Personal Gaming

Team Tech Transform

Brice Nzeukou

Kunmi Jeje

Stephen Schwee

David Carrega

Table of Contents

Executive Summary

Objective

For the past few years, innovation within the video game industry has plateaued. Six years ago the current batch of consoles hit the market with grand visions of the next generation of gaming. Unfortunately, very few games could live up to the hype surrounding these visions. The objective of this paper is to analyze innovation opportunities within the video game industry. The focus of our analysis will be upon the application of artificial intelligence (AI) to gaming and real life.

Approach

We employed the following techniques to analyze the video game industry

1. Interviews with Academic Researchers
2. Interviews with Game Designers
3. Interviews with AI Programmers
4. Secondary Research from Gaming and Venture Investing Websites

Conclusions

Advanced AI could be implemented to radically transform video game experiences for the better, but it will not be implemented in the near future. Game design is both a science and an art. The science, the advanced AI, is ready for implementation, but the art, the actual game design, is questionable. Until a total genius successfully creates and tests a grand artistic vision that incorporates advanced AI as a key gameplay element, no videogame publisher will dramatically change the types of games that they offer. It is too risky.

Despite the lack of innovative games, AI will be instrumental in innovative developer tools and in the transformation of entertainment consumption. The developer tools of the future will increase productivity through the automation of tedious tasks, such as creating a forest of unique trees. This innovation is an incremental improvement that will not disrupt the videogame industry. The transformation of entertainment consumption, hereafter referred to as personal gaming, will be the focus of our paper because it is a disruptive technology.

Introduction

History of Videogames

Videogames technically began in 1947 when Thomas T Goldsmith and Estle Ray Man filed a patent for a machine in which a cathode ray tube could be manipulated to simulate firing at "air-borne" targets [1]. Similar games followed, including OXO a graphical version of tic-tac toe created by A.S. Douglas in 1952 at the University of Cambridge [2]. These early games and their derivatives were developed as hobby projects on university mainframe computers.

The 1960s brought about much innovation in the basic science behind videogames. From 1959 – 1961, a collection of interactive videogames were developed at MIT. Four games were of particular importance. Mouse in the Maze was a mouse maze simulator. HAX was a primitive music maker. Tic-Tac-Toe was adapted to a touch screen. Spacewar! was a simple two player shooting game that was widely distributed via the internet [3]. In 1966, Ralph Baer and Bill Harrison, two engineers at Sanders Associates, a military electronics contractor, created the first home console prototype [4].

The 1970s brought about the first major commercialization of videogames. Atari created the first profitable arcade game, Pong, in 1972 [5]. Magnavox created the first profitable home video game console with the Odyssey [6]. RCA and a variety of other manufacturers entered the console business. Most of the games for home consoles were Pong clones and the industry took a dive in 1977 when some manufacturers began to sell at a loss to clear stock [7]. During this time, university mainframe game development blossomed. Mainframe computer games were often made illicitly by making questionable use of university resources. These games were not sold for profit. It must be noted that during this time, videogame production was still a niche skill. More often than not, videogames were developed entirely by one person [8].

The 1980s brought about large changes in the videogame landscape. Arcades boomed, but the old manufacturers of consoles from the seventies went into financial ruin in 1983. Some

attribute the crash to poor games, such as ET [9]. Nevertheless, the videogame industry was saved by Nintendo in 1985 with the NES. With the NES, a renaissance of gaming came about. New genres and new experiences were created [10].

From the 1990s onward, small incremental changes have characterized the videogame industry. 3D Graphics became the standard. The Arcade business slowly died in the 90s as home consoles ate away at their customers. Because of Moore's Law, home consoles became more powerful than arcade machines in 1998 with the launch of the Dreamcast [11 Add Reference]. Dreamcast also marked the beginnings of significant online multiplayer. The development of the 2000s and later will be discussed in detail later.

