

# Literature Review on Web Application Gamification and Analytics

Yongwen Xu  
Collaborative Software Development Lab  
Department of Information and Computer Sciences  
University of Hawai‘i  
Honolulu, HI  
[yxu@hawaii.edu](mailto:yxu@hawaii.edu)

CSDL Technical Report 11-05  
<http://csdl.ics.hawaii.edu/techreports/11-05/11-05.pdf>

April 2012  
Copyright © Yongwen Xu 2012

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Related Work</b>	<b>3</b>
2.1	Defining Gamification . . . . .	3
2.2	Gamification Examples . . . . .	3
2.2.1	FourSquare : Check-in to Unlock . . . . .	3
2.2.2	Nike+: Making Fitness Fun . . . . .	4
2.2.3	Microsoft RibbonHero - Making You Better Your Job . . . . .	4
2.2.4	RecycleBank - Making the World Sustainable . . . . .	4
2.2.5	Power House - A Energy Game . . . . .	5
2.3	Why Games and Now . . . . .	5
2.4	Why Gamification . . . . .	7
2.5	Science behind Gamification: Motivation and Behavior Change . . . . .	8
2.5.1	Flow . . . . .	8
2.5.2	Player Type . . . . .	9
2.5.3	Fogg Behavior Model . . . . .	9
2.6	Gamification Design . . . . .	10
2.6.1	Gamification 1.0 : Game Mechanics and Elements . . . . .	10
2.6.2	Four Keys to Fun . . . . .	10
2.6.3	Smart Gamification . . . . .	14
2.7	Gamification Services and Platforms . . . . .	15
2.7.1	Commercial products and services . . . . .	15
2.7.2	Mozilla - Open Badges Infrastructure . . . . .	16
2.7.3	Open Source Gamification Platform . . . . .	16
2.7.4	Summary of Gamification Platforms . . . . .	16
2.8	Related Concepts . . . . .	17
2.8.1	Serious Game . . . . .	17
2.8.2	Persuasive Game . . . . .	18
2.8.3	Gameful Interaction Design . . . . .	18
2.8.4	Alternative Reality Games . . . . .	18
2.9	Gamification Analytics . . . . .	19
2.9.1	E-Score . . . . .	19
2.9.2	Social Game Metrics . . . . .	20
2.9.3	A/B Testing . . . . .	21

<b>3 Conclusion and Future Directions</b>	<b>22</b>
3.1 Conclusion . . . . .	22
3.2 Future Directions . . . . .	23
<b>4 Appendix</b>	<b>24</b>
4.1 Growing list of Gamification thought leaders . . . . .	24

## **Abstract**

As “Gamification” quickly becomes a hot topic across a wide range of industries and academia, it deserves more thorough study through qualitative and quantitative research. This document provides a survey of this recent phenomenon of “gamification”: a concept that has been applauded as a “game changing layer” and derided as a “useless buzzword”. It provides a comparative review of different schools of thoughts on the effectiveness of applying game mechanics to non-game contexts. Both industry implementations and academic research is reviewed and analyzed. With the goal of providing an empirical research basis on effectively gamifying web applications, this document also surveys the current methodology of game related analytics.

# Chapter 1

## Introduction

Wikipedia defines gamification as “the use of game play mechanics for non-game applications, particularly consumer-oriented web and mobile sites, in order to encourage people to adopt the applications” [66].

The term gamification only came into widespread use in February 2010, as part of the DICE 2010 conference. Jesse Schell, a game designer and professor from Carnegie Mellon, gave a presentation entitled “the future of games” in which he claimed that elements of games will invade every part of our daily lives [59]. The term gained more prominence through several recent books such as Gabe Zichermann’s “Game Based Marketing” [75], who advocated the use of game mechanics in marketing, and Jane McGonigal’s “Reality is Broken” [42], who claimed that games will make us better human and game is a solution to the broken reality. Finally, Baron Reeves’s “Total Engagement” [54], who claims that games and virtual worlds will change the way people work and businesses compete. At SXSW 2011, entrepreneur Seth Priebatsch talks about games as the new layer that similar to the social layer, ”will change the world” [52].

In IT industry research, Gartner predicts that by 2015, more than half of companies managing innovation processes will employ gamification, a process of applying game mechanics to non-game contexts [27]. In that same time frame, M2 Research forecasts that game mechanics production will generate \$1.6 billion in revenues and will account for 23% of social media marketing budgets [56]. As of today, existing gamified applications already range across diverse application areas in including productivity, finance, health, sustainability, news, user-generated content and e-learning. Several vendors, mainly startups, offer gamification as a service layer of reward and reputation systems with points, badges, levels and leader boards, with a recent spate of venture capital investment in this emerging industry.

In the 2011 Gartner Hype Cycle report, gamification, along with big data and the internet of things, are new additions [26]. According to Gartner, gamification is on the rise to the peak of the hype, the stage of the ”peak of inflated expectation”, with a subsequent 5-10 years required for mainstream adoption, as shown in figure 1.1. Gartner uses hype cycle theory to track technology adoption: after the peak period, the technology will slip into the trough of disillusionment, after which some technologies will start climbing the slope of enlightenment and eventually reach the plateau of productivity. As with any technology, gamification will inevitably slip into the disillusion-

sionment trough where the hype is passed and the masses realize that there are a lot of unsolved problems. The question remains if gamification will eventually climb out of the trough and appear in the plateau of the cycle.

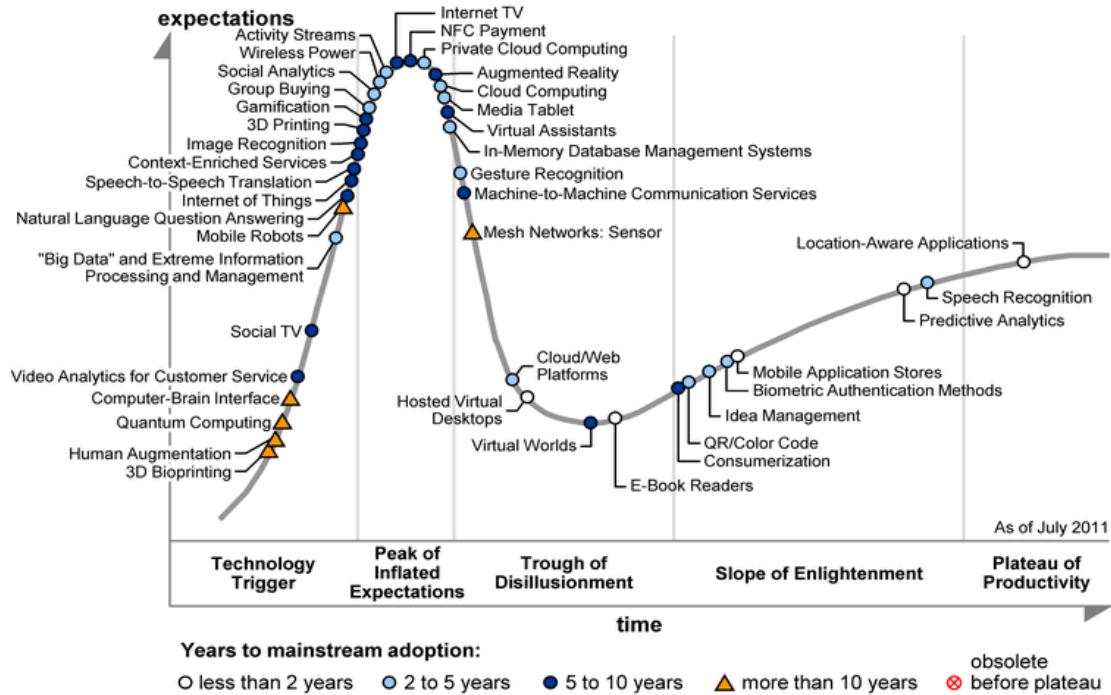


Figure 1.1: 2011 Gartner Hype Cycle (source: Gartner) [26]

In fact, there is already quite a lot criticism of gamification in the media. Some call it a mere buzzword, a hyped-up version of a mileage loyalty program, or a superficial “pointification”, which often misses elements such as storytelling and experiences which are central to what make games effective [58]. More and more game designers and researchers are looking into the deeper practice of gamification. Amy Jo Kim presents “Smart Gamification” which focuses on designing an effective “Player Journey” with intrinsic rewards preferred over extrinsic rewards [35]. Jane McGonigal emphasizes the aspect of “Playfulness” in gamification instead of game mechanics [44]. Similarly, researcher Sebastian Deterding criticizes the current practice of simplistic gamification and stresses the importance of “meaningful play” in his Google Tech Talk “Getting Gamification Right” [15].

As the preceding shows, Gamification is quickly becoming an IT phenomenon, with some argue it is a meaningless buzzword, while others argue it will revolutionize information technology in the same way as social networks.

The goal of this document is to review the different gamification design thoughts and approaches as thoroughly as possible, and to examine commonly employed game mechanics with respect to their usage and effectiveness. In order to provide quantitative insight into the research in gamification, we will also examine the gamification metrics of gamified applications.

# Chapter 2

## Related Work

### 2.1 Defining Gamification

Although gamification is a popular buzzword, there are quite a few definitions. Bunchball, a company that provides gamification services to marketers, defines gamification as “integrating game dynamics into your site, service, community, content or campaign in order to drive participation” [11]. Wikipedia defines gamification as “the use of game play thinking and mechanics to solve problems and engage audiences” [66]. They all seem to tie gamification to the goal of engagement. Some others consider any game-related application as gamification, such as serious game, playful interaction and game-based technologies. Researcher Sebastian Deterding proposes an academic definition: “Gamification is the use of game design elements in non-game contexts” [17]. This is the definition we choose to use in our discussion.

### 2.2 Gamification Examples

There are many examples of applications that effectively employ game design elements. We will only briefly examine a few here for the purpose of better understanding the gamification concept and how it is utilized across a wide range of technologies.

