



In-Game Currency Design and Consumer Spending Behavior

by

Justin Fang

Thesis Advisor: Professor Justin Huang

PhD Advisor: Reuben Hurst

A thesis proposal submitted in fulfillment of the requirements of the
Michigan Ross Senior Thesis Seminar (BA 480), 4/22/2019.

Abstract

In this decade, the gaming industry has rocketed in size and variation of possibilities. New games are seeing new monetization methods that only increasingly grow in complexity and merge digital behavior with the behavior we see in humans in the real world. An example of this would be in the rise of the importance of freemium and competitive game scenes, resulting in a shift in motivations for making in-game purchases switching from functional to non-functional. For immensely popular games such as League of Legends or Fortnite, the emphasis is more on how players can pay to express themselves rather than to gain advantages over other competitors. There has also been tremendous usage of in-game tokens in games to prompt behavior in in-game purchases. This can take place through games providing bonuses in the conversion rate between real money and their in-game purchases, creating bundles, and providing exclusive product offerings. This study dives deeper into the behavior of how people interact with in-game tokens, analyzing how the conversion rate between the home currency to the in-game token may affect the willingness to pay of gamers.

Table of Contents:

Introduction	pg #1
History of Monetization in the Gaming Industry	pg #1
Motivations Driving Purchasing of In-Game Items	pg #3
Examples of the Usage of In-Game Currency	pg #4
Statement of the Problem	pg #10
Justification of the Problem	pg #11
Hypothesis	pg #12
Approach to Identifying Willingness to Pay	pg #13
Reasoning for Item's Chosen	pg #16
Concerns for the Questionnaire	pg #19
Acquiring and Filtering Data	pg #20
Results	pg #22
Further Questions	pg #26
Conclusion for Monetization Efforts of Game Developers	pg #27
Citations	pg #29

Introduction

Since 2012, the value of the video game market in the United States has been steadily increased every single year. The industry has gone from being worth \$14.308 billion USD in 2012 to a projected \$20.278 billion USD in 2020 (VentureBeat). The rise of the video game industry has not just been a US phenomenon. In 2018, the Chinese Mobile Gaming Market accounted for ¥161.24 billion Yuan in revenue, which amounts to over \$23 billion USD in conversion as of 4/5/2020 (iResearch). According to iResearch China, revenues from the Chinese Mobile gaming Market expected to further climb to ¥270.36 billion yuan, or roughly \$38 billion USD, by 2021 (iResearch). That would be more than the total global mobile gaming app revenue in 2015, which had been \$34.8 billion USD (App Annie).

For game developers, there are many monetization methods from which they can obtain pecuniary benefit. The most glaringly obvious would be to sell the ability to access and play a game for a set price, such as in the case of games like Starcraft 2 or Age of Empires. Two more ways to drive revenues would be through allowing for advertisers to pay to put their advertisements on video games and to directly allow for gamers to make in-game purchases. To understand how game developers, choose between different monetization methods for their games, it is useful to dive into the history of the gaming industry.

History of Monetization in the Gaming Industry:

Believe it or not, the gaming industry has been around since even before the Internet. Back then, games were sold on tapes and floppy disks, leading to a high amount of lost revenue for the developers due to copying and piracy (Hughes). As games continued to develop, an important innovation was the introduction of expansion packs, which helped to create continued interest

and revenue as games would be able to evolve to stay relevant. With the internet, the entire industry changed, as there was now an evolution in the connectivity of Multiplayer Gaming. With this new technology, gamers could now interact with one another across various games in the form of Multi-User Dungeons and Massively Multiplayer Online Games. With the gaming platform becoming social, there came the introduction of status, which could then be leveraged to encourage players to return and pay the subscription to access the internet game. Besides using a levelling system, another way to show and reward consistent game play is through providing in-game currency. While the in-game currency is often earned through achieving in-game accomplishments, another monetization strategy is that of allowing players to pay to purchase in-game currencies. It is a precarious "endeavor to maintain equality for players and a level of purity in the game itself" (Marder), as players that invest substantial time towards gameplay typically demand for fairness and an emphasis upon player skill for competitive and social games. This phenomenon is especially important in the case of the freemium model, which happens when games decide to drop the subscription fee altogether, allowing for players to immediately download and play the game. The freemium model has received immense popularity from both gamers as well as game developers, and the developers are able to generate revenue through a mix of in-game purchases and advertisements. But it is also key with this monetization method that the game developer can "create value for augmenting products through a careful configuration of the interplay between the free core service and the premium products therein" (Hamari). Especially as the value of the gaming industry is only getting higher, and the level and acceptability of competitive play also rises, this pursuit for equality of gameplay while still being able to generate revenue becomes the priority. As such, many of the largest and most

popular games such as “LOL, Smite, and Dota2” have become “strictly monetized by means of purely non-functional virtual items” (Marder).