The constant throughout gaming history, until the 2000s, has been the information asymmetry between publishers and gamers. Before 1981, there were no consumer-oriented video gaming magazines [11]. Even after these publications came into being, most people did not consult these magazines. So consumers were left with renting games before purchasing them, playing games that other friends own, or taking a risk with each purchase. On the publisher's side, not much was known about consumers and their preferences aside from the quarterly sales figures. Today, this information asymmetry has become smaller on the consumer side with the advent of online gaming forums. We believe that publishers will be able to decrease the information asymmetry on their side of the market by using AI.

History of AI
Artificial intelligence is the intelligence of machines and the branch of computer science that aims to create it. AI textbooks define the field as "the study and design of intelligent agents" [12] where an intelligent agent is a system that perceives its environment and takes actions that maximizes its chances of success. John McCarthy, who coined the term in a conference at Dartmouth in 1956, defined it as "the science and engineering of making intelligent machines" [13]. After the conference, AI research made tremendous progress with aid from the US government [14]. However, the optimism of the early researchers ended in the 1970s when

funding was cut due to insurmountable technological hurdles, such as limited computing power, that rendered most of their findings inapplicable to the real world [15]. Heavy AI research resumed in the 1980s when the Japanese government, British government, and American corporations resumed funding ambitious AI projects. By the end of the 1980s, funding was cut yet again. After this AI bubble, AI research became extremely fragmented into subdomains such as machine learning, data mining, and object tracking.

Intersection of AI and Video Games

Adam Noonchester of Insomniac Games offered insight into the intersection of AI and videogames. Academic researchers are interested in creating intelligent machines. AI in videogames is concerned with creating a fun experience. The creation of realistic and intelligent enemies, something only hardcore gamers desire, is a design choice that might alienate a lot of potential customers. This point is discussed in detail in our roadblocks to adoption section.

Because of the potential economic backlash from a niche game, AI could be better used outside of gameplay to enhance the end user experience. One such example of this would be a behind the scenes algorithm that quantifies the amount of fun that a player is experiencing at any given time. We believe that this "fun algorithm" can be implemented and enhanced through the application of data mining and personal gaming.

Technology Description

Data Mining

Data mining is the process that results in the discovery of new patterns in large data sets via the use of AI technology [16]. The goal of data mining is to extract knowledge from an existing data set and convert this information into an understandable structure that can then be used. The process of data mining can be divided into six main processes. The first process called anomaly detection attempts to detect outliers in the information or data errors that may require further investigation. The second process is association rule learning, which searches for relationships between variables. The third process is the clustering of similar data into groups. The fourth process is classification, which is used to classify new data and place them into groups. The fifth process is regression, which attempts to find a function to model the data. Finally the last process is summarization, which attempts to provide a compact representation of the respective data set. [17]

Personal Gaming

An example of how AI can be used in data mining for enhanced video game experience is in personal gaming, a new paradigm of videogame interaction being developed by Will Wright. Hivemind, his latest working title, embodies personal gaming. HIvemind will be a cross-platform experience that allows players to connect through mobile devices, computers, and consoles, focusing on gamifying the player's life. Personal gaming requires a lot of information to be shared by the player; however, the information is used exclusively to build a personal gaming experience for the player. Thus, game experience can change based on the player's emotional state and patterns that develop in the player's life. This creates the "personal gaming" experience that immerses the player into the real world through connectivity with sites like Facebook and Meetup. Data mining will play a key role in the implementation of "personal gaming" because an enormous amount of data needs to be mined and interpreted using AI [18].

Roadblocks to Adoption

Power of Executives

A major issue with the development of AI in video games lies in the power of the executives. The executives of gaming companies have the last say on the games that are produced. Our contact at Insomniac games, Joel Goodsell, explained that the choice of not using AI in a video game is a design choice. Games such as Call of Duty and Halo, basic first person shooters that use primitive AI for enemies in the game, are characteristic of most of the popular games for the past decade. Gamers have expectations for certain franchises to behave in certain ways. Because these current video games are selling quite well, executives are reluctant to deviate from their formulas for success. This is why we will not see a high level of AI in game play for the next generation of game video games.