#### 2.2.1 FourSquare : Check-in to Unlock

FourSquare [23] is a location-based game-like service where players check-in to locations for virtual points and rewards. It is probably the most recognized example of applying game mechanics to location-based networking application. By employing gamification elements such as points, badges, levels and leader boards, it engages users to revisit a location such as restaurant or pub and become a loyal customer and finally the “mayor” of the place. Some virtual rewards such as the “mayors” of Starbucks or certain badges can be converted into real products, e.g. a free coffee. Foursquare proved that simple game mechanics can affect user behavior by engaging 10 million customers with a successful business model.

#### 2.2.2 Nike+: Making Fitness Fun

Nike+ [46] is a social running game-like application that employs game mechanics to encourage runners - both casual and hardcore - to compete and improve their fitness, with the goal of solving



Figure 2.1: Foursquare makes modern badges popular

the main problem of most fitness programs: motivation. Nike+ makes it easy for runners to upload their exercise data to its web site, and start challenging themselves and their friends. They can also get supports from their friends through the web site. The game attempts to make running and exercise fun.



Figure 2.2: Nike+ attempts to make fitness run

### 2.2.3 Microsoft RibbonHero - Making You Better Your Job

RibbonHero [57] is a game that attempts to help users discover new Microsoft Office features in a fun and motivating way. The goal is to have users build familiarity and expose them to the Office UI, so that they understand what kind of features are available. According to the creator of the game, Office “has a lot of powerful features that users might not know but can be really

useful”. The game gives users a chance to learn those features in a fun and engaging way, rather than reading the software manuals or watching the typically dry IT training videos.

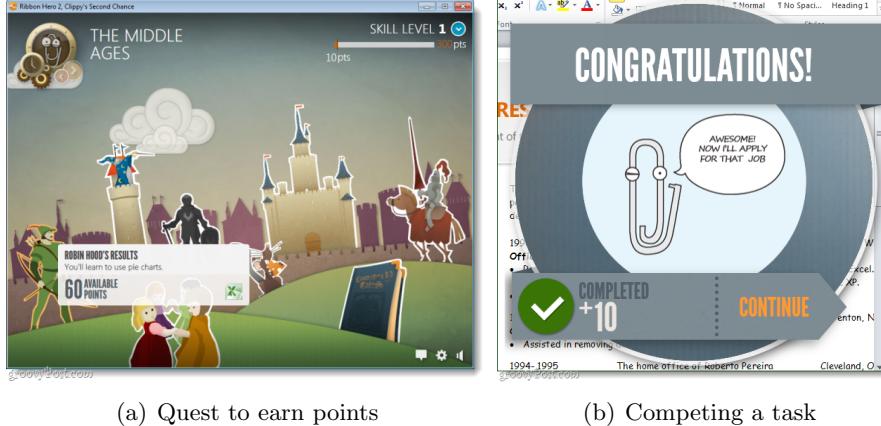


Figure 2.3: RibbonHero Helps to Learn Office

#### 2.2.4 RecycleBank - Making the World Sustainable

RecycleBank [53] introduced a series of “Green Challenges” that used gaming techniques online to motivate participants to learn about green living and to take small green actions to live more sustainable lives offline. According to their report [30], 49,000 individuals participated in the “Green Your Home Challenges”. Partnered with Google Analytics and ROI research, they found that:

- Gamification can increase awareness of positive environmental actions. 97% of participants surveyed said the game increase their knowledge of environment.
- Games can drive individuals to take positive social and environmental actions. Most participants surveyed indicated they are very or extremely likely to take green actions as a result of participating in the challenge.
- Games are an effective and appealing educational tool. 86% participants agreed online games and contest can be a good way to inform and educate them personally.

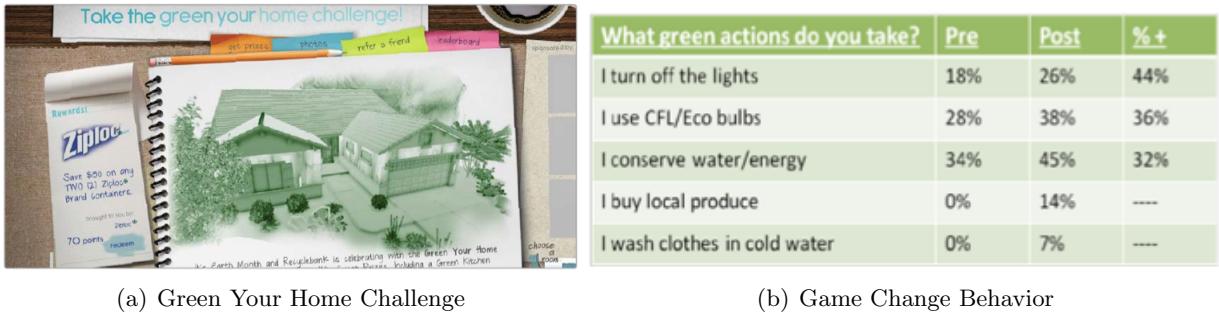


Figure 2.4: RecycleBank - Gaming for Good

### 2.2.5 Power House - A Energy Game

Reeves et al. described the design of Power House, an energy game that connects home smart meters to an online multiple player game with the goal to improve home energy behavior [55]. In the game, the real world energy data are transformed into a “more palatable and relevant form of feedback”, and players may be incentivized by the in-game rewards to complete more energy-friendly real-world behaviors.



Figure 2.5: Power House (source: Reeves [55])

## 2.3 Why Games and Now

Gamification is not games. In fact, the subjects of gamification deal with everything else but games. However, to understand the research in gamification, we have to look at the studies of games. Games already prove to be an effective, engaging media and are ubiquitous in every day life. “Video games are everywhere” is the critical thesis of many gamification advocates.

Why game? Results of a study published in the May 1998 issue of Nature [36] demonstrated that video game players experienced regular releases of dopamine during game play. Dopamine is a neurotransmitter that signals pleasure rewards for food, sex and addictive drugs, such as cocaine. This study proves that playing games stimulates pleasure centers in the brain. People are hard-wired to enjoy games.

Carnegie Mellon University professor and game designer Jesse Schell, who ignited the first wave of interest in gamification with a keynote address at the 2010 Design Innovate Communicate Entertain (D.I.C.E.) Summit, mentioned that he was surprised so many people are now taking interest in his presentation. He had talked about the phenomenon for years with little response. Back in 2008, Gabe Zichermann coined the term ”funware”, which is the use of game mechanics to encourage desired user actions and generate customer loyalty [65]. Although it has the similar concept as gamification, the term ”funware” did not gain traction.

Why now? According to Schell, “We’re moving from a time when life was all about survival to a time when it was about efficiency into a new era where design is largely about what’s pleasurable”. Online games have entered the mainstream and become a new culture revolution, helped

by platforms such as smart phones, tablets and Facebook. Gamification is a way to arrive at a “fundamental understanding of what it is that’s pleasurable to people” from many aspects of life.

Stanford professor Byron Reeves describes that a “Game Tsunami” is happening now in his book “Total Engagement” [54]. According to him, “Games Are Big” in three ways:

1. Big Bucks. The game industry is already a \$10 billion market, one of the largest existing entertainment categories. Besides traditional console and software sales, the current model of subscription fees, virtual goods sales and in-game purchase also account for the huge revenue for the game industry.

2. Big People. The stereotype about the majority of gamers being unemployed youth is easily proved wrong. One research study reveals that across all computer games, the average age of gamers is 35, and 26% of players are over 50, an increase from 9% in 1999. Another research study shows that the mean household income of players in one popular MMO (Multi-Player Online game) was about \$85,000, and almost two-thirds of the players have some college education.

3. Big Time. “One sizable cohort of players who are thirty-something, most with a full-time job and many with a family, play MMOs over 25 hours per week, compared with 7 hours a week for all video games”.

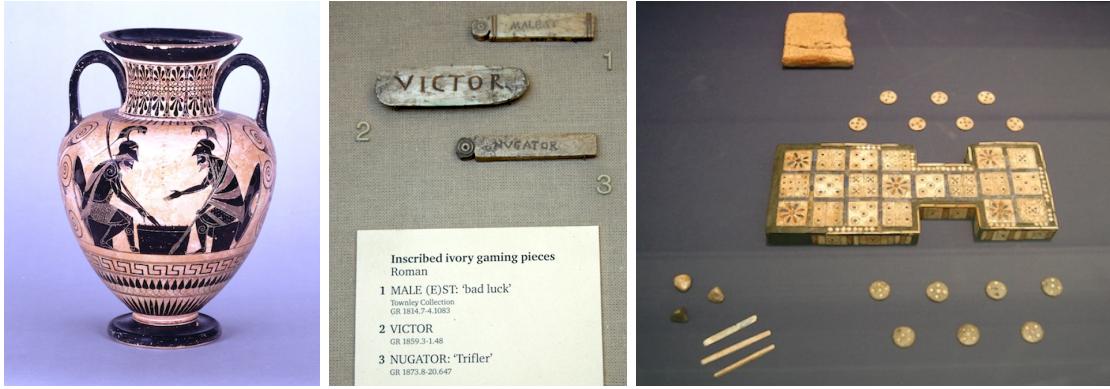
In the British Museum’s department of Greek and Roman antiquities, there is an exhibition section about ancient games. The description of the exhibition states that “We know very little about how most ancient games were played. Their rules were probably too familiar for people to take the trouble of writing them down”. A favorite subject of Greek vase-painters was Ajax and Achilles playing backgammon as illustrated in Figure 2.6. It is noteworthy that both Ajax and Achilles have the full armor on while playing the game. According to Arthur A. Krentz, Plato’s “Republic” described the connection between play and education of both adult and children. He points out that, the term “paideia” (in Greek, means education/culture), “paidia” (means play/game/pastime/sport), and “paides” (means children), have the same root. The three terms often show up in the same context. “The central aim of pedagogy (paidagogia) is to encourage learning as a form of play (paidia), which is the most persuasive and effective approach to learning” [39].

Another game artifact exhibited in the museum is a set of label-shaped ivories, inscribed on one side with words and on the other with numbers. The series of numbers run from 1 to 25. The higher numbers have inscriptions of complimentary words, such as FELIX (“lucky”) and BENIGNE (“kindly”) [62]. The pieces may have been used in the Roman game called “the game of soldiers”. One can relate the inscribed ivory pieces to the badges in modern games.

