Association for Information Systems
AIS Electronic Library (AISeL)

MCIS 2012 Proceedings

Mediterranean Conference on Information Systems (MCIS)

2012

SCHEDULES OF REINFORCEMENT AND GAME EXPERIENCE

Ganit Richter
University of Haifa, grichter@campus.haifa.ac.il

Daphne Raban
University of Haifa, draban@univ.haifa.ac.il

SCHEDULES OF REINFORCEMENT AND GAME EXPERIENCE

Richter, Ganit and Raban, Daphne, Graduate School of Management, University of Haifa, Mount Carmel, Haifa 31905, Israel, grichter@campus.haifa.ac.il, draban@univ.haifa.ac.il

Abstract:

The objective of this paper is to better understand the incentives and rewards structure in online serious games for crowds. We address the issue of feedback mechanisms with a focus on the relationship between game behavior and accumulated game scores (points). We posit that the score keeping system design is likely to inform us regarding patterns of participation in games. Our question is: what is the theoretical basis for designing a solid scoring function that would motivate players in three ways: a. to start playing; b. to continue playing; c. to strive to win? This paper presents a serious game for a large user base (crowd) and highlights some aspects and benefits of using an online serious game for crowds to enhance knowledge sharing. Understanding game scores promises to offer interesting implications in various fields such as business, knowledge sharing, game design, collaborative design environments and education. Currently, this paper is conceptual; however, findings are expected before the MCIS conference.

Keywords: serious games, rewards, points, motivation

INTRODUCTION

A game is a competitive interaction which is guided by rules and is intended to achieve certain objectives. Broadly, games can be divided into two large groups: serious and casual games. Specifically, serious games are games which are used for more than mere entertainment (Breuer & Bente, 2010). Serious games have been applied in military, government and NGOs, educational, corporate, healthcare, political, business, marketing and communication settings. This rapid development in recent years generates academic and business interest (Breuer & Bente, 2010; DeKanter, 2004). The worldwide online game market is forecasted to reach over $29 billion in 2016, almost twice the $15.7 billion sales of 6 years earlier in 2010 (Hsiao & Chiou, 2011).

Prior research on games covers aspects such as social and intrinsic motivations for playing games, game flow and learning (Crawford, 1984; Crawford, 2003; Garris, Ahlers, & Driskell, 2002; Leemkuil, Jong, & Ootes, 2000), yet very few published research studies have focused on score keeping as motivators. This is surprising in light of the prominence of scores in game interfaces and in light of the large variety of available score keeping schemes. This research offers to narrow this gap by gaining a deep understanding of game motivations and linking them to game behavior and outcomes via novel scoring functions.

Our focus is on players' motivations in a new game environment called serious games for crowds. These games were born from the combination between the concept of "The Wisdom of Crowds" and serious games. Consequently, games for crowds are computerized and networked games played in order to fulfill productive tasks such as knowledge sharing, error correction, sense making and more. The crowd fills a purpose while each player is intrinsically and extrinsically motivated. Using serious game for crowds, developed at IBM Haifa research lab, a series of controlled experiments is planned within which we wish to link between established behavioral theories and emerging theories describing the concept of the wisdom of crowds, and explore this new model in the serious multi-player games arena.

Following is a brief overview of motivation and behavioral theories, an outline of feedback mechanisms and scoring in games, and, finally, a suggestion to apply a crowd-based game to help enrich and expand social network information and organizational knowledge sharing.

MOTIVATION IN GAMES

Game playing is fun, attractive, engaging, and often provides immediate feedback. Part of the motivation of game players arises from the uncertain outcome and focus on the goal. Studies have shown that games create intrinsic motivation partly through fantasy, challenge, curiosity and competition (Crawford, 1984; Crawford, 2003; Garris et al., 2002; Leemkuil et al., 2000).