Motivations Driving Purchasing of In-Game Items:

If the items being available for purchase in games are purely non-functional and virtual, what motivates for gamers to spend real money to buy them? This was a question that Ben Marder and his team tackled in the paper “The Avatar’s new clothes: Understanding why players purchase non-functional items in free-to-play games.” Marder et al creates a framework to analyze in-game purchasing behavior through interviewing avid League of Legend players with a history of making in-game purchases that categorize the three main types of motivations within players of League of Legends and other freemium games. Firstly, through citing "The experiential aspects of consumption: Consumer fantasies, feelings, and fun" by Holbrook and Hirschman, Marder establishes that hedonic motivation drives purchases through appealing to a gamer looking for fun, feelings, and fantasies. Specific examples of how this is expressed in League of Legends include a gamer need for novelty in game players are used to, the multisensory appeal of aesthetics, reciprocity back to developers, self-gratification, or character dedication. Both reciprocities back to developers and character dedication will not be examined through this experiment as the experimental design does not use goods from any specific game. Secondly, Marder references "Possessions and the extended self" by Belk, and "The role of products as social stimuli: A symbolic interactionism perspective" by Solomon, to establish the importance of social motivation. For Marder, social motivation for in-game purchases refer to how gamers understand social relationships and externalized identities. Specific examples of how this is expressed in League of Legends include when gamers are gifting each other items, looking to achieve social distinction, hoping to show reciprocity back to developers to gain social approval,

or to establish visual authority. Although a very large part of the specific example of League of Legends, gifting is not experimented with in my study. In addition, showing reciprocity back to developers to gain social approval is a very special case that is specifically seen in freemium game experiences. As such, it is not tested in this experiment, as the seller of items and services in the questionnaire use business models incomparable to the experience found in League of Legends. The final type of motivation is utility, which is defined to directly help the game player in a functional way. This is not seen as much in this paper by Marder due to League of Legends emphasis upon being an authentically skill-based game. However, many freemium video games sell functional utility benefits such as Homescapes, which allows for gamers to buy extra lives when they fail to meet benchmarks.

What is found by Marder can be confirmed by in-game purchasing data. A Statista Survey conducted in December 2016 found that of purchases made by gamers, 58% came from the utility-based motivation that is "to reach in-game objectives faster." On the other hand, 40% of purchases were made for the social motivation "to be better than other players" (Statista). Amongst dedicated male gamers, 45% would purchase power-ups, 49% would purchase DLC/Expansion Packs, 39% would purchase Playable Characters, and 36% would purchase cosmetics or skins (ACI Worldwide). Amongst dedicated female gamers, 53% would purchase power-ups, 35% would purchase cosmetics or skins, 34% would purchase time-savers, and 33% would purchase playable characters (ACI Worldwide). Looking at this data, we see that across both genders, gamers are willing to use real money to purchase virtual items due to motivations that can be hedonistic, social, and utility driven.

Examples of the Usage of In-Game Currency:

Homescapes is an example of a game that allows gamers to play on both mobile and computer. In this game, a gamer solves puzzles to obtain in-game credit from which the gamer can then use in order to redesign the mansion to their liking. The game developer makes money through both advertisements as well as in-game purchases. Listed below is the bank from which you can make in-game purchases through spending real money.



(Author Screenshot)

Conversion rate starts at 5500 tokens to \$4.99, which is roughly a conversion rate of 1100 tokens to \$1. But if you are willing to spend more money, the conversion rate becomes noticeably better. At \$10, you can receive a conversion rate of 1200 tokens to \$1. And at \$20, you can receive a conversion rate of 1250 tokens to \$1. The tokens allow the player to purchase in-game boosts and extra lives or moves that allow the player to continue to level up, and design more of the house. Beyond directly buying the token, Homescapes also provides pricing of bundles, which it calls packs such that players can directly buy an array of in-game items for better prices. These bundles are typically deeply discounted, but also require more commitment by the player as they are bundled to be more expensive than direct token conversion options.