Yet another important game antique in the museum is the Royal Game of Ur, dating from the First Dynasty of Ur, before 2600BC. It is one of the most popular games of the ancient world, and probably the oldest set of board game equipment ever found. The beauty of the equipment is still amazing today. Wikipedia notes that the game of Ur is still played in current day Iraq. [67].

In modern times, World of Warcraft (WoW) is a massively multiplayer online role-playing game (MMORPG) with 11.1 million subscribers, currently the world’s most popular MMORPG. More than 50 billion hours have been spent in playing the game since the start of this game in 2004. The players created 250,000 articles in the WoW-Wiki, the second largest wiki behind Wikipedia. On average each WoW-player spends from 17 to 21 hours per week playing WoW.

Nick Yee describes 5 motivation factors behind why people play MMORPGs [73]: (1) Relationship: Players desire to develop meaningful relationships with other players in the game as supportive friendships. (2) Immersion: Players enjoy being immersed in a make-believe construct



(a) Ajax and Achilles Playing (b) Ancient Game Badges (c) The Royal Game of Ur

Figure 2.6: The Beauty of Ancient Board Games in British Museum

such as a fantasy world. (3) Grief: Players desire to objectify and use other players for one's own gains by killing or deceiving. (4) Achievement: Players desire to become powerful by reaching the goals defined by the game. (5) Leadership: Players desire the gregariousness and assertiveness enabled by a group.

Yee also noted that the shared experience, the collaborative nature of most activities makes MMORPG unique. "It's the people that are addictive, not the game". "Most importantly, it is the reward of being socialized into a community of gamers and acquiring a reputation within it" [74]. He claimed that "WoW truly is a virtual Skinner box", smoothly increasing reward and difficulty and reinforcing player commitment along the way [72].

Furthermore, based on longitudinal data collected directly from playing the game, Ducheneaut et al. described that many of WoWs subscribers play alone with a different kind of social factor, "audience", a sense of social presence [19]. It is different than the quest grouping that providing direct support and camaraderie. There are three appeals in being "alone together" in multiplayer games: (a) interacting with an audience: MMORPGs are in essence reputation games - an avatar wearing powerful items, for instance, is essential to the construction of a players identity; (b) being surrounded by others; (c) laughing at and with others.

## 2.4 Why Gamification

In her popular TED talk "Gaming can make a better world" [43] and in her book "Reality is Broken" [42], researcher and game designer Jane McGonigal illustrated why good games make us better, and how they can help us change the world. She notes that currently more than 3 billion hours a week spent playing video games by our society, for good reasons. She says that the average gamer plays 10,000 hours of games by age 21. That's about the same number of hours that students spend in high school and middle school. There are 500 million gamers today, playing on all sorts of platforms from the iPhone to the game consoles. Instead of the common conception that gaming is a waste of time, she argues that "playing games is the single most productive thing we can do with our time" and is the solution to our current "Broken Reality". According to McGonigal, games are "unnecessary obstacles" that we volunteer to tackle. "eustress" or positive stress is the reason we spend so much time on unnecessary obstacles. Based on the findings of positive psychology,

she argues that the blissful productivity comes from positive emotion, relationships, meaning and accomplishments while playing games.

Another instrumental work comes from Byron Reeves's book "Total Engagement" [54]. He argues that games, especially MMO type games, can change the way people work and businesses compete. He illustrates ten ingredients of great games and how to use them to design a better productive work place: (1) Self-representation with avatars; (2) Three-dimensional virtual environments; (3) Narrative context; (4) Feedback; (5) Reputations, ranks, and levels; (6) Marketplaces and economies; (7) Rules that are explicit and enforced; (8) Teams; (9) Communication system that can be reconfigured by participants; (10) Time pressure.

In his book "Game Based Marketing" [75], Gabe Zichermann stated that "FunWare" is about taking the lessons learned from the game industry and baking them into any kind of life experience. Marketing has always been about a certain degree of persuasion and motivation, and a degree of manipulation. Games do that most effectively. "Game mechanics and the psychological conditions are powerful tools that marketers can use, and they are a lot cheaper ... than cash in the long run". "Games are the only force in the known universe that can get people to take actions against their self-interest, in a predictable way, without using force".

## 2.5 Science behind Gamification: Motivation and Behavior Change

Researchers from game industries and academia, have studied the psychology of motivation that makes games so engaging.

### 2.5.1 Flow

Psychology professor Mihaly Czikszentmihalyi introduced a specific kind of happiness that he named "flow" [14], which is considered as one of the fundamental reasons that people play games [45]. Flow is a state of absorption, characterized by intense concentration, loss of self-awareness, a feeling of being perfectly challenged (neither bored nor overwhelmed) and a sense that time is flying.

In order to achieve flow, the important condition is a balanced goal that is challenging yet achievable within the individual's ability. A task that is not challenging or requires excessive time to complete becomes boring and players lose interest; A task that is too hard causes frustration and anxiety and again players lose interest. With a person's skills improve over time, the challenge needs to increase along with the improving skills. This balance is referred to as the flow channel as shown in figure 2.7.

### 2.5.2 Player Type

In order to understand why people play games, Richard Bartle identified four player personality types by studying players of the Multi-User Dungeon (MUD) game in 1960s [5]. The four types are based on the 2 underlying axes:

1. Achievers: driven by in-game goals, usually some form of points gathering - whether experience points, levels, or money.
2. Explorers: driven to find out as much as they can about the virtual construct - including mapping its geography and understanding the game mechanics.
3. Socializers: use the virtual construct to converse and role-play with their fellow gamers.

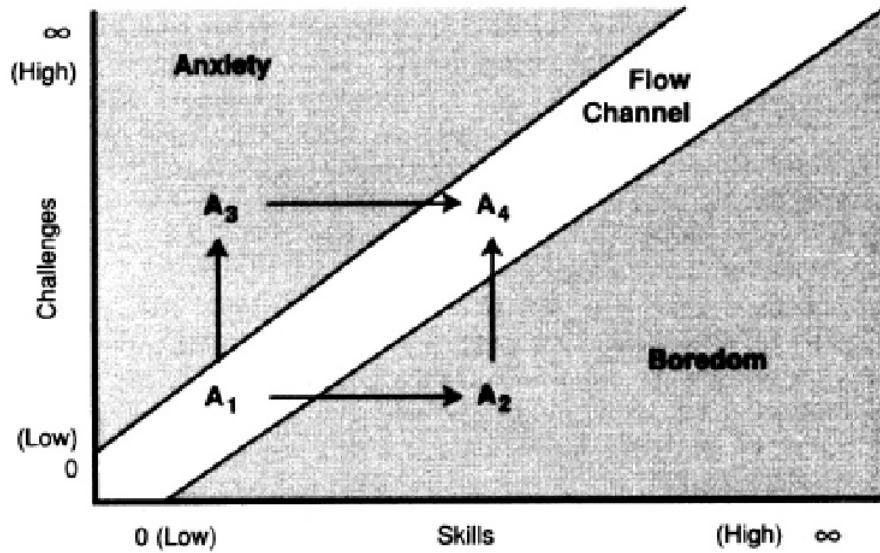


Figure 2.7: The state of flow is achieved between anxiety and boredom (source: Czikszentmihalyi [14])

4. Killers: use the virtual construct to cause distress on other players, and gain satisfaction from inflicting anxiety and pain on others.

Bartle's player type model has been the basis for understanding player motivation. Dan Dixon presented the limitation and misuse of Bartle's model in general games and gamification contexts [18]. Amy Jo Kim applied the model in her gamification approach by overlaying social actions from the game on top of the player types [35], as shown in Figure 2.8.

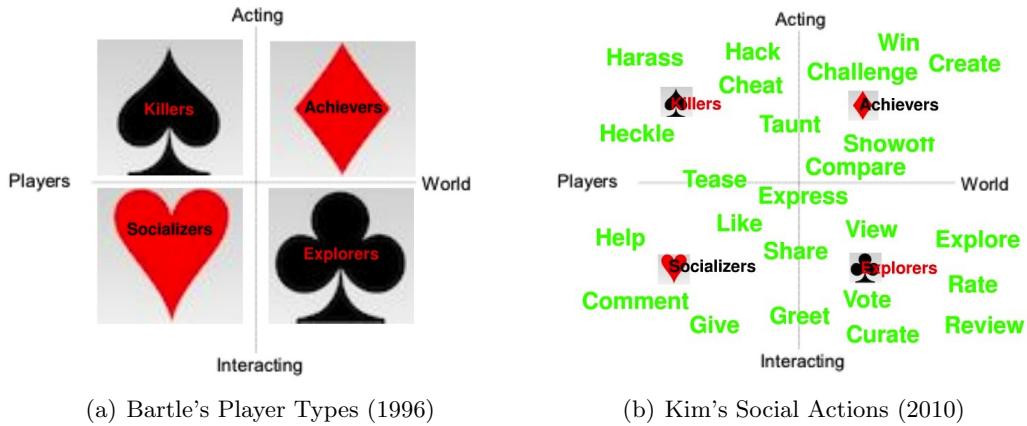


Figure 2.8: Player Types

### 2.5.3 Fogg Behavior Model

Stanford University researcher BJ Fogg introduces the Fogg Behavior Model (FBM) to explain what causes behavior change [22]. The model shows that three elements must converge at the same moment for a behavior to occur: (1). Motivation: the person wants to perform the behavior. (2). Ability: the person can easily carry out the behavior (3). Trigger: the person is prompted to do the behavior. The model is illustrated in Figure 2.9.

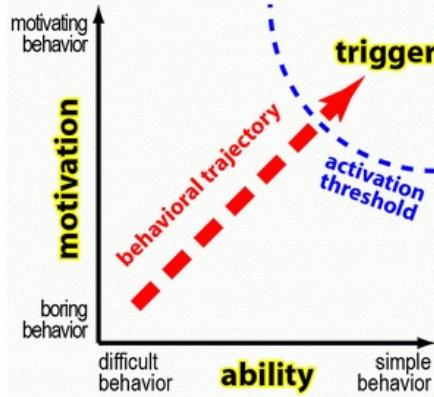


Figure 2.9: Fogg Behavior Model (source: Lithium [71])

Michael Wu uses FBM to analyze why and how gamification is able to drive actions [71]. “Game mechanics and game dynamics are able to positively influence human behavior because they are designed to drive the players above the activation threshold, and then trigger them into specific actions”. Wu suggests that gamification is an iterative process and works best when all three of motivation, ability, and trigger converge.