Two important research streams are relevant to the study of motivation in games. The first focuses on identifying frameworks that explain motivations for playing games. Two theories central to our research in this field are: Skinner's Principle of Partial Reinforcement, and Deci & Ryan 's Self-Determination Theory. The second research stream centers on Csikszentmihalyi Flow theory and identifying attributes that influence gaming. Some of these attributes mentioned in the literature include players' engagement, intensity of arousal, attention, enjoyment, depth of involvement, and task persistence (Garris et al., 2002). Understanding the interplay between the research streams is expected to help develop better serious games for business and management purposes.

Motivation Theories

Motivation refers to an individual's choice to engage in an activity and the intensity of effort or persistence in that activity (Garris et al., 2002). People who are highly motivated are more likely to engage in, devote effort to, and persist longer at a particular activity.

Motivations are often divided into two major types: intrinsic and extrinsic (Deci, Koestner, & Ryan, 1999; Ryan & Deci, 2000a). Intrinsic motivation is defined as engaging in an activity for the inherent satisfaction it provides rather than for some separable consequence. Intrinsic motivation drives a person to act for the fun or challenge entailed rather than because of external prods, pressures, or rewards (Ryan & Deci, 2000a). Extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome. Extrinsic motivation thus complements intrinsic motivation (Ryan & Deci, 2000a). Common extrinsic motivations are rewards like money, grades, status or prizes. Both intrinsic and extrinsic motives play a role in determining player behavior (Garris et al., 2002). The present research aims to combine intrinsic with extrinsic motivation in order to raise engagement in serious games.

Many researchers consider intrinsic and extrinsic motivations as two distinguishable and separable motivations; in contrast Self-Determination Theory (SDT) defines intrinsic and varied extrinsic sources of motivation on a continuum from external to internal motivation (Ryan & Deci, 2000b). The theory focuses on types, rather than amount, of motivation, paying particular attention to autonomous motivation, controlled motivation, and amotivation as predictors of performance and well-being. SDT proposes that motivation is multidimensional and resides along a continuum of self-determination ranging from amotivation (lack of motivation to act) through extrinsic motivation (acts in response to external outcomes) to intrinsic motivation (when a person acts for the inherent pleasure derived from that particular activity) (Gillison, Standage, & Skevington, 2006; Ryan & Deci, 2000b).

SDT discussed three psychological needs: autonomy, competence, and relatedness (Rigby & Przybylski, 2009; Ryan & Deci, 2000b; Wang, Khoo, Liu, & Divaharan, 2008). Autonomy is the ownership of one's behavior. Competence is the ability to produce desired outcomes and to experience mastery and effectiveness. Relatedness is the feeling of being connected with others. If these three needs are satisfied, growth and development results, and intrinsic motivation for the task increases. When the three needs are not met, negative emotions (anxiety and anger) may result, and intrinsic motivation is undermined (Wang et al., 2008).

According to the SDT theory there are 4 extrinsically motivated behaviors: external regulation, introjected regulation, identified regulation and integrated regulation (Ryan & Deci, 2000b). Integrated regulation and intrinsic motivation are both forms of autonomous self regulation. Accordingly, qualities that are associated with intrinsically motivated behavior can be used as markers of the extent to which an extrinsic regulation has become integrated (Deci, Vallerand, Pelletier, & Ryan, 1991) . Studies show that more autonomous extrinsic motivation is associated with more engagement, better performance, lower dropout, higher quality learning (Ryan & Deci, 2000b).

SDT was instrumental in explaining the motivational dynamics of learning (Ryan & Deci, 2000a; Ryan & Deci, 2000b). Studies of SDT and education have shown that supporting intrinsic needs of autonomy, competence, and relatedness facilitates deeper and more internalized learning (Rigby & Przybylski, 2009), and that from the self-determination perspective, the fundamental principles that support both enjoyable games and learning are well synchronized (Rigby & Przybylski, 2009). Recent studies confirmed that experiences of competence, autonomy, and relatedness were major contributors to game enjoyment, regardless of the specific content, complexity, or genre of games (Przybylski, Rigby, & Ryan, 2010; Wang et al., 2008).