Data Mining Considerations

Two different tech challenges lie in this issue of data mining. The first challenge that there are many different formats of information that the AI has to aggregate [19]. Creating a universal format for all of this data, with the capability of expanding to new data types, will be a challenge. An even more pressing issue is the quantification and connection of data. How do you quantify fun? How do you quantify relevant user behavior? How do you make relevant suggestions based upon this data? It is beyond the scope of this paper to investigate these questions in detail, but AI can theoretically answer all of these questions [19]. Cloud computing will probably be used in the actual analysis of the data. Personal gaming companies could run their own server farms, or they could just use the spare CPU cycles of all platforms that run their software.

Privacy

The second issue that arises with personal gaming is privacy and security of information [20]. All of the information that is being mined and analyzed by the AI, most likely by cloud computing, needs to be protected and kept private[21]. Beyond the actual security of personal information is the perception of security from end users. End users must not feel violated

because some software knows more about them than their friends do. We believe that a successfully marketing campaign would calm most user fears.

Projections

Industry is Ripe for Disruption

Currently, the gaming industry is undergoing dramatic changes. Retail sales are dwindling. April 2012 marked $1 Billion in retail videogame sales. However, that figure is 32% less than the retail sales of 2011[22]. Moreover, April marked the fifth month of declining retail sales. Big publishers have hurt the most from these turn of events. One such example is THQ, one of the dominant players in the video game industry during the 90s, who has had to sell licensing rights and dismantle some of its studios for financial reasons [23]. Because of these massive layoffs, plenty of talented programmers and designers are developing their own indie games or are joining other publishers that are investing in new mobile gaming studios [24].

Given the financial climate of the gaming industry, innovative gameplay utilizing advanced AI will not be a major disruptive technology because publishers are unwilling to take huge risks right now. It would only take one major flop to put any publisher into crisis mode. Publishers are more likely than ever to release formulaic games with smaller budgets to mitigate their risk. Nevertheless, advanced AI algorithms within the realm of data mining might prove to be disruptive within the realm of videogames. Essentially publishers need to know the answers to these two questions: (1) How does one price a video game? (2) Which customers does one make a game for?

Hypotheses

1. Mobile Gaming will become a Significant Part of Every Publisher's Portfolio
2. Free to Play Will Become the Standard Pricing Model of Mobile Gaming
3. Several Powerful Recommendation and Digital Distribution Channels Will Emerge
4. A Developer Independent Recommendation Engine and Distribution Channel Will Emerge and Dominate
5. The Developer Independent Recommendation Engine will Extend to Real Life

Rationale

Mobile Gaming Will Become a Significant Part of Every Publisher's Portfolio (2 years)

By the year 2016, one billion consumers will have smartphones. In the US alone, consumers will own 257 million smartphones and 126 million tablets [25]. Currently, 70% of smartphone users have over 10 apps [26]. Of these apps, games are the most popular. On average, smartphone users spend 7.8 hours a month playing games [27]. These numbers cannot be ignored. To be competitive large videogame publishers must enter the mobile gaming market and find a way to monetize players to the fullest extent.

Among the larger publishers, EA and Ubisoft are making the first moves. EA is set to publish Outernauts, an Insomniac Game, later this summer. They are targeting 13 – 25 year old demographic that desires the depth of Pokémon within a Facebook game [28]. Outernauts is an entirely new franchise. Ubisoft is taking another approach. Instead of creating a new franchise, Ubisoft is expanding its old Ghost Recon franchise. Essentially the mobile app, Facebook game, console game, and PC game will all be connected. Playtime in any of the platforms will advance the overall game and unlock new weapons and levels for the single player experience [29]. This strategy rests upon the fact that most people, including hard core gamers, are on Facebook. These gamers cannot always be at their consoles, but they can always log in a few minutes of gameplay on their mobile phone.