Another Stanford Researcher Kaptein developed a technique he called “Persuasion Profiling” to build a profile of which psychological triggers work best for a given person, and uses these triggers to drive new behaviors in the future [33].

## 2.6 Gamification Design

This section describes current approaches into gamification design. It starts with gamification design 1.0, which means simply adding points, badges and leader boards in applications. After, this section discusses smart gamification that emphasizes a player’s journey to mastery in an application.

### 2.6.1 Gamification 1.0 : Game Mechanics and Elements

Different game mechanics and elements can be used to serve different functions in satisfying players’ needs, and the basic elements such as points, badges, and leader boards are the defining attributes of the current gamification practices [16]. Figure 2.10 illustrates these basic game mechanics and elements.

Seth Priebatsch stated that you can get anyone to do anything with 7 game dynamics [52]. Techcrunch published a “secret” game dynamics play deck that is used by Priebatsch’s company SCVNGR [8]. The play deck is a set of 47 flash cards. Each card illustrates one game dynamics.

	Reward	Status	Achievement	Self Expression	Competition	Altruism
Points	●	●	●		●	●
Levels		●	●		●	
Challenges	●	●	●	●	●	●
Virtual Goods	●	●	●	●	●	
Leaderboards		●	●		●	●
Gifting & Charity	●	●		●		●

(a) Satisfies Human Needs (source: Bunchball)



(b) Basic Mechanics (source: Deterding [15])

Figure 2.10: Gamification 1.0

SCVNNGR employees are instructed to memorize them and apply in their applications as needed. Social interaction designer Adrian Chan commented that the play deck does not include the sociological factors in social gaming and confuses game mechanics with game dynamics [12].

Gamification.org compiles a list of game mechanics and categories them into three types (Behavioral, Feedback, Progression) and their benefits [24]. Table 2.1 - 2.3 organizes the mechanics in type, a short description or examples, benefits, and possible player types in Bartle's model [5]:

Game Elements are different than mechanics. They manifest the game information to the player, usually as UI components. Table 2.4 lists some popular game elements and their examples:

## 2.6.2 Four Keys to Fun

By doing a research study of 15 hardcore gamers, 15 casual games, and 15 non-players, Nicole Lazzaro identified four Keys to releasing player's emotions during play: "Hard Fun, Easy Fun, Serious Fun, and People Fun" [40]. Most of the popular games selected in her research created emotion in at least three of the Four Keys, thus she hypothesizes that combining these four keys in game design will make a deeply enjoyable game for a wide market.

Nicole Lazzaro described the "Four Keys to Fun" framework to design better engagement in games, especially the MSO (Massively Social Online) games [41]. Figure 2.11 illustrates the framework in more details.

## 2.6.3 Smart Gamification

Amy Jo Kim presented "Smart Gamification" which focuses on designing an effective "Player Journey" with intrinsic reward preferred over extrinsic reward [35]. Kim pointed out that game techniques are not equal to core experience and intrinsic values are greater than extrinsic rewards. Kim stated that "a good game take the player on a journey toward mastery". As illustrated in Figure 2.12 (a), when over time players progress from newcomer to regular and finally to enthusiast, they progress from novice to expert to master. When designing the journey, Kim suggests using different techniques to meet players needs, where novices need onboarding, experts need fresh content, activities and challenges, and masters need exclusivity, recognition and impact. As shown in Figure 2.12 (b), Kim incorporates the MDA framework [31], using it to guide and motivate the player journey.

Table 2.1: List of Game Mechanics (compiled from gamification.org [24])

Types	Mechanics / Examples	Benefits	Player Types
Progression	Achievements: normally represents as badge, completed something	Engagement, Loyalty, Time Spent, Influence, Fun, SEO, UGC	Achievers, Explorers, Killers
Progression	Levels: a system of reward for a cumulation of points, Often are unlocked as players progress to higher levels.	Engagement, Loyalty, Influence, Time Spent, Virality, Fun	Achievers, Explorers, Killers
Progression	Points: a running numerical value given for any single action or combination of actions.	Engagement, Loyalty, Influence, Time Spent, Virality, Fun, UGC	Achievers, Explorers, Killers
Progression	Progression: success is granularly displayed and measured through the process of completing itemized tasks, such as a progress bar.	Engagement, Loyalty, Influence, Time Spent, Fun, UGC	Achievers, Killers
Feedback	Appointment Dynamics: at a predetermined times/places a user must return for a positive effect	Engagement, Influence, Time Spent	Archivers, Explorers, Socializers
Feedback	Bonuse: a reward after having completed a series of challenges or a specific task	Engagement, Influence, Time Spent, Virality, Fun, UGC	Archivers, Explorers, Socializers, Killers
Feedback	Cascading Information Theory: information should be released in the minimum possible snippets to gain the appropriate level of understanding	Engagement, Loyalty, Influence, Time Spent	Archivers, Explorers, Socializers, Killers
Feedback	Combos: reward skill through doing a combination of things, usually comes with the reward of a bonus	Engagement, Influence, Time Spent, Virality	Archivers, Explorers, Socializers, Killers
Feedback	Countdown: players are only given a certain amount of time to do something. This will create an activity graph that causes increased initial activity increasing frenetically until time runs out, which is a forced extinction.	Engagement, Fun, Influence	Achievers, Explorers, Killers
Feedback	Quests/Challenges: Challenges usually implies a time limit or competition whereas Quests are meant to be a journey of obstacles a player must overcome. a way to organize player effort.	Engagement, Loyalty, Revenue, Influence, Time Spent, Virality, SEO, Fun, UGC	Achievers, Explorers, Killers

Table 2.2: List of Game Mechanics (cont.)

Types	Mechanics / Examples	Benefits	Player Types
Feedback	Reward Schedules: The fixed or variable timeframe and delivery of the rewards, contingency, response, reinforcer.	Engagement, Loyalty, Revenue, Influence, Time Spent, Virality, SEO, Fun, UGC	Achievers, Explorers, Killers
Behavioral	Discovery/Exploration: players love to discover and to be surprised.	Engagement, Loyalty, Influence, Time Spent, Fun	Explorers, Achievers
Behavioral	Epic Meaning: Players will be highly motivated if they believe they are working to achieve something great, something awe-inspiring, something bigger than themselves.	Engagement, Loyalty, Influence, Time Spent, Fun	Achievers, Explorers, Socializers, Killers
Behavioral	Free Lunch: getting something for free due to someone else having done work. Groupon	Engagement, Loyalty, Revenue, Influence, Virality, Fun	Achievers, Explorers, Socializers, Killers
Behavioral	Infinite Gameplay: do not have an explicit end, static state is its own victory.	Engagement, Loyalty, Revenue, Influence, Time Spent, Fun	Achievers, Killers
Behavioral	Loss Aversion: influences user behavior not by reward, but by not instituting punishment. the player having to perform an action to avoid losing something they currently have.	Engagement, Loyalty, Influence, Time Spent, Virality, Fun	Achievers, Explorers
Behavioral	Lottery: the winner is determined solely by chance. winners will generally continue to play indefinitely while losers will quickly abandon	Engagement, Loyalty, Revenue, Influence, Time Spent, Virality, Fun	Achievers, Explorers, Socializers, Killers
Behavioral	Ownership: creates Loyalty by owning things.	Engagement, Loyalty, Revenue, Influence, Time Spent, Virality, SEO, Fun, UGC	Achievers, Explorers, Socializers, Killers
Behavioral	Community Collaboration: an entire community is rallied to work together to solve a riddle, a problem or a challenge. Immensely viral and very fun.	Engagement, Influence, Time Spent, Virality	Archivers, Explorers, Socializers
Behavioral	Behavioral Momentum: a tendency of players to keep doing what they have been doing	Engagement, Loyalty, Revenue, Influence, Time Spent	Archivers, Explorers, Socializers, Killers

Table 2.3: List of Game Mechanics (cont.)

Types	Mechanics / Examples	Benefits	Player Types
Behavioral	Blissful Productivity: playing hard rather than relaxing makes you happier	Engagement	Archivers, Explorers, Socializers, Killers
Behavioral	Status: The rank or level of a player. Players are often motivated by trying to reach a higher level or status. Also relates to envy.	Engagement, Loyalty, Revenue, Influence, Time Spent, Virality, SEO, Fun, UGC	Achievers, Socializers, Killers
Behavioral	Urgent Optimism: The desire to act immediately to tackle an obstacle combined with the belief that we have a reasonable hope of success.	Engagement, Fun	Explorers, Killers
Behavioral	Virality: more successful in the game if you invite your friends, the social check-in.	Engagement, Loyalty, Revenue, Virality, SEO, UGC	Socializers, Achievers, Killers

Table 2.4: List of Game Elements (source: gamification.org [24])

Elements	Description and Examples
Activity Feed	shows players what has been taking place in the system overall and motivate the player to obtain the same achievement as others.
Avatars	unique representations for a player. shows a high emotional attachment between the player and the game. often customization and decoration are enhancement for higher engagement.
Easter Eggs	an intentional hidden message, in-joke.
Instances	are created for players to have a unique experience that is outside the normal experience. When a player creates a special unique page experience that allows to log into and view their unique content an instance has been created.
Leader boards	are a means by which users can track their performance, subjective to others. Leaderboards visually display where a user stands in regards to other users. Leaderboards can be broken down into several subcategories such as: Global, Friends, Relative, Isolated etc.
The Notifier	is a direct way to give the user direct feedback about their progress, change of status in the gameplay experience etc.
User Profile	displays a User's data about their activity on a website and can be used to tell the world and a community on the internet who they are.