Skinner's Principle of Partial Reinforcement claims that occasional reinforcement of behaviors leads to slower extinction than continuous reinforcement (Lilienfeld, 2009). Skinner found out that different schedule of reinforcement yield distinctive patterns of responding (Lilienfeld, 2009). Malone applied the same idea stating that in order to engage a learner, feedback should be surprising, and he proposed to do this by using randomness (Malone, 1981). We propose to examine Skinner and Malone's observations in the context of games through the angle of the score keeping function and in order to exhibit integrated regulation.

Theory of Flow

Flow is a concept that is often applied to understanding the environmental and individual variables that influence users' intrinsic motivations for playing games (Chen, 2007; Rieber, 1996). Csikszentmihalyi (1990) described a state of flow as the positive experience of being fully engaged in an activity, with a high level of enjoyment and fulfillment (Chen, 2007). Flow derives from activities that are optimally challenging and in which there are clear goals and feedback, concentration is intensely focused, there is a high degree of control, and users are absorbed to the extent that they lose a sense of time and self (Crawford, 1984; Garris et al., 2002; Rieber, 1996; Van Eck, 2006). Chen (2007) claims that games should have three core elements in order to evoke flow: be intrinsically rewarding, offer the right amount of challenges to match with the player's ability, and provide a sense of personal control over the game activity.

While playing, the player acts in the 'flow zone', where the activity reaches a balance between difficulty or challenge complexity and the player's ability to address and overcome it (Chen, 2007). If the challenge is beyond or under the player's ability then anxiety or boredom break the player's flow experience (Chen, 2007). Different players have different flow zones, since they have different skills and expect different challenges. Therefore, according to Chen (2007) games have to offer many choices, adapting to different users' personal flow zone.

Flow has an important role in driving people to play online games and in their intention to play continuously (Hsu & Lu, 2004; Lee, 2009). Voiskounsky et al. (2004) show that there are numerous sets of flow dimensions that depend on task specificity. Based on Csikszentmihalyi's flow framework Sweetser and Wyeth(2005) define a model of player enjoyment in computer games. GameFlow consists of eight core elements: concentration, challenge, skills, control, clear goals, feedback, immersion, and social (Sweetser & Wyeth, 2005).

The next section describes parts of the achievement structure of games which plays a role in making games motivational and engaging.

INTERACTIVITY, FEEDBACK, REWARDS AND SCORES

Games contain elements designed to deliver information to the player as part of an ongoing motivational process. These include: interactivity, feedback, reward and score.

Interactivity is the extent to which users feel the mutual effect that they and the environment have on one another (Manninen, 2000; Kalman, Ravid, Raban, & Rafaeli, 2006). It measure how actively responsive a medium is to users (Chou, 2003).The game's interactivity allows a continuous stream of challenging and competitive situations to be resolved by the player (Vorderer et al., 2003; Vorderer, Hartmann, & Klimmt, 2003). The level of interactivity is a function of the speed of response, the number of different events that can happen as a result of the player's input and the match between the virtual actions in the game and natural actions in the real world (Manninen, 2000; Reeves & Read, 2009). Reeves adds that interactivity creates contingency, the result is that the player feels important and feels listened to (Reeves & Read, 2009). Better interactivity produces a more pleasing, better-controlled interaction within the virtual environment (Manninen, 2000), engagement (Kalman et al., 2006), enjoyment (Vorderer et al., 2003) and satisfaction (Rafaeli & Sudweeks, 1997). One particular interactivity element is feedback which is described next.