Free to Play Will Become the Standard Pricing Model of Mobile Gaming (2 years)

There has been a shift in the revenue potential of the business models employed by the gaming industry. With the emergence of social/casual mobile and online gaming as an ever growing sector of the gaming market, the free to play or "freemium" games with micro transactions and subscriptions model will be the focus of many game developers. This business model does not charge a price for the game, but allows users to upgrade to a better version of the game with more features for a premium. Game developers also can put a focus on micro transactions in the game play, such as buying improved weapons or increased ammo storage. This will be the dominate strategy for game developers because gamers are constantly playing on the go, 33%

of gamers play games on their smartphones [30]. The growth of the sector has been staggering with online and mobile gaming increasing from 32% of global revenue in 2009 to a projected 50% in 2014 [30]. Chinese company Tencent has already capitalized on the value of the casual/social online and mobile gaming sector. Tencent holds a dominant stake in the Chinese online/mobile market. Even in the volatile gaming market, Tencent was able to sustain 49% growth for five financial quarters starting in the third quarter of 2009 [30].

Piracy has also been an issue for console games. Moving towards online and mobile gaming decreases the chance for piracy while increasing distribution. Chinese gaming company Tencent has solved the piracy problem in China. Its free to play model does away with the need for piracy because gamers do not have to pay to play, the original reason for pirating games. Another plus of the free to play market is that it reduces direct price competition. Therefore companies can focus on attracting customers through content. There will be some competition on the pricing of in game content, but those indirectly affect the ability of gamers to play competitors' games.

We have already seen many games that employ the free to play model. A relatively new studio, U4iA has plans to release a free to play first person shooter in beta testing this summer. It boasts user customization and 'the most competitive multiplayer action ever seen within a browser' [31]. Other notable games that employ the free to play strategy are Lord of the Rings Online, and League of Legends. These games have a dedicated gamer base and revenue streams due to upgrades and in game and downloadable content. Additionally, the free to play model was endorsed by the speakers at the Caltech-MIT Forum on Mobile Gaming.

Several Powerful Recommendation and Digital Distribution Channels will Emerge (3 years)
With the increased ease of publishing video games, as well as the explosion of digital and online video games, gamers are going to be overwhelmed by the number of options. Reviews tend to be misleading and biased, therefore a need for a standard rating and recommendation engine would be a disruptive concept to the gaming industry. Distribution has also been a challenge for

many gaming companies. Now that digital releases of video games are becoming more common, it is becoming more necessary to have a centralized distribution channel. Valve Software uses Steam, a computer program that distributes their games as well as other gaming companies. EA has Origin, a similar program to Steam that centralizes downloads and game extras for their games only. EA and Valve are ahead of the curve in establishing this centralized application model. This distribution channel model is meant to service the hardcore gamer and allow for direct access to companies such as EA and Valve. There are also game consolidation engines that operate in the social/online gaming sector. Aeria Games is a company that consolidates free to play MMO profiles for over 30 games, "Ignite was created by Aeria Games to provide a comprehensive, easy-to-use distribution mechanism for free-to-play developers while giving our players one-click access to their favorite games, community features, and support"[32]. With plans to move into the mobile sector, companies like Aeria Games will be the leaders in game distribution and information consolidation.

A Developer Independent Recommendation and Distribution Channel will Emerge and Dominate (5 years)

Although we foresee a shift to centralized distribution channels, there will still be a need for a developer independent channel that services the social and mobile gamers and developers. This model is employed by both Apple mobile platform and the Google Android platform. Both app stores are battling for market share in the app markets. Currently, 55% of the top 100 iPhone paid and free apps are games. This suggests that the "app store" is a viable way of promoting and distributing certain types of games. Google is second in this market, with a total apps growth rate that is five times that of Apple [30]. Therefore, a centralized database like Apple's iTunes, although not disruptive, would still be able to take over the market if they were able to consolidate the information from both platforms in order to make recommendations and distribute the right games to gamers.