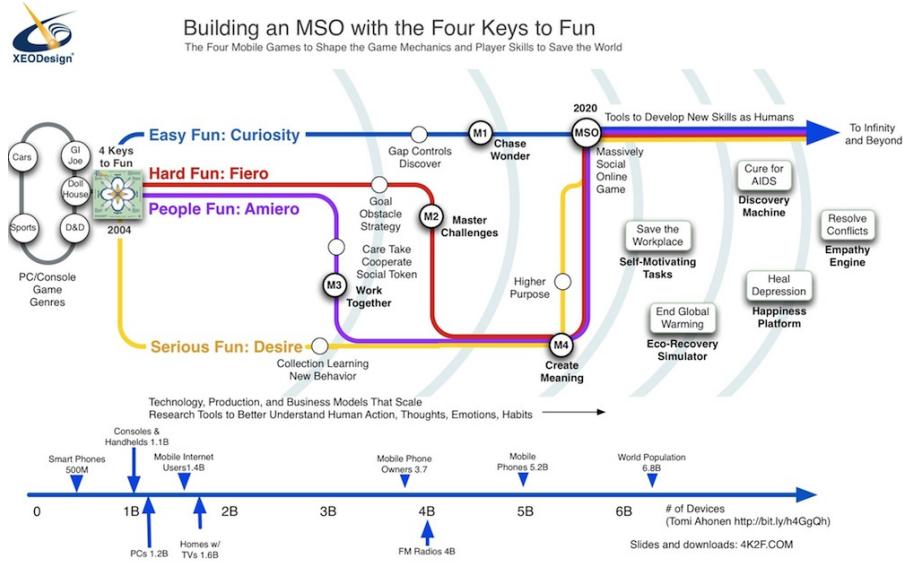


Figure 2.11: Four Keys to Fun Game Map (source: Lazzaro [41])

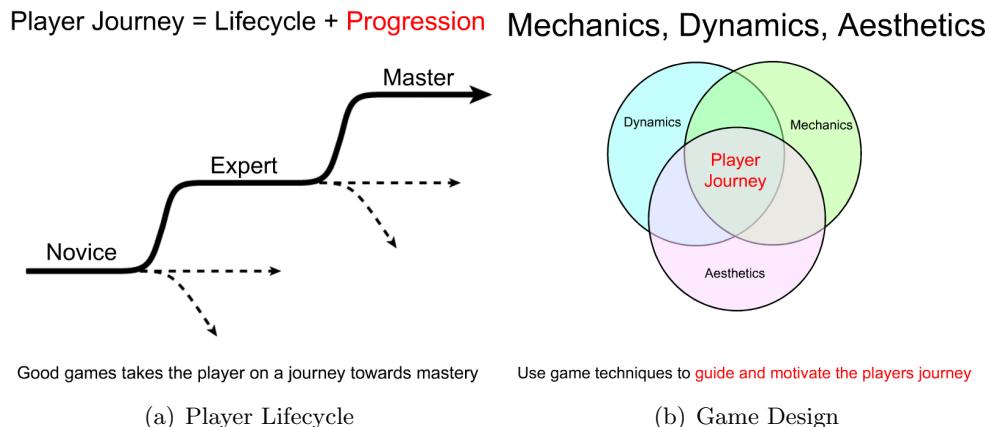


Figure 2.12: Designing Player Journey (source: Kim [35])

Similarly, researcher Sebastian Deterding not only criticized the current practice of simple gamification practices but stressed the important of “meaningful play” and proposed a user experience design around the three most important aspects: Meaning, Master and Autonomy [15]. It is an adaptation to the three elements to motivate people in Daniel Pink’s book “Drive: The Surprising Truth About What Motivates Us” [51]. Deterding explained that the reason why we play is because of the meaning and autonomy with choice in the game. The mastery in the game give us fun and enjoyment.

## 2.7 Gamification Services and Platforms

There are several gamification services and platforms from by commercial companies and open source providers. They aim to meet the increasing needs of gamifying non-game applications.

### 2.7.1 Commercial products and services

This section outlines the current industry players that provide gamification services via platforms or consultation services, as illustrated in Figure 2.13. Almost all of them are recent startups funded by venture capitals.



Figure 2.13: Gamification Service Industry

Here we take a brief look at the three most active players:

**Badgeville** [4] brands itself to be the world’s leading Social Loyalty Platform. Its products include “Dynamic Game Engine”, providing an easy and flexible way to setup behaviors, rewards, missions; “Gamification Widget Studio”, offering a collection of skinnable and configurable game mechanics widgets; and “Social Fabric”, integrating social graph, social notification, relevant activity streams for better social engagement.

**Bunchball**’s [11] Nitro Platform provides a comprehensive set of game mechanics, besides the normal points and badges levels, it provides Actions, Groups, Virtual Goods, Social networks, Trivia, Poker, Comments etc. It is a fully integrated platform for engineers, designers, and marketers. Another product that Bunchball introduced is the Nitro Elements, which is a suite of

cloud-based, simple plug and play applications, that is aimed for quick implementation of gamification. The current elements includes “FanBox” (a reward system) and “GameBox” (hosted poker game).

**BigDoor** [7] also provides a platform with flexible API and customizable widgets to add game mechanics to web sites, to reward users with points, badges, achievements and leader boards. The javascript based “MiniBar” widget is a quick way to add game layer to the web site.

All of the above platforms feature built-in analytics built to provide some kinds of metrics about the result of the gamification. While Badgeville seems emphasize on social integration; Bunchball provides a comprehensive solution even with a game box; and BigDoor provides a simplest “Mini-Bar” for easy non-technical integration into existing web site.

### 2.7.2 Mozilla - Open Badges Infrastructure

Open Badges [48] is a project of Mozilla with support from the MacArthur Foundation to provide a software infrastructure for issue and display of badges across the web. It uses shared badges as the recognition for all types of learning and achievement that can take place anywhere, such as a skill learned from after-school program, a certification earned or simply an achievement of providing useful technical answers. The badges can be displayed in a personal or social web site, or be used in a job search as a convenient showcase of an applicant’s qualifications.

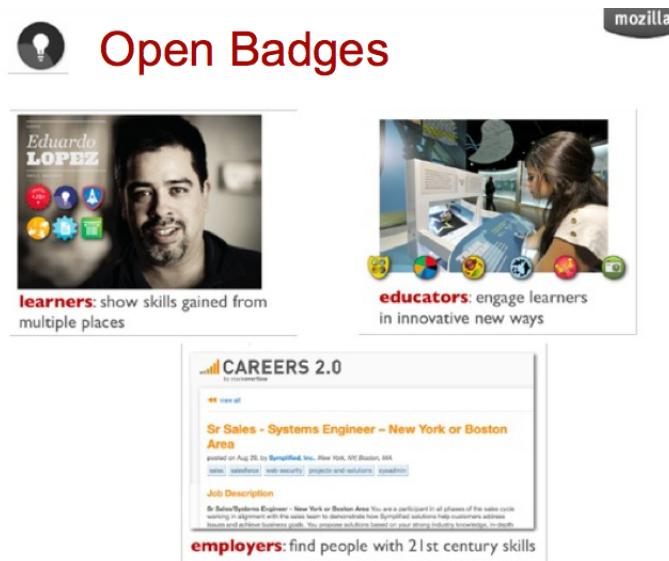


Figure 2.14: Mozilla - Open Badges Infrastructure

### 2.7.3 Open Source Gamification Platform

Userinfuser [61] is an open source platform that provides customizable gamification elements designed to increase user interaction on web sites. The project involves badging, points, live notifications, and leader boards. Additionally, the platform provides analytics to track user participation. The current documentation shows the following widgets available in the platform.

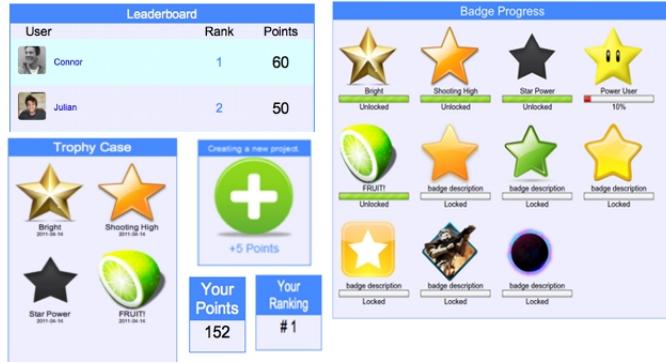


Figure 2.15: Open Source Gamification: Userinfuser Widget

#### 2.7.4 Summary of Gamification Platforms

Table 2.5 summarize the services provided by the platform discussed above.

Table 2.5: Summary of Gamification Platforms

Platform	Licence	Game mechanics	Analytics	Games
Badgeville	Commercial	Yes	Yes	No
BigDoor	Commercial	Yes	Yes	No
Bunchball	Commercial	Yes	Yes	Yes
Open Badges	Open Source	Yes (only badges)	No	No
Userinfuser	Open Source	Yes	Yes	No

## 2.8 Related Concepts

As we discussed before, gamification's main driving force is motivation. Serious games also try to solve the motivation problem and influence people's behavior. Deterding illustrates the distinctions between gamification, serious games and other related concepts, As shown in Figure 2.16 [17].

According to Deterding, a) Gamification is about games. It is different than playful interaction, playful design. b) Gamification uses game elements. It is not a complete game such as a serious game. c) Gamification applies to non-game contexts. Similar to serious games, it uses games for other purposes than game's normal expected use for entertainment. d) Gamification focuses on design. It is not game-based technology or a practice of wider game ecology.

The following sections discusses serious games and related concepts in more details.

### 2.8.1 Serious Game

A Serious game is a complete game designed for a primary purpose other than pure entertainment [68]. It includes categories such as educational games and advergames (advertising), political games, and training game (also known as game-learning).

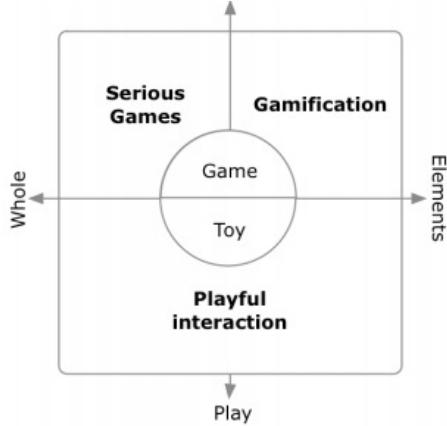


Figure 2.16: Serious Game and Gamification (source: Deterding [17])

One example is Fold.it, which made headlines [34] by using game play to help solve problems that computers cannot solve very well. In this case, online gamers were able to do what biochemists have been trying to do for a decade: decipher the structure of a protein that is key to the way HIV multiplies.