Feedback is a broad term referring to information provided back to a player based on his/her performance (Mason & Bruning, 1999). It implies that there is an interactive flow between the learner and the system, based on information generated by the player and coming back to him as an output after some processing (Burgos, Van Nimwegen, Van Oostendorp, & Koper, 2007). The purpose of providing feedback is to enhance learning and improve performance. Feedback provides useful and immediate information about performance (Burgos et al., 2007; Garris et al., 2002), and it informs the users about whether or not their intended actions resulted in the expected outcomes (Rieber, 1996).

Quick feedback creates immediacy and contingency in the interactions. Contextual and instant feedback based on goal commitment increases the effort, the performance and the motivation (Burgos et al., 2007). The close connection between behavior and feedback increases the likelihood that reinforcement will be effective (Reeves & Read, 2009).

Games give feedback over long and short time scales and also at every scale in between (Reeves & Read, 2009). Some games give general feedback which can take many forms such as textual, visual, and aural (Rieber, 1996), whereas others provide granular and timely feedback using quantitative feedback such as points, progress bars, status gauges (Reeves & Read, 2009; Przybylski et al., 2010).

Rewards are a type of feedback which has several purposes such as enticement to enter or continue the game, to provide frequent/ immediate game feedback, to reach the final game goal, to encourage learning (Kolo & Baur, 2004; Rettberg, Corneliussen, & Rettberg, 2008; Sweetser & Wyeth, 2005). Rewards create a forward looking environment and therefore they encourage players to sustain in the game play, and help to develop a competitive environment. Players expect to be rewarded appropriately for continued play; the effort invested in a game should be correlated to the rewards of success (Sweetser & Wyeth, 2005). Complex tasks usually are broken down into small units, so larger accomplishments are recognized as smaller ones accumulate (Reeves & Read, 2009).

Some types of rewards used in online games include treasures, items, high scores, gold pieces, achievements, or badges (Kolo & Baur, 2004).

Scores play a role in making games motivational, challenging and engaging (Hacker & Von Ahn, 2009; Vukovic, Laredo, & Rajagopal, 2010). Events in the game can raise or lower the score of different players. By earning points the player gets information about his/her performance and incremental success in the game is thus encouraged to continue playing (Mason & Bruning, 1999; Von Ahn, Liu, & Blum, 2006). The exact number of points given to the players for different actions is believed to be unimportant (Von Ahn et al., 2006).

The score during the game reflects performance; score indicates completion or failure of missions. Performance feedback and score keeping allow the player to track progress towards desire goals (Garris et al., 2002) and encourage mastery of the game (Federoff, 2002). Final outcome measures reflect the learner's overall performance in the game. Outcome measures document the final status of events, or may specify a relative scaling of performance in relation to others (Leemkuil et al., 2000). Using points increases motivation by providing a clear connection between effort in the game, performance and outcomes (points) (Von Ahn & Dabbish, 2008).

Hacker and Von Ahn (2009) studied several variations of score keeping functions. They show that using a constant or a linear score keeping function makes the game less enjoyable than using an exponential or sigmoid scoring function. Using a constant function, for example, allows players to earn points in every round with high probability, whereas in the other cases, the score keeping function adds excitement to the game by creating an artificial ladder from which players can fall if they make a mistake (Hacker & Von Ahn, 2009).

Related to score-keeping is the use of ranks (player skill levels) and top scores list (leaderboard) (Von Ahn et al., 2006; Von Ahn, 2009). Players are ordered based on the total number of points they have accumulated. Leaderboards display a list of top scores along with players names next to each value. Leaderboards usually compare and rank players using measurements such as number of wins or high score (Medler & Magerko, 2011). Comparing players along quantitative measurements provokes competition (Medler & Magerko, 2011). Current rank and the number of points remaining for the next rank drive the player to earn more points in order to reach the next level (Von Ahn, 2009). Virtual points and user ranking increase players' activity and also encourage secondary contributions such as engagement of lurkers through ratings and comments (Farzan et al., 2008; Vukovic et al., 2010). Thom, Millen and DiMicco (2012) show that removal of a points-based incentive system made a significant negative impact on players activity, it reduce overall participation.