The Recommendation Engine will Extend to Real Life with Personal Gaming (10 years)

Personal gaming will be an emerging frontier in the gaming industry. With increasing capability

of data collection and data processing, AI will be used to help identify trends in personal data. This will allow many companies to target different people with different games and products. There are companies already starting to enter the social data mining market. Kontangent is an analytics tools company that is expanding its capabilities to the mobile platform, "Kontangent's gaming analytics tool updates its web-based dashboard with feedback on social game usage every 10 seconds" [33]. Companies are now looking to go even beyond the scope of targeted video games, to essentially 'gamifying life'. This idea has been expressed by notable game developer Will Wright, as he believes that personal gaming will have the ability to "customize itself for the individual player, taking into account aspects of player's real-life situation as elements of the game" [34]. Essentially games will change to suit the unique needs and routines of the user.

Scenario

At first glance, Bob seems like your typical 22 year old American male. He has a smartphone that is connected to his Facebook and a variety of social games. When not on the go, he enjoys his downtime on his computer and Xbox 360. However, Hivemind, a personal gaming application, has been working behind the scenes and mining all of his digital data to create an accurate digital mapping of him and connect him with other interesting people. Hivemind has not intruded his privacy. He actually installed Hivemind on all of his devices. This choice of his will impact him for the better. Hivemind knows Bob better than he knows himself.

Bob recently received a job offer from Volkswagen. Being a mechanical engineer looking for work, he took the job without even visiting Chattanooga, TN. After his first week of work, he hates his job. He doesn't actually hate his job. He just hates the fact that all of his friends are in Sunny Southern California and the only person he knows in Chattanooga is his third cousin that he has not seen in ten years. It might come as a shock to you, but Hivemind knows all of this.

To improve Bob's wellbeing, Hivemind suggests playing MLB 12 The Show, a baseball game. Bob takes the suggestion and starts playing. He begins to play the game every night after work. Every time he plays the game, he chooses the LA Dodgers as his team. Hivemind recognizes that the LA Dodgers are his favorite team, so it recommends a meet up for Dodgers fans in Chattanooga, TN. Bob reluctantly goes on the basis that he actually does have nothing better to do.

Bob drives to the Tremont Tavern with no expectations. He arrives and sees a bunch of guys decked out in Dodger blue. He immediately feels a connection with these people. After a few beers over the game, Bob actually feels like he has some friends. Hivemind knows this because his Facebook network grew after the meetup. Later Hivemind suggests playing UFC Unleashed, a fighting game that the people at the meetup have played together in the past. Bob buys the game and has plenty of fun. Hivemind predicts that Bob would actually like to engage in more physical activity, so it alerts Bob of a deal at the Chattanooga Jiu Jitsu Academy. Bob joins and realizes that his life has become a lot more interesting since he installed Hivemind on all of his devices. It turns out that Chattanooga, TN is not that bad after all.

Conclusion

The gaming industry, although stagnant in technology applications within video games, is headed in a very interesting direction. Game companies are becoming entertainment consolidators. They are consolidating the old console game model and expanding the promising social and mobile gaming sector. Given that consoles supply more than a platform to play video games, these gaming companies will become entertainment experts and eventually they will be able to personalize each system with recommendations for the user.

The true innovation in the gaming industry isn't going to come from console hardware, or in game software, but in the way that games interact with people. Gamers are going to be looking for the next gamer experience, a personalized one. Applications will tailor recommendations for games, TV shows, movies, and entertainment content for the user. It will be the task for AI to sift through enormous amounts of user data, and find relevant trends that can be translated into potential revenue streams. Games will even adjust their in game content to match user routines and identified trends. Personalized gaming is the new frontier for video games.