The difference between Gamification and serious games is not very clear. Both are trying to solve a problem with game thinking. Some reference serious game such as Foldit as a victorious example of gamification in science [10]. Sebastian Deterding's definition [17] indicates that gamification can be totally different than serious games.

It is interesting to see that although the concept of serious games has been around since long before gamification, gamification has arguably made steps into the mainstream whereas serious games stay in much smaller scale.

### 2.8.2 Persuasive Game

The term “persuasive game” is introduced in the title book “Persuasive Games, The Expressive Power of Video games” by Ian Bogost [9]. In the book, Bogost argues that video games have a unique persuasive power that goes beyond other forms of computational persuasion. Not only can video games support existing social and cultural positions, as in Serious games, but they can also disrupt and change those positions, leading to potentially significant long-term social change, as in Persuasive games.

Persuasive game is closely tied to Persuasive Technology, designed to change attitudes or behaviors of the users through persuasion and social influence, but not through coercion [22].

Loren Baxter [6] posted that persuasive design, the use of psychology in design to influence behavior, could benefit UX design in a new level, hinting at the use in gamification design as well.

### 2.8.3 Gameful Interaction Design

According to The Interaction Design Association (IxDA) [70], Interaction design defines the structure and behaviors of interactive products and services, and user interactions with those products and services. It is design principles with main focus on behavior. [47].

For example, the “SmartGauge” dashboard for Ford’s hybrid cars, where a digital plant is responding to how energy-efficient the users driving behavior is an example of interaction design. [32]. The design gives drivers a game like interaction that for them, the game to grow more lush and beautiful leaves, a visual reward, by driving efficiently, is the desired behavior.

Another great example is the “Piano Staircase” created by Volkswagen Sweden and ad agency DDB, installed in a metro station in Stockholm [60]. The design is to make the staircase next to the escalator look and respond like a piano keyboard, so that every step on the stair will generate different piano sounds every time a commuter walked on it. Observation indicates that 66 percent more people chose the staircase over the escalator, a good example of a “Fun Theory” design for persuading and encouraging energy-efficient behavior.

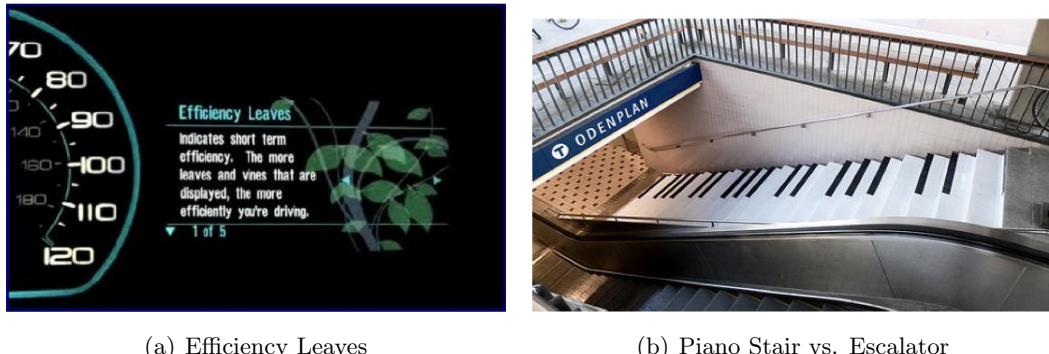


Figure 2.17: Examples of Gameful Interaction Design

The goal of such gameful interaction design is to achieve a certain influence, a change in the behavior of their users not through a mode of informative feedback and rational processing, but through the activation of emotion or sensibility.

#### 2.8.4 Alternative Reality Games

Blending of real and virtual worlds has been explored in broader contexts. McGonigal designed the award winning serious Alternative Reality Game (ARG) “World Without Oil” [20] and later “Evoke” [69] with the goal to empower people to come up with creative solutions to our most urgent real-world problems. ARGs have also been used to support learning. Connolly et al. discuss the development of an educational ARG to motivate secondary school students across Europe to learn foreign languages [13]. The results of the pilot run of the game in 2009 indicated that 92% of students felt the game motivated students to learn a second language. One of problems the team identified is the limitation of Moodle platform the game is based on.

The report of the ARGOSI project provides insights to the use of ARGs in game based learning and the challenges in the field of higher education [64]. The pilot was run at the University of Bolton with the aim to provide an engaging alternative to traditional methods of introducing students to university life. The overall up-take of the game was fairly low with 173 players and 23 (13%) of whom were active. The project identifies a number of questions surrounding educational ARGs, such as motivation, relationship to curriculum, marketing and timing. The report suggests that a complete ARG model may not be appropriate for wholesale learning, but there is certainly potential in using game elements.

## 2.9 Gamification Analytics

Ducheneaut et al. provides a good example of using game metrics for analysis of player's experience in a quantitative approach [19]. They reported the relationship of playing time and leveling in the MMORGs, as shown in Figure 2.18:

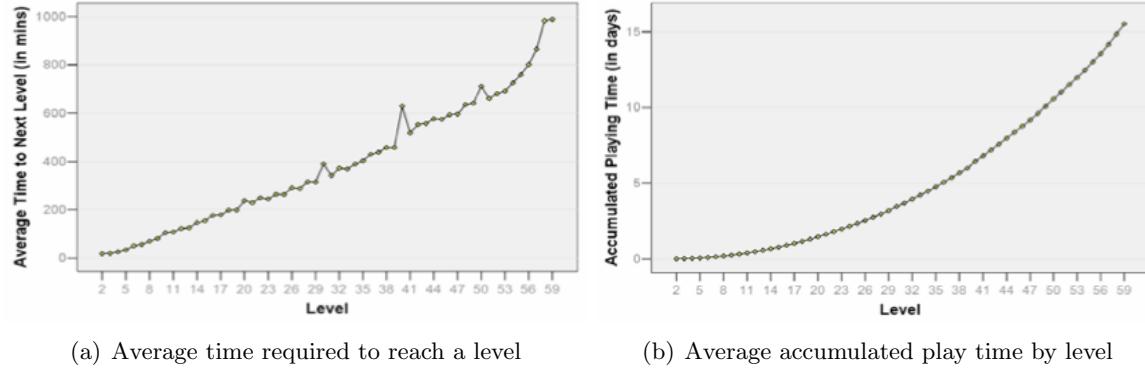


Figure 2.18: Player Metrics (source: Ducheneaut [19])

Game metrics could be as important as creativity in game design. As Nadia Oxford points out, in the social game industry, player metrics collection and analysis are widely practiced to provide game designers to determine what the player audience likes and dislikes about a certain game experience [49].

This section reviews what kinds of the metrics and analytics could be employed in gamification and serious game design.

### 2.9.1 E-Score

E-Score is introduced by Gabe Zichermann, mainly applies in marketing gamification [50]. These are the metrics that go into the score:

- Recency : How long ago did they visit?
- Frequency : How often did they come back?
- Duration : How long did they stay?
- Virality : How many people have they told about you?
- Rating : What did they explicitly say when asked about you?

### 2.9.2 Social Game Metrics

Matt Fairchild lists and explains the basic terminology for social games metrics [21]:

**ARPU:** Average Revenue Per User (ARPU) is measured as total revenue divided by the number of subscribers. This includes revenue from subscriber fees, virtual goods, affiliate marketing and ad impressions. Because social games are so metrics-heavy, ARPU can be broken down by day, by country, by demographic, or by pretty much any other metric.

**Churn:** The turnover rate (or attrition rate) of a social games active players. Churn refers to the constant loss and gain of members, especially high in casual gaming.

**Cohort:** Cohorts are used for analyzing retention. By organizing users in groups such as “everyone that visited on June 10th” and analyzing the percentage that revisit, you can pinpoint what promotions are having the greatest effect.

**DAU:** Daily Active Users (DAU) is the number of active users over the course of a single day.

**DAU/MAU:** Comparing Daily Active Users to Monthly Active Users shows roughly how many days per month the average user engages with a game. The DAU/MAU ratio is strongly correlated with social gaming success.

**Engagement:** Engagement measures how long users spend playing a game. How many features do they access? Are they spending hours or seconds? How many pages does the average user view? What percentage are returning visitors?

**Entry Event:** An entry event is the first action a user performs when he enters the game. What do users do first? Which entry events are the most effective at bringing people back? By determining the more popular entry events, you can push more resources towards them, thus increasing retention, engagement and re-engagement.

**Exit Event:** Exit events are the last actions a user performs before exiting the game. Tracking the Exit Event Distribution helps show why users are disengaging with the game.

**K Factor:** K Factor measures the virality of a game.  $K \text{ Factor} = (\text{Infection Rate}) * (\text{Conversion Rate})$ . An Infection Rate is how much a given user exposes the game to other players, such as through status updates or email invites. A conversion rate is when that “infection” results in a new sign up. A high K Factor indicates effectiveness of bringing in new players.

**Lifetime Network Value:** The value a user provides to your network over the course of his entire “lifetime” on the network. For instance, is the user contributing to viral effects, evangelizing the game or contributing positively to ARPU? This is compared to the User Acquisition Cost, or how much it costs (via marketing and viral efforts) to bring in new members.

**MAU:** Like DAU, Monthly Active Users (MAU) tracks the total number of users in a given month.

**Re-Engagement:** Re-engagement is about how to get users back. It includes re-engaging gamers who have been signed off for an hour, a day, a month, or more.