Score strategies used to keep players engaged include extra bonus points, dividend points, or points deduction for using hints (Von Ahn et al., 2006).

Scores can be found in offline games as well, but they are prevalent online where a large variety of scoring mechanisms is available. The computer can implement complex arithmetic and logical rules, and can readily change game parameters (Crawford, 1984). Combined with the ability to monitor game decisions and performance, the computerized environment is well-suited for developing behavior-based score keeping schemes.

RESEARCH TOOL

The prominence of scores in game interfaces creates an intriguing research opportunity on the effect of game scores on player behavior and motivation. In a series of controlled experiments we will examine the effect of different scoring schemes on game participation aiming to improve persistent and productive participation.

The main research tool is a crowd-based networked game called GuessWho which was developed by IBM. GuessWho prompts players with names of people they are likely to know based on a corporate recommender system. The player's task is to provide related people and tags for those individuals. The participants are rewarded for contributing valuable information about the implicit corporate social structure while having fun. An early version of the game used in pilot testing indicates that the game rapidly collects large volumes of valid information using points as an incentive for participation (Guy, Perer, Daniel, Greenshpan, & Turbahn, 2011). GuessWho focuses on collecting data about social relationships. In addition it introduces a score keeping function that includes dividend points (Guy et al., 2011). We offer to take a closer look at the scoring scheme; investigate refinements, means for longer engagement, and balances between validity and diversity. Currently, lessons learned are being implemented in the game software. The first series of planned experiments is described next.

Pilot Experiment

The proposed pilot experiment is the first of a series of planned controlled experiments. In this level we investigate different patterns of reinforcement as means for longer engagement. Based on Skinner's Principle of Partial Reinforcement, the planned experiments vary along two dimensions:

- The consistency of administering reinforcement: size of score (fixed versus variable response)
- The timing of reinforcement (constant frequency versus variable time intervals).

Based on these two dimensions a 2X2 experiment will be conducted to examine the behavior of players under partial, non-continuous reinforcements versus full, continuous, reinforcements. This design will result in four schedules of reinforcement (see Figure 1):

- provide fixed reinforcement for each player action
- provide varying reinforcement for each player action
- provide fixed reinforcement intermittently
- provide varying reinforcement intermittently