Interviews

Academic Researchers

Ken Stanley, Professor of Computer Science at UCF

Game Designers

Doug Church, Valve Software

Joel Goodsell, Insomniac Games

Stephane Bura, Independent

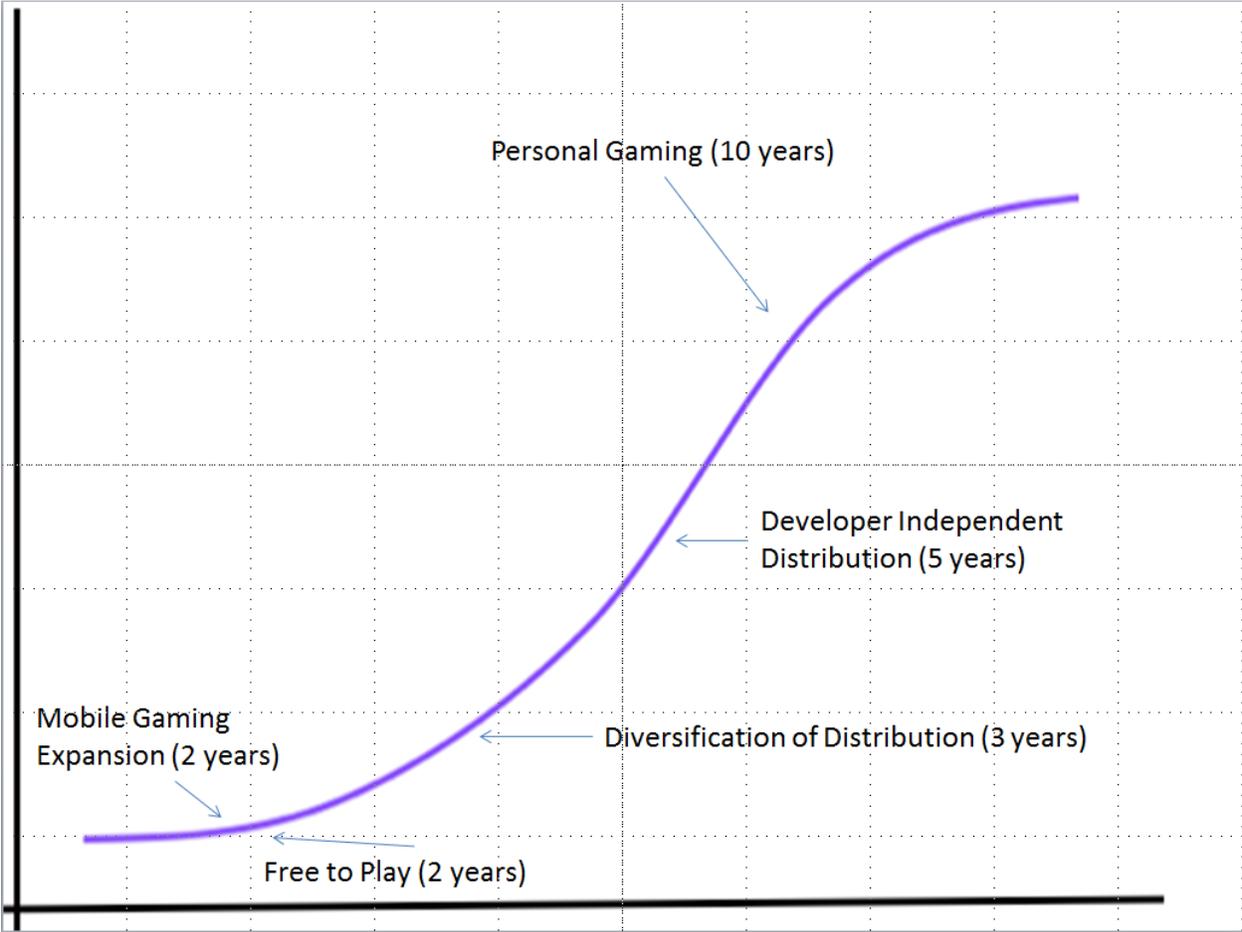*AI Programmers*

Ian McMeans, Insomniac Games

Adam Noonchester, Insomniac Games

References

1. http://worldwide.espacenet.com/publicationDetails/biblio?CC=US&NR=2455992&KC=&FT=E&locale=en_EP
2. http://www.pong-story.com/1952.htm
3. http://inventors.about.com/od/sstartinventions/a/Spacewar.htm
4. http://americanhistory.si.edu/collections/object.cfm?key=35&gkey=216&objkey=9931
5. http://www.pong-story.com/arcade.htm
6. http://classicgames.about.com/od/classicvideogames101/p/MagnavoxOdyssey.htm
7. Jason Whittaker (2004). The cyberspace handbook. Routledge. p. 122. ISBN 0-415-16835-XBlank
8. http://www.slate.com/articles/technology/the_browser/2009/03/speak_atari.html
9. http://games.ign.com/articles/119/1195693p1.html
10. ^ Kent, Steven L. (2001) [2001]. The Ultimate History of Video Games: From Pong to Pokémon and Beyond- The Story That Touched Our Lives and Changed the World (First ed.). Roseville, California: Prima Publishing. pp. 306–307. ISBN 0-7615-3643-4.
11. http://www.goodcowfilms.com/farm/games/news-archive/NZ-AUS%20Dreamcast%20FAQ.htm
12. http://people.cs.ubc.ca/~poole/ci/ch1.pdf
13. http://www-formal.stanford.edu/jmc/whatisai/whatisai.html
14. http://www.nap.edu/openbook.php?record_id=6323&page=7
15. http://www.aaai.org/aitopics/assets/PDF/AIMag26-04-016.pdf
16. "Data Mining Curriculum". ACM SIGKDD. 2006-04-30. Retrieved 2011-10-28
17. Fayyad, Usama; Gregory Piatetsky-Shapiro, and Padhraic Smyth (1996). "From Data Mining to Knowledge Discovery in Databases". Retrieved 2008-12-17.