**Retention:** Retention is how well you maintain user base, as the opposite of churn.

Appdata.com gathers independent application metrics from most of the social game application. For example, the graphs in [Figure 2.19](#) shows the DAU (Daily Active User) and MAU (Monthly Active User) metrics for the popular Farmville social game [3]:

Kontagent, a user analytics service company, introduces the top 10 social game metrics [38]: (1) Entry Event Distribution. (2) Outbound Messages/User. (3) Viral Message CTR/Conversion. (4) Virality (K-factor). (5) Engagement. (6) Exit Event Distribution. (7) Retention - Revisit Rate. (8) Lifetime Network Value. (9) Conversion to paying users. (10) Average Revenue Per Paying User.

### 2.9.3 A/B Testing

A/B testing is often part of the services from analytics solution providers. For example, Google’s Website Optimizer [28] can be combined with Google Analytics to provide in-depth A/B testing experiments and data analysis.

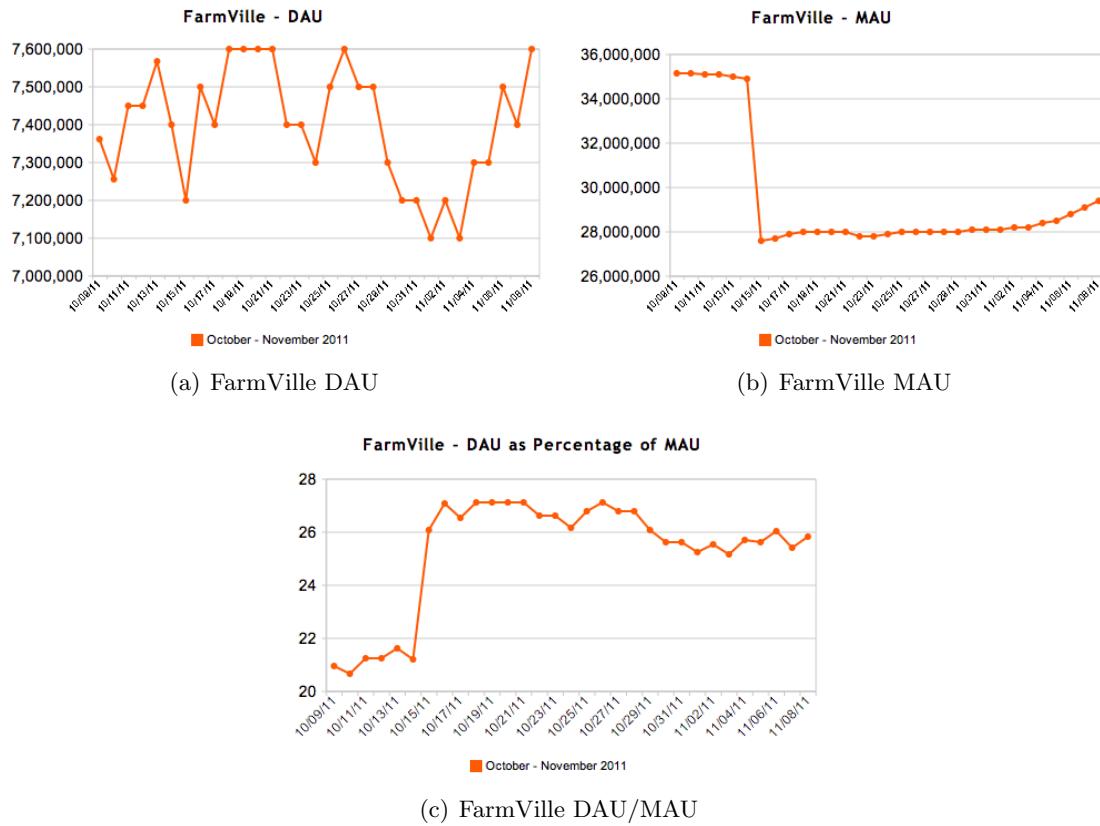


Figure 2.19: Social Game Metrics (source: Appdata.com [3])

A/B testing, also called controlled experiment, is data-driven evaluation methodology recently employed by researchers and game industries to support game design decisions [37]. In A/B testing, two conditions are randomly presented to users in the same population and see how they response. For example, Zynga used this approach to collect player metrics in different conditions and found that pink fonts caused players to click on an advertisement for PetVille far more often [29].

Andersen et al. at the Center for Game Science of University of Washington describe several A/B testing research in evaluating games. Using a series of large-scale A/B tests, they found that music and sound effects had little or no effect on player retention in the two popular Flash games they developed, while animations caused users to play more [1]. The results of their another A/B testing study of over 45,000 players show that the usefulness of game tutorials depends greatly on game complexity. In simpler games, tutorials did not significantly improve player engagement; while in complex game, they increased play time by as much as 29% [2].

## Chapter 3

# Conclusion and Future Directions

### 3.1 Conclusion

A key findings from the Gartner report "Gamification Primer: Life becomes a game" [25] is that games often model the real world, gamification has emerged as a recognizable trend and impact so many areas of business/society whereas exists many opportunities and risks. They recommend "Only organizations with a high risk tolerance should attempt to broadly exploit this trend today; organizations with a lower risk tolerance should watch this trend develop and/or begin small pilot applications."

There was a definite feeling of infancy of gamification, be it the definition of gamification or the effectiveness of gamification, there are debates from different areas of business. Most of gamification thought leaders agree that the current state of gamification is mainly focus on extrinsic rewards such as points, badges and leaderboards, and this novelty of simple gamification will have its effectiveness in user engagement before the novelty worn off. Many also see the bigger potentials of sustainable gamification with deeper researches in the intrinsic rewards from good game designs. Sebastian Deterding even introduce the term "gameful design" (design for gameful experiences) as a potential alternative to "gamification". [17]. He argues that, "given the industry origins and the debates about the practice and design of gamification, 'gameful design' currently provides a new term with less baggage, and therefore a preferable term for academic discourse".

Be it "gamification" or "gameful design", the debate and the above literature surveys warrant broader academic research in this interdisciplinary area that bridges HCI and game studies and other fields to study a wide ranges of gamified applications. The major take away of reading the debates of gamification is that, this is a field rife with anecdotes but little hard data. [63]. "That's why research is valuable – to get beyond whether gamification is good or bad, and does it work or not."

One approach to provide empirical research into the gamified application is to collect the application's game related metrics and analyze the effectiveness of the game mechanics applied in the application. The current use of the social game metrics surveyed above will provide a good starting points of analytics of the gamified system.

## 3.2 Future Directions

The current state of the gamification is focus on the relatively superficial game mechanics, such as point, level, leader board and badges. More and more researchers and commercial service providers are looking more in-depth approach to achieve engagement of whatever industries the gamification is applied on. The followings are a few directions and efforts in furthering the effectiveness of gamification:

1. Social interaction. With the social games are transforming so many non-gamers into casual gamers in a massively engaging way, the studies of social interaction in game will inevitably benefit the progress in gamification application.
2. Mobility. Mobile devices' ubiquitousness is one of the main reason that the mobile games are invading people's every minute in everyday life. This unique engaging factor should also be gamification's research topic.
3. Analytics. although most of the commercial services provide some kinds of engagement metrics and behavior analytics, it is still an new area that need broader, deeper researches and experiments to find out what works and how it works.

Because gamification is relatively new field, the development of new thoughts and new areas of gamified application will emerge and change rapidly. To closely follow the future development in this field, a growing list of gamification thought leaders and their biographies is provided in the appendix as the future readings and researches.

# Chapter 4

## Appendix

### 4.1 Growing list of Gamification thought leaders

**Jane McGonigal**, Author of "Reality is Broken", works at the "Institute for the Future" and founder of "Gameful". Twitter: @avantgame

**Jesse Schell**, Author of "The Art of Game Design". works at Carnegie Mellons Entertainment Technology Center. Twitter: @jesseschell

**B.J. Fogg**, teaches at Stanford, inventor of Captology. Twitter: @bjfogg

**Dennis Dens Crowley**, co-founder of Foursquare and teaches (adjunct) at NYU. Twitter: @dens

**Amy Jo Kim**, Researcher, CEO of Shufflebrain, author of "Google Talk: Putting the Fun in Functional". Twitter: @amyjokim

**Natron Baxter**, Developer of "Evoke", blog Fun is not the enemy of work. Twitter: @natronbaxter

**Jen McCabe**, Founder of healthmonth.com, mobile health game imoveyou, Twitter: @jensmccabe

**Nicole Lazzaro**, President of XEODesign. Author of "Four keys to Fun". Twitter: @nicolelazzaro

**Raph Koster**, Author of "A Theory of Fun for Game Design". Twitter: @raphkoster

**Mark Pincus**, Co-founder and CEO of Zynga. Twitter: @markpinc (not active)

**Gabe Zichermann**, founder of Gamification Co. Twitter: @gzicherm

**Eric Zimmerman**, Co-author of "Rules of Play", blog "Being Playful". Twitter: @zimmermaneric (not active)

**Keith Lee**, CEO and co-founder of Booyah (MyTown). Twitter: @keithlee0 (not active)

**Byron Reeves**, Professor at Stanford, Co-founder of Seriosity, Inc, author of "Total Engagement" and talk "Work Sucks, Games are Great". Twitter: @Seriosity

**Colleen Macklin**, Professor at the Parsons New School for Design and the director of the PET-Lab. Twitter: @colleenmacklin

**Sebastian Deterding**, Researcher and UX designer, blog "gamification-research.org", web "codingconduct.cc". Twitter: @dingstweets

**Keith Smith**, Co-Founder and CEO of BigDoor. Twitter: @ChiefDoorman

**The Gamification Daily**, daily newsletter at <http://paper.li/busterbenson/gamification>

# Bibliography

- [1] E. Andersen, Y.E. Liu, R. Snider, R. Szeto, and Z. Popović. Placing a value on aesthetics in online casual games. In *Proceedings of the 2011 annual conference on Human factors in computing systems*, pages 1275–1278. ACM, 2011.
- [2] E. Andersen, E. ORourke, Y.E. Liu, R. Snider, J. Lowdermilk, D. Truong, S. Cooper, and Z. Popovic. The impact of tutorials on games of varying complexity. In *Proceedings of the 2012 annual conference on Human factors in computing systems*. ACM, 2012.
- [3] appdata. Appdata farmville. <http://www.appdata.com/apps/facebook/102452128776-farmville>, 2011.
- [4] Badgeville. Badgeville. <http://www-badgeville.com>.
- [5] R. Bartle. Hearts, clubs, diamonds, spades: Players who suit muds. *Journal of MUD research*, 1(1):19, 1996.
- [6] Loren Baxter. Why persuasive design should be your next skill set. <http://uxmag.com/design/why-persuasive-design-should-be-your-next-skill-set>, 2011.
- [7] Bigdoor. Bigdoor. <http://www.bigdoor.com>.
- [8] John Biggs. Scvngr's secret game mechanics playdeck. 2010.
- [9] I. Bogost. *Persuasive games: The expressive power of videogames*. The MIT Press, 2007.
- [10] Torie Bosch. Score one for gamification. 2011.
- [11] Bunchball. Bunchball. <http://www.bunchball.com>.
- [12] Adrian Chan. Scvngr's secret game mechanics playdeck. 2010.
- [13] T. Connolly, M. Stansfield, T. Hainey, I. Cousins, J. Josephson, A. O'Donovan, et al. Arguing for multilingual motivation in web 2.0: a games-based learning platform for language learning. In *European Conference on Games Based Learning*, 2009.
- [14] M. Csikszentmihalyi. *Flow: The psychology of optimal experience: Steps toward enhancing the quality of life*. Harper Collins Publishers, 1991.
- [15] Sebastian Deterding. Meaningful play. getting gamification right. <http://www.slideshare.net/dings/meaningful-play-getting-gamification-right>, 2011.