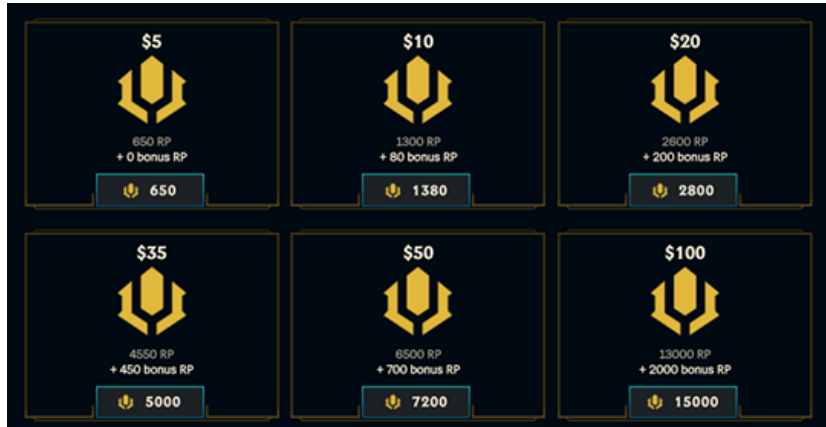


(Author Screenshot)

Being that Homescapes is an individual game, the in-game purchases offered primarily relate to functions that stem from utility motivations. Another freemium game like Homescapes in that it uses puzzles and provides utility based in-game purchases would be Candy Crush which accumulated over \$693 million in gross player spending between August 2017 to July 2018 (Reffell).

Another game that uses in-game currency would be League of Legends. With revenue nearly reaching \$7 billion between 2015 to 2018 (Gamasutra), this multiplayer online battle arena video game has reached tremendous worldwide popularity and success. Professional League of Legend teams and tournaments can be found through China, USA, Korea, Taiwan, Turkey, Brazil, Vietnam, and many more regions. Compared to Candy Crush or Homescapes, there is added complexity due to the social element of the game. As players play together on the same platform, and can see and interact with one another, the in-game purchases have also changed to reflect this. With a competitive player base and established professional prize system, the game has prioritized skill, and in-game purchases do not allow for players that pay money to gain utility advantages over those that do not. Thus, as seen from B Marder et al, League of Legends tries to

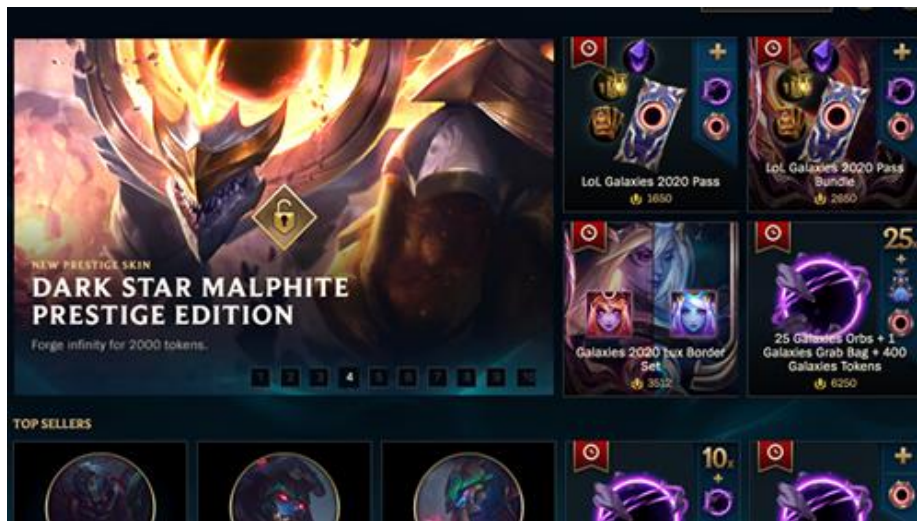
provide in-game purchases that appeal to social and hedonistic motivations (Marder) for its players. For example, the game has recently partnered with luxury brand Louis Vuitton to release designs for champions in League of Legends (Silbert).



(Author Screenshot)

There are three ways to make purchases in League of Legends. Blue Essence is the currency that players obtain through directly playing the game. With Blue Essence, players can unlock new champions, ensuring fairness across the game as all players can obtain and use any champion without putting in any real money. Riot Points are the premium currency used in League of Legends that must be bought by the gamer to be able to use. Listed above is the conversion structure between US Dollar to Riot Points. It is the only way to purchase skins and chroma which leads to different designs and colors in the gameplay, although it also creates no other advantage for the players using them. With no functional advantage, League of Legends is able to effectively balance fairness and an emphasis upon skill with generating revenues for the company. The final in-game currency is Orange Essence, which is a premium version of Blue Essence, and is obtainable through unlocking unique features such as capsules or orbs from gameplay or through using Riot Points. It is a unique in-game currency that provides the skins

and designs that were previously only purchasable through riot points, or real money, for gamers that are willing to play enough to accomplish listed quests (Friedman).