18. http://www.fastcocreate.com/1679260/will-wright-talks-hivemind-blending-games-and-real-life
19. http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/issues.htm
20. http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/issues.htm
21. http://www.privacyrights.org/ar/Privacy-IssuesList.htm
22. http://www.theledger.com/article/20120602/NEWS/120609922
23. http://kotaku.com/5881479/how-thq-went-from-bad-to-very-bad?tag=thq
24. http://articles.boston.com/2012-05-28/business/31878689_1_game-makers-video-game-game-industry
25. http://business.time.com/2012/02/14/one-billion-smartphones-by-2016-here-comes-the-mobile-arms-race/
26. http://www.coolinfographics.com/blog/2012/3/28/client-infographic-the-mobile-advantage.html
27. http://www.fastcodesign.com/1665591/infographic-of-the-day-all-about-the-mobile-app-market
28. http://blog.games.com/2012/05/15/outernauts-plush-toys-interview/

29. http://venturebeat.com/2012/05/21/ghost-recon-commander-offers-headshots-in-a-facebook-game-hands-on-preview/
30. http://www.digi-capital.com/reports.html
31. http://www.joystiq.com/2012/05/16/u4ia-rips-the-wrap-off-free-to-play-fps-offensive-combat/
32. http://venturebeat.com/2012/05/17/aeria-games-announces-ignite/
33. http://venturebeat.com/2011/07/13/kontagent-mobile-analytics/
34. http://venturebeat.com/2011/11/16/will-wright-hivemind/

Appendix A: S – Curve

Personal Gaming (10 years)

Developer Independent Distribution (5 years)

Mobile Gaming Expansion (2 years)

Diversification of Distribution (3 years)

Free to Play (2 years)

Appendix B: Team Dynamics

We all worked well together. Overall there was a fairly even distribution of work. We learned a lot and we had quite a few laughs together during group meetings. There really isn't that much to report.