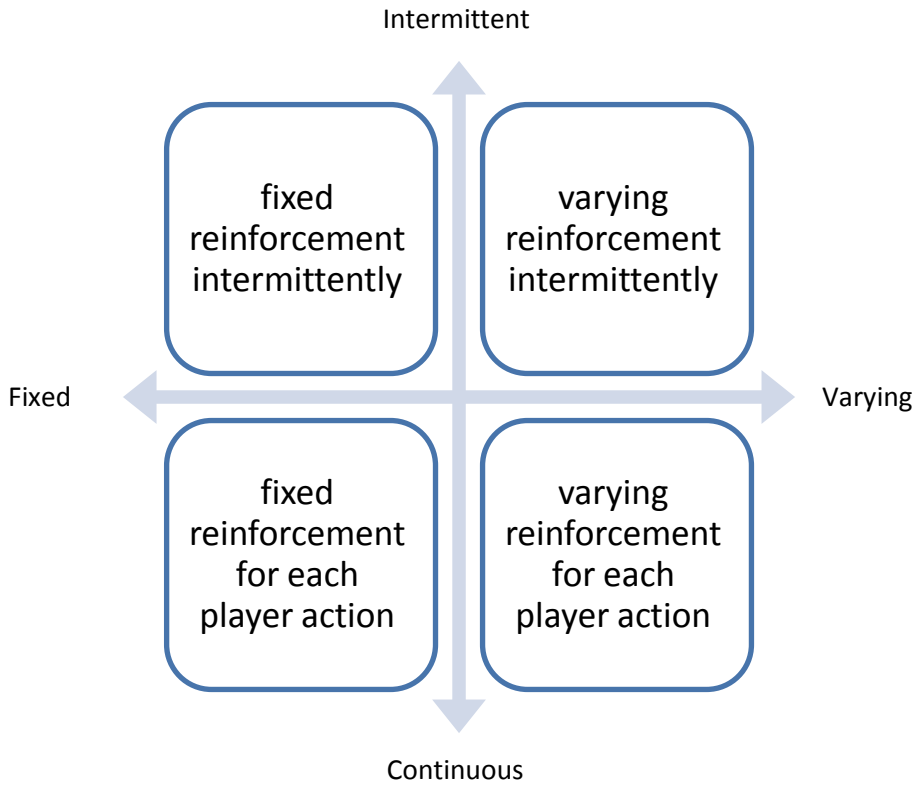

Figure 1: 2X2 experimental design for a pilot study

Hypothesis 1: Partial, non-continuous reinforcement will be associated with the following outcomes:

- improve persistent and productive game participation
- the duration of participation in the activity will be longer
- increase frequency of participation in the game
- players will have a better gaming experience
- players will play more intensely

Hypothesis 2: If player's experience is supported by partial, non-continuous reinforcements then he/she will exhibit integrated motivation

We hypothesize that different patterns of reinforcement yield distinctive patterns of responding; if players are rewarded only occasionally it is more likely that they continue playing in the hope of getting reinforcement, so they maintain the game play for a long time. This pattern of partial reinforcement may keep players engaged and therefore create lasting participation.

If accepted, preliminary results will be presented in the MCIS conference.

References

Breuer, J. S., & Bente, G. (2010). Why so serious? on the relation of serious games and learning. Eludamos.Journal for Computer Game Culture, 4(1), 7.

Burgos, D., Van Nimwegen, C., Van Oostendorp, H., & Koper, R. (2007). Game-based learning and the role of feedback: A case study. Advanced Technology for Learning, 4(4), 188-193.

Chen, J. (2007). Flow in games (and everything else). Communications of the ACM, 50(4), 31-34.

Chou, C. (2003). Interactivity and interactive functions in web-based learning systems: A technical framework for designers. British Journal of Educational Technology, 34(3), 265-279.

Crawford, C. (1984). The art of computer game design Osborne/McGraw-Hill.