(Author Screenshot)

Costs for skins, which are changing themes for champions, range between 520 RP, 750 RP, 975 RP, 1350 RP, 1820 RP, and 3250 RP. Chromas are color changes for champions that are sold at 290 RP. In addition, similarly to Homescape, League of Legends offers a plethora of bundles that can cost a various range of RP. These bundles typically consist of a mix of a champion along with a champion skin or two, and then lots of chromas for the specific champion offered. League of Legends also offers further exclusivity through having changing themes and seasons in which certain skins or icons can only be purchased for a few months, and then never again. Another interesting point to note is how the purchasing prices in Riot Points for the bundles and items do not factor into the amount of Riot Points you can obtain per purchase. As such, upon the completion of purchases, the balance of Riot Points does not ever go all the way down to zero.

Fortnite is another game that uses in-game currency which has found tremendous success.

Fortnite is a social game in which players can compete to be the last man standing in Fortnite

Battle Royale, work together to survive against zombies in Fortnite: Save the World, or create worlds and battle arenas through Fortnite Creative. The number of registered users has climbed from 30 million in December 2017, to 200 million by November 2018, and 250 million by March 2019 (Business Insider). Revenue has also climbed from \$1.7 Billion US Dollars in 2017 to \$20.1 Billion US Dollars in 2019. This has come through Fortnite opening up its game to platforms across premium PC, premium console, free-to-play console, free-to-play PC, and even mobile (Richter). 68.8% of registered users in June 2018 had spent money on Fortnite, and of this group, 58.9% of the in-game spending went to outfits or skins. The remaining in-game spending went towards gliders, harvesting tools, and emotes. The way to make in-game purchases on Fortnite is through purchasing the in-game currency V-Bucks, which can be converted at roughly \$1 for 100 V-Bucks as is shown in the table below (LendEDU).

US Price in USD	V-Bucks Conversion
\$9.99	1000 V-Bucks
\$24.99	2500 V-Bucks +300 Bonus V-Bucks
\$59.99	6000 V-Bucks +1500 Bonus V-Bucks
\$99.99	10000 + 3500 Bonus V-Bucks

Yet the popularity of Fortnite is such that the usage of V-Bucks may very well go from purely virtual goods that only exist in the gaming platform, to being able to purchase physical goods with the Fortnite brand in the future. With the popularity and the amount of transactions occurring through V-Bucks, the IRS had investigated and deemed Fortnite's in-game currency to not need to be reported on tax returns (Fung). With the introduction of goods available for

purchase through V-Bucks that do not exist solely in the virtual world of Fortnite, it is unclear how the tax laws on V-Bucks could change. With such an addition, it could become arguable that V-Bucks should be treated as an investable virtual coin, which could lead to investment gains taxes found in cryptocurrencies such as Ethereum. Regardless of how the usage and tax considerations of V-Bucks change, Fortnite has already revolutionized the applications from which its in-game currency can be used. Its tremendous popularity has gifted the game massive opportunity from which further innovative use of its in-game currency can transpire.

Statement of the Problem:

In just looking at these three examples, we can see that there is tremendous complexity found in the usage of in-game currencies for monetization across games. For example, to purchase RP, League of Legends uses whole numbers with 0 cents, which contrasts to how both Fortnite and Homescapes like to have 99 cents instead of a full dollar. On the other hand, Fortnite items always have 0 in both the tens and singles digits. This allows for Fortnite V-Bucks buyers to be able to more easily calculate how to spend all the V-Bucks that they have available. This is very different from League of Legends, which likes to charge for items numbers like 1380, resulting in an RP balance that can never empty back to zero. Looking at the pricing conversion between the three games, all of them use different conversion rates, with League of Legends at 1 to 130, Fortnite at 1 to 100, and Homescape at 1 to 1100, if not considering any of the bonuses. While the bonuses structures all lead to better conversion rates from US Dollar to the in-game currency if the gamer is just willing to spend more money on the transaction, by percentage, they all differ in terms of how much of a bonus is provided for the extra dollars spent.

In all of these games, I have noticed that 1 unit of an in-game currency is worth significantly less than 1 US Dollar, meaning the conversion rate function as a multiple of the US Dollar. In-game hard currencies, whether tokens, V-Bucks, RP, or gems, all seem to