player might become the weakest side on the conflict, while "Threat" is the actual power of the opposing forces on the conflict (the system itself or other players), a concept directly related to game balance. Aesthetic resources such as graphics and sound can be used to increase or decrease Tension, but not Threat.

The third concept, Movement Impetus, is the will or desire of a player to move forward through a level [Davies 2009], but in this work it is not limited to its application in level design ("baits" and architectural pressure). Most importantly, it determines how willing the player is to make "advancement decisions", thus representing his interest in keep playing. In a game like PopCap's Plants vs. Zombies, for example, Movement Impetus represents the player's will to keep planting his defenses and waiting for the outcome of the play session (defeating the zombies or having his brain eaten) instead of abandoning it out of frustration/perceived defeat or boredom.

Finally, Tempo is the "intensity" of play. It is the time between each significant decision made by the player. In a game like PopCap's Bejeweled, it represents the number of seconds between each move a player decides to make in the 8x8 grid. Higher Tempo means that the player's decision-making is slow, and he is either waiting for some change of state on the system, thinking about his movement, or simply confused. Lower tempo represents more frantic decision-making by the player.

6. Restricting the Space of Possibility

Designing a game is designing a space of possibility. It is the creation of a structure that will play out in complex and unpredictable ways, a space of possible action that players explore as they take part in the game [Zimmerman and Salen 2004]. In a game of soccer, it covers all the possible movements of every player for every individual position of the ball in the field, every foul and every goal, and so on. It is the collection of all possible actions and outcomes inside the designed space of the game – all actions and outcomes artificially made possible by the system. The first goal of this work is to investigate how some techniques of restriction of this space can contribute to make fun casual games that can stand on their own in long-term play.

6.1 Space of Possibility and Player Experience

When playing a game, the player is trying to figure out patterns. Our brain, according to Raph Koster [2005], is pretty good at that: "the destiny of games is to become boring, not to be fun. Those of us who want games to be fun are fighting a losing battle against the human brain because fun is a process and routine is its destination (...). All of this happens because the human mind is goal driven". Our brains are constantly trying to optimize information, simplify it, put everything in little boxes inside of our heads. We create and refine patterns throughout our lives to identify facial expressions, written and spoken words, odors, everything that can be perceived by our senses. It is through this process that we have meaning.

Playing games is not different. When playing Space Invaders, for example, a player is constantly trying to figure out the patterns for the enemy ships' movements, the trajectory of his shots, the best way to destroy the first rows of enemies as fast as possible, and so on. According to Koster [2005], "the natural instinct of a game player is to make the game more predictable because then they are more likely to win". Taking the definition of "fun" as being "pleasure with surprises" [Schell 2008], when there are no more surprises, there is no more fun. If all the patterns have been figured out, the game becomes uninteresting. The classic example is tic-tac-toe – it's space of possibility is so narrow, its patterns so few and obvious, that it gets

boring pretty fast. Chess, on the other hand, has an almost infinite array of possible moves and counter-moves, short and long-term strategies, and players from several different cultures have been trying to master it for centuries.

However, it is not safe to assume that simply making a game with more patterns will turn it into a good experience. What usually happens when a player is frustrated at a "hard" game and can't play it "right" is that he/she is not figuring out all the patterns required by the system to advance the experience. Chess is a great game. So is Sid Meier's Civilization. But one cannot expect to play only 20 minutes of any of these games and effectively scan the space of possible moves to become a skilled player. Tic-tac-toe, on the other hand, can be taught to small children in a matter of minutes.

In this perspective, is there a desired balance between complexity and simplicity for casual game design? Yes and no. What is interesting to the purpose of this work is how the overall complexity of a game system – the space of possibility – is related to Tempo. How many possible moves should a player think about before choosing a single one in a turn of Chess? How many potential plays from the other player must he take into account? How much information does he need to create the short-term goals that will allow him to slowly build his road to victory? There is a huge space of possibility involved, so the Tempo is usually high. In a game like Bejeweled, on the other hand, things tend to get a lot more frantic.