Crawford, C. (2003). Chris crawford on game design New Riders Publishing Thousand Oaks, CA, USA.
Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation Psychological Bulletin, 125, 627-668.
Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. Educational Psychologist, 26(3-4), 325-346.
DeKanter, N. (2004). Gaming redefines interactivity for learning. TechTrends, 49(3), 26-31.
Farzan, R., DiMicco, J. M., Millen, D. R., Dugan, C., Geyer, W., & Brownholtz, E. A. (2008). Results from deploying a participation incentive mechanism within the enterprise. Proceedings of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems, pp. 563-572.
Federoff, M. A. (2002). Heuristics and Usability Guidelines for the Creation and Evaluation of Fun in Video Games,
Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. Simulation and Gaming, 33(4), 441-469.
Gillison, F., Standage, M., & Skevington, S. (2006). Relationships among adolescents' weight perceptions, exercise goals, exercise motivation, quality of life and leisure-time exercise behaviour: A self-determination theory approach. Health Education Research, 21(6), 836-847.
Guy, I., Perer, A., Daniel, T., Greenshpan, O., & Turbahn, I. (2011). Guess who?: Enriching the social graph through a crowdsourcing game. Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems, pp. 1373-1382.
Hacker, S., & Von Ahn, L. (2009). Matchin: Eliciting user preferences with an online game. Proceedings of the 27th International Conference on Human Factors in Computing Systems, pp. 1207-1216.
Hsiao, C. C., & Chiou, J. S. (2011). The effects of a Player's network centrality on resource accessibility, game enjoyment, and continuance intention: A study on online gaming communities. Electronic Commerce Research and Applications,
Hsu, C. L., & Lu, H. P. (2004). Why do people play on-line games? an extended TAM with social influences and flow experience. Information & Management, 41(7), 853-868.
Kalman, Y. M., Ravid, G., Raban, D. R., & Rafaeli, S. (2006). Pauses and response latencies: A chronemic analysis of asynchronous CMC. Journal of Computer- Mediated Communication, 12(1), 1-23.
Kolo, C., & Baur, T. (2004). Living a virtual life: Social dynamics of online gaming. Game Studies, 4(1), 1–31.
Lee, M. C. (2009). Understanding the behavioural intention to play online games: An extension of the theory of planned behaviour. Online Information Review, 33(5), 849-872.
Leemkuil, H., Jong, T., & Ootes, S. (2000). Review of educational use of games and simulations. Knowledge Management, Interactive Training System,
Lilienfeld, S. O. (2009). Psychology: From inquiry to understanding Pearson/Allyn Bacon.
Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. Cognitive Science, 5(4), 333-369.
Manninen, T. (2000). Interaction in networked virtual environments as communicative action: Social theory and multi-player games. Criwg, pp. 154.
Mason, B. J., & Bruning, R. (1999). Providing feedback in computer-based instruction: What the research tells us. Retrieved July, 6, 2004.
Medler, B., & Magerko, B. (2011). Analytics of play: Using information visualization and gameplay practices for visualizing video game data. Parsons Journal for Information Mapping, 3(1)
Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. Review of General Psychology, 14(2), 154.
Rafaeli, S., & Sudweeks, F. (1997). Networked interactivity. Journal of Computer- Mediated Communication, 2(4), 0-0.
Reeves, B., & Read, J. L. (2009). Total engagement: Using games and virtual worlds to change the way people work and businesses compete Harvard Business School Press.

Rettberg, S., Corneliussen, H., & Rettberg, J. (2008). Corporate ideology in world of warcraft. Digital Culture, Play, and Identity: A World of Warcraft Reader, , 19–37.
Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. Educational Technology Research and Development, 44(2), 43-58.
Rigby, C. S., & Przybylski, A. K. (2009). Virtual worlds and the learner hero how today's video games can inform tomorrow's digital learning environments. Theory and Research in Education, 7(2), 214-223.
Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions* 1. Contemporary Educational Psychology, 25(1), 54-67.
Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68.
Sweetser, P., & Wyeth, P. (2005). GameFlow: A model for evaluating player enjoyment in games. Computers in Entertainment (CIE), 3(3), 3.
Thom, J., Millen, D., & DiMicco, J. (2012). Removing gamification from an enterprise SNS. Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work, pp. 1067-1070.
Van Eck, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. Educause Review, 41(2), 16.
Voiskounsky, A. E., Mitina, O. V., & Avetisova, A. A. (2004). Playing online games: Flow experience. PsychNology Journal, 2(3), 259-281.
Von Ahn, L. (2009). Human computation. Design Automation Conference, 2009. DAC'09. 46th ACM/IEEE, pp. 418-419.
Von Ahn, L., & Dabbish, L. (2008). Designing games with a purpose. Communications of the ACM, 51(8), 58-67.
Von Ahn, L., Liu, R., & Blum, M. (2006). Peekaboom: A game for locating objects in images. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 55-64.
Vorderer, P., Hartmann, T., & Klimmt, C. (2003). Explaining the enjoyment of playing video games: The role of competition. Proceedings of the Second International Conference on Entertainment Computing, pp. 1-9.
Vukovic, M., Laredo, J., & Rajagopal, S. (2010). Challenges and experiences in deploying enterprise crowdsourcing service. Web Engineering, , 460-467.
Wang, J. C. K., Khoo, A., Liu, W. C., & Divaharan, S. (2008). Passion and intrinsic motivation in digital gaming. CyberPsychology & Behavior, 11(1), 39-45.