- [16] Sebastian Deterding. There be dragons: Ten potential pitfalls of gamification. <http://www.slideshare.net/dings/there-be-dragons-ten-potential-pitfalls-of-gamification>, 2011.
- [17] Sebastian Deterding, Dan Dixon, Rilla Khaled, and Lennart Nacke. From game design elements to gamefulness: Defining “gamification”. In *Proceedings of MindTrek*, 2011.
- [18] Dan Dixon. Player types and gamification. In *Proceedings of the CHI 2011 Workshop on Gamification*, 2011.
- [19] N. Ducheneaut, N. Yee, E. Nickell, and R.J. Moore. Alone together?: exploring the social dynamics of massively multiplayer online games. In *Proceedings of the SIGCHI conference on Human Factors in computing systems*, pages 407–416. ACM, 2006.
- [20] Electric Shadows. World without oil, <http://www.worldwithouthoil.org/metaabout.htm>, 2010.
- [21] Matt Fairchild. The secret glossary of social games analytics. <http://www.wavedash.net/2010/04/the-secret-glossary-of-social-games-analytics/>, 2010.
- [22] B J Fogg. *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann, 2003.
- [23] foursquare. foursquare. <http://foursquare.com/>.
- [24] gamification.org. Game mechanics. <http://gamification.org/wiki/Encyclopedia>.
- [25] Gartner. Gamification primer: Life becomes a game. [www.gartner.com/DisplayDocument?id=1528016](http://www.gartner.com/DisplayDocument?id=1528016), 2010.
- [26] Gartner. Gartner’s 2011 hype cycle special report evaluates the maturity of 1,900 technologies. <https://www.gartner.com/it/page.jsp?id=1763814>, 2011.
- [27] Gartner. Press release. <https://www.gartner.com/it/page.jsp?id=1629214>, 2011.
- [28] Google. Google website optimizer.
- [29] K. Graft. Dice 2010: Zyngas reynolds on social first and foremost, 2010.
- [30] Scott Haiges. Gaming for good. Technical report, ROI Research Inc, 2011.
- [31] R. Hunicke, M. LeBlanc, and R. Zubek. Mda: A formal approach to game design and game research. In *Proceedings of the AAAI-04 Workshop on Challenges in Game AI*, pages 1–5, 2004.
- [32] IDEO. Hybrid electric vehicle interaction. <http://www.ideo.com/work/hybrid-electric-vehicle-dashboard-interaction>, 2009.
- [33] M. Kaptein. Adaptive persuasive messages in an e-commerce setting: The use of persuasion profiles. 2011.
- [34] F. Khatib, F. DiMaio, S. Cooper, M. Kazmierczyk, M. Gilski, S. Krzywda, H. Zabranska, I. Pichova, J. Thompson, Z. Popović, et al. Crystal structure of a monomeric retroviral protease solved by protein folding game players. *Nature Structural & Molecular Biology*, 2011.

- [35] Amy Jo Kim. Designing the player journey. <http://www.slideshare.net/amyjokim/gamification-101-design-the-player-journey>, 2010.
- [36] MJ Koepp, RN Gunn, AD Lawrence, VJ Cunningham, A. Dagher, T. Jones, DJ Brooks, CJ Bench, PM Grasby, et al. Evidence for striatal dopamine release during a video game. *Nature*, 393(6682):266–267, 1998.
- [37] R. Kohavi, R.M. Henne, and D. Sommerfield. Practical guide to controlled experiments on the web: listen to your customers not to the hippo. In *Proceedings of the 13th ACM SIGKDD international conference on Knowledge discovery and data mining*, pages 959–967. ACM, 2007.
- [38] Kontagent. Kontagent - top 10 social game metrics. <http://www.slideshare.net/kontagent/kontagent-top-10-social-game-metrics>, 2010.
- [39] A.A. Krentz. Play and education in plato’s republic. In *Twentieth Congress of Philosophy*. <http://www.bu.edu/wcp/Papers/Educ/EducKren.htm>, 1998.
- [40] N. Lazzaro. Why we play games: Four keys to more emotion without story. 2004.
- [41] Nicole Lazzaro. Chasing wonder and the future of engagement. In *Talk*. <http://www.slideshare.net/NicoleLazzaro/chasing-wonder-and-the-future-of-engagement>, 2011.
- [42] J. McGonigal. *Reality is broken: Why games make us better and how they can change the world*. Penguin Press, 2011.
- [43] Jane McGonigal. Gaming can make a better world. 2010.
- [44] Jane McGonigal. We dont need no stinking badges. <http://www.slideshare.net/avantgame/we-dont-need-no-stinkin-badges-how-to-reinvent-reality-without-gamification>, 2011.
- [45] C. Murphy. Why games work and the science of learning. 2011.
- [46] nikeplus. nikeplus. <http://nikeplus.com/>.
- [47] D.A. Norman. *The design of everyday things*, volume 16. Basic Books New York, 2002.
- [48] openbadges. openbadges. <http://openbadges.org/>.
- [49] Nadia Oxford. Metrics vs. creativity: Killing video games? <http://gametheoryonline.com/2010/12/13/metrics-video-games-gaming-data/>, 2010.
- [50] Laurie Petersen. Gabe zichermann on gamification, fun and metrics. <http://econsultancy.com/us/blog/7283-q-a-with-gabe-zichermann-on-gamification-fun-and-metrics>, 2011.
- [51] D.H. Pink. *Drive: The surprising truth about what motivates us*. Riverhead Books, 2009.
- [52] Seth Priebatsch. The game layer on top of the world. [http://www.ted.com/talks/seth\\_priebatsch\\_the\\_game\\_layer\\_on\\_top\\_of\\_the\\_world.html](http://www.ted.com/talks/seth_priebatsch_the_game_layer_on_top_of_the_world.html), 2010.
- [53] RecycleBank. Recyclebank. <http://www.recyclebank.com/>.

- [54] B. Reeves and J.L. Read. *Total engagement: using games and virtual worlds to change the way people work and businesses compete*. Harvard Business School Press, 2009.
- [55] Byron Reeves, James J. Cummings, and Dante Anderson. Leveraging the engagement of games to change energy behavior. In *Proceedings of the CHI 2011 Workshop on Gamification*, 2011.
- [56] M2 Research. The gamification summit 2011 m2 research presentation. <http://www.slideshare.net/loyoyo/gamification-summit-2011-presentation-m2-research-final>, 2011.
- [57] ribbonhero. ribbonhero. <http://ribbonhero.com/>.
- [58] Margaret Robertson. Cant play, wont play. <http://www.hideandseek.net/2010/10/06/cant-play-wont-play/>, 2010.
- [59] J. Schell. Design outside the box. *DICE summit*, 2010.
- [60] thefuntheory.com. Piano staircase. <http://www.thefuntheory.com/piano-staircase>, 2009.
- [61] UserInfuser. Userinfuser. <http://code.google.com/p/userinfuser/>.
- [62] HB Walters, British Museum. Department of Greek, and Roman Antiquities. *A Guide to the Exhibition Illustrating Greek and Roman Life*. British Museum, 1929.
- [63] Wharton. Can gamification advance to the next level? <http://knowledge.wharton.upenn.edu/article.cfm?articleid=2829>, 2011.
- [64] Nicola Whitton. Alternate reality games for orientation, socialisation and induction (ARGOSI). Technical report, JISC, 2009.
- [65] Wikipedia. Funware. <http://en.wikipedia.org/wiki/Funware>.
- [66] Wikipedia. Gamification. <http://en.wikipedia.org/wiki/Gamification>.
- [67] wikipedia. Royal game of ur.
- [68] Wikipedia. Serious game. [http://en.wikipedia.org/wiki/Serious\\_game](http://en.wikipedia.org/wiki/Serious_game).
- [69] World Bank Institute. Urgent evoke. <http://www.urgentevoke.com>, 2010.
- [70] Luke Wroblewski. Defining interaction design. <http://www.lukew.com/ff/entry.asp?327>, 2006.
- [71] Michael Wu. The magic potion of game dynamics. <http://lithosphere.lithium.com/t5/Building-Community-the-Platform/The-Magic-Potion-of-Game-Dynamics/ba-p/19260>, 2011.
- [72] N. Yee. The virtual skinner box. <http://www.nickyee.com/eqt/skinner.html>, 2001.
- [73] N. Yee. Facets: 5 motivation factors for why people play mmorpgs. [www.nickyee.com](http://www.nickyee.com), pages 1–14, 2002.
- [74] N. Yee. Understanding mmorpg addiction. *Retrieved February, 15:2008*, 2002.
- [75] G. Zichermann and J. Linder. *Game-based marketing: inspire customer loyalty through rewards, challenges, and contests*. Wiley, 2010.