In a Gamasutra interview by Brandon Sheffield [2009], Jason Kapalka, Chief Creative Officer at PopCap Games, talks about the creative process of Bejeweled Twist, successor of their flagship title Bejeweled. When questioned about the reasons for the game limiting the board rotation to clock-wise instead of allowing the jewels to turn both ways, Kapalka made a very interesting point: "It sounded like a good idea when we tried it, it's the same problem we had with some games like *Bejeweled*. Technically there's no reason in *Bejeweled* you couldn't allow people to move jewels diagonally, as well as up and down. But it's that same problem that it increases the move space by a huge number, and suddenly, for most people, it just makes it a lot slower, and more deliberate of a game -- which for most people, is less fun" [Sheffield 2009].

The reason why the gameplay slowed down is that players would now have a broader space of possibility to analyze before making their moves. No one wants to make uninformed decisions – if a player is forced to take action whithin a system without feeling that he/she has assessed all the possible actions and outcomes for that game state, he/she is very likely to become frustrated.

Simply put, giving players more things to choose from increase the Tempo of the game. There is "a clear and definite limit" to the accuracy with which the players can "identify absolutely the magnitude of a unidimensional stimulus variable" [Miller 1956]. If there are too many patterns at one time, the player will not be able – at least not without considerable dedication and training – to internalize the process of making those significant choices, and will constantly have to stop for a moment and organize the space of possibility in his head. It is beyond his or hers short-term memory capacity. This can get extremely uncomfortable, in most cases causing the Player Impetus to decline, as stated by Miller: "when we have a large variance, we are very ignorant about what is going to happen. If we are very ignorant, then when we make the observation it gives us a lot of information. On the other hand, if the variance is very small, we know in advance how our observation must come out, so we get little information from making the observation" [Miller 1956].

Earlier, when defining the concept of casual games, this paper made reference to the expression "pick up and play". This means that, when designing a casual game, one must pace the experience to provide the player with time to learn and time to play [Zimmerman 2008]. There should be little or no tutorial or extra instructions – the learning happens as the game moves forward, and this type of game should not require the player to invest a considerable amount of time learning its patterns. It is supposed to be fast and organic.
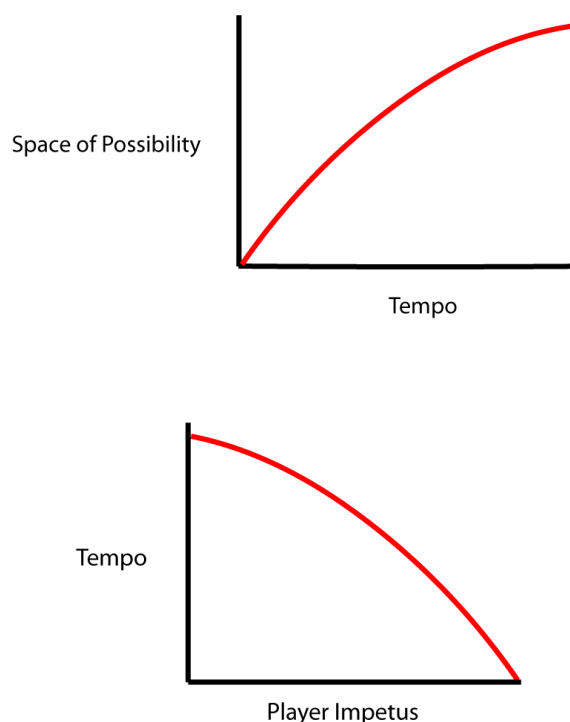

Figure 3: as the Space of Possibility increases, Tempo also increases. Higher Tempo generates lower Player Impetus.

This leads back to the previous point: a game that is too simple will get boring fast – players will quickly figure out the patterns and move on to other game or activity. This is what happens to most casual games available in PC flash game portals. However, making it complex will require more time for the player to master its patterns, consequently slowing down Tempo, which reduces Player Impetus. Maintaining this approach will lead to an inevitable Catch-22 while trying to find a "right balance" or a "sweet spot" between small and large spaces of possibility.

Part of the solution for that problem is well-known: switch focus from the Lower to the Upper Arch of Pacing. Most games today introduce layering game mechanics and raise the difficulty of the game for the player as he or she makes progress. This kind of continuous complexity/difficulty curve is the most common-sense and widely used solution, but not necessarily the best one.

6.2 Replacing Instead of Adding

This article proposes a different technique: to also work out a solution on the Upper Arch of Pacing, modifying the play experience as it progresses, but instead of adding new features, making the game increasingly more complex, the idea is to replace some non-core mechanics – and sometimes even the core itself – in a perceivably constant rhythm.

For deeper understanding of this concept, two cases of mechanic replacing in games will be presented: Peggle's Master switching and Plants vs. Zombies management of zombie and plant types, as well as Day/Night and Rooftop/Pool mechanics.

6.3 Peggle Case Study

Peggle is a game similar to Pachinko in which the player launches a metal ball from the top of the screen, trying to clear the board of all orange pegs by hitting them.

Figure 4: Peggle's Gameplay

It starts out with a traditional feature-adding method, introducing only one or two of the core mechanics at a time, using only short sentences and no tutorial or instruction screens, providing, as presented above, time to learn and time to play. At first, only the unicorn Peggle Master is available. Each Peggle Master provides the player with a special ability that can be tapped when the ball hits a green peg. The ability provided by the Unicorn, "Superguide", allows the player to see the trajectory of his shot, improving his early ability to predict what path the ball is going to follow. At the fifth level, the game reaches the first plateau of feature-adding and a new Peggle Master, the beaver, is introduced, replacing the unicorn ability with a new one, called "Multiball". This ability duplicates the player ball when it hits the green peg, allowing him to hit more pegs in the same launch. The position of the pegs on the following levels is optimized for interesting uses of this new ability. From that point on, the player is able to understand, through a simple progression screen, that he will unlock a new Master – therefore a new ability – at every five levels.

Figure 5: Peggle's Progression Screen

This design decision, apart from keeping the player informed of what he is working towards, how far down the path he is and how much there is left (discernibility), creates a pattern that can be easily perceived by him/her, who will always know that, at each five levels, a new ability will replace his/hers current one, completely changing the arrangement of the pegs on the levels, his/hers space of possible strategies to take and, therefore, the overall approach to how the game will be played.

6.4 Plants vs. Zombies Case Study

Plants vs. Zombies is PopCap's take on the popular Tower Defense genre. The player must defend his lawn of a zombie attack by planting several kinds of vegetables that provide resources, attack the zombies, and have strategic uses like blocking an incoming attack or making the enemies change their paths. Unlike Peggle, it does not make a light use of the

"Mechanic Replacing" concept, relying heavily on it to build its superb Pacing.

Figure 6: Plants vs. Zombies' Gameplay

On the early levels, the game adopts a traditional feature-adding method similar to Peggle's. The core mechanics are presented at a constant pace, using only short sentences and highlights on the screen, providing time to learn and to play. At first, only one lane, one type of plant and one type of zombie are available. A few levels later the main game is complete, with the full six-lanes lawn, a few kinds of zombies and the main types of plants (solar power providers, attackers and blockers). Interestingly enough, one new element is added every level, and this pattern, easily perceived by the player, carries on through the entirety of the game.

At the fifth level, there is a core mechanic break – also referred to as a "mini-game" – in which the player still has the same goal (stop the zombie waves from reaching your house), but, instead of planting defenses and managing resources, he rolls giant nuts down the lanes to smash the zombies, making bowling sounds. It is rather amusing, but, most importantly, it represents the first contact the player has with the core break pattern: one mini-game will be presented at every five levels.

Very much like Peggle, the game stops adding complexity to the mechanics at a given point – in this case, around the tenth level. From then on, yet another pattern is presented: at every ten levels, the play area changes. First, day becomes night, and the Mushrooms come into play. This day/night switch keeps constant as the field changes from front lawn to back lawn (featuring a swimming pool that enables the use of water plants), and then to rooftop (featuring pots and plants that can fire from an angle).

Finally, there is an enormous number of plants and zombies supporting all these gameplay variations, creating a space of possibility that could be

overwhelming. However, there is a limit to the number of plants that the player can use in a given level (six plants in the beginning of the game, but up to ten at later stages). Also, not all zombie types are available either – the game setup screen, where the player decides which plants to use in the following level, shows what types of zombies are going to attack the lawn, as well as detailed information about them.

This allows the player to make an informed decision about what plants to bring, apart from keeping him/her from having an optimal set-up to use in every level. Also, it restrains the space of possibility when positioning the plants – the player knows that only some specific types of zombies are going to show up, so it is not necessary to think about all possible attackers that could move into each lane.

Figure 7: Plants vs. Zombies' Setup Screen

These several combinations of mechanical replacing, applied in a perceivable pattern of one new element every level, one core break at every five levels, a change of scenario at every ten levels and new zombie type combinations at every level make this game a masterpiece in terms of Pacing. To add even more different patterns to be learned, there are dozens of unlockable mini-games and puzzles, as well as a "gardener" mini-game known as Zen Garden. Many reviews from industry professionals and enthusiasts around the world claim that it is impossible to stop playing, and the clever design behind the title is to blame.

6.5 Creating a Perceivable Pattern of Continuous Learning

What were the design principles behind such solid implementations? As stated before, the main focus of these methods is to keep a constantly high Player Impetus throughout the whole experience – for the purposes of this work, referred to as "Upper Arch" of Pacing. This idea is related to the concept of double seduction [Zimmerman and Salen 2004] – a player must be seduced to agree with his or hers entrance on the game experience, but it is also necessary to

continuously seduce him or her to stay there. This paper also made reference to the idea of fun as the learning of play patterns [Koster 2005] [Schell 2008]. In this perspective, all games are destined to have their patterns completely absorbed by the player and, after that, become boring. On the other hand, if the patterns cannot be absorbed, the player becomes frustrated and the experience will still come to an end.

However, in the two cases above – and specially in Plants vs. Zombies – the design allowed the players to realize that there will always be new patterns to be learned in the near future, and the game is presented in a way that these new patterns can be quickly absorbed and mastered – there is time to learn and time to play, and the space of possibility is restricted in a way that keeps Tempo low and movement frantic and fluid. The mechanics are replaced and new patterns arise, hopefully before boredom takes its place, breaking the seduction and ending the experience. When such a marvelous thing happens, Player Impetus is kept constant throughout the Upper Arch, thus providing the sensation that it is "impossible to stop playing" – combined with ideal relations between Threat/Tension and player ability, which creates an optimal challenge, the players are able to reach a state of Flow [Csikszentmihalyi 1990 *apud* Chen 2006].

That is made possible through the creation of a perceived pattern of continuous learning. Zimmerman and Salen [2004] bring this idea to the surface when presenting the example of the old Breakout-like game called Alleyway: "the levels in Alleyway follow a repeating pattern. (...) The player plays a 'standard' version of the game, then a version with horizontally moving bricks, then vertically moving bricks, before reaching a bonus level. (...) This pattern of levels creates a wonderfully heterogeneous playing experience, providing both familiarity (the variations cycle in a consistent way) and newness (every four levels, a new structure appears)".

The key concept here is this balance between "familiarity" and "newness". By maintaining the core mechanics and replacing the peripheral ones, the time it takes for the player to adjust to the new environment and begin making advancement decisions with good Tempo is minimized. In Plants vs. Zombies, for example, by the time the player reaches the tenth level, he/she has already absorbed the patterns for positioning plants, gathering solar power and fighting against different zombie types. When the field changes from day to night, new mechanics replace the current ones, but the basic patterns remain the same: click and drag plants when there is enough solar power, use damage plants do bring down zombies and special ones to counter specific zombie abilities. Even when there is a core mechanic break, like in the clever mini-game "Beghouled", the familiarity of the interface, interaction and meaning of the signs provide the player with enough information to quickly adapt to the new environment.

The game is balanced accordingly, with the overall Tension and Threat dropping considerably at each major change in the mechanics. This "Hills and Valleys" configuration also improves Pacing. It is a widely known technique among all forms of entertainment: the interest curve. "The quality of an entertainment experience can be measured by the extent to which its unfolding sequence of events is able to hold a guest's interest" [Schell 2008].

Of course, as discussed before, this ease would generate boredom if it wasn't for the perceived pattern of change that can be detected by the player. This works exactly like any other type of patterned pauses in action or action sections when pacing a game: "once the pattern has been established, players learn to expect breaks in game action, which can heighten the pace or slow it down" [Zimmerman and Salen 2004].

7. Conclusion

The method proposed by this paper, developed from close observation of PopCap's designs, is not supposed to be definitive. As stated before, to talk about design is always to talk about principles, not rules. In that regard, the concept may be double-edged – knowledge does not exist in separate little boxes (specially not in design), and all games, casual or not, are able to see improvements on the experience they provide when there is an active concern on keeping the space of possibility in a manageable size, and long-term play is benefited from replacing mechanics in perceivable patterns.

But even when approaching the subject of the design fundamentals of casual games in such specific manner, the numerous tangent and parallel subjects that rise from this work are noticeable. The closest matter is that of game Balancing – it is directly involved in effectively applying the principles described in this work to new designs, especially when dealing with the "hills and valleys" required by the mechanic replacing principle.

The author intends to further explore the matter in future studies, investigating the principles behind effective casual game design with emphasis in Balancing and other pertinent areas related to the subject.

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References

CASUAL CONNECT, 2006. *Casual Connect Lectures & Articles*: Game Design. Available from: http://www.casualconnect.org/content/contente-design.html [Accessed 22 July 2009].

CASUAL GAMES SIG, 2009. Casual Games SIG: IGDA Wiki. Available from: http://igda.org/wiki/Casual_Games_SIG [Accessed 22 July 2009].

CHEN, J., 2006. *Flow In Games*. MFA Thesis.

DAVIES, M., 2009. Exa*mining Game Pace: How Single-Player Levels Tick* [online] Gamasutra article. Available from: http://www.gamasutra.com/view/feature/4024/examining_game_pace_how_.php [Accessed 22 July 2009].

KOSTER, R., 2005. *A Theory of Fun for Game Design*. Paraglyph Press.

Juul, J., 2009. *A Casual Revolution:* Reinventing Video Games and Their Players. The MIT Press. [to appear]

MILLER, G., 1956. *The magical Number Seven, Plus or Minus Two:* Some Limits on Our Capacity for Processing Information. *Psychological Review, 63, 81-97.*

POPCAP, 2000. *PopCap Games:* Home of The World's Best Free Online Games. Available from: http://popcap.com [Accessed 22 July 2009].

SCHELL, J., 2008. *The Art of Game Design:* A Book of Lenses. Morgan Kaufmann.

SHEFFIELD, B., 2009. *Casual Game Design:* PopCap's Jason Kapalka and Bejeweled Twist *[online] Gamasutra feature. Available from: http://www.gamasutra.com/view/feature/3895/casual_game_design_popcaps_jason_.php [Accessed 22 July 2009].*

TAKAHASHI, D., 2008. *PopCap Games Executive Interview*: Don't be stupid, have fun [online] Gamesbeat feature. Available from: http://games.venturebeat.com/2008/04/21/popcap-games-executive-interview-dont-forget-about-the-fun/ [Accessed 22 July 2009].

WILLING, W., 2006. *Casual Game Design* [online] Available from: http://www.casualgamedesign.com/ [Accessed 22 July 2009].

ZIMMERMAN, E., 2008. *An Easy Kind of Love*. Lecture Delivered at Casual Connect Seattle.

ZIMMERMAN, E. AND SALEN, K. 2008. *Rules of Play: G*ame Design Fundamentals. The MIT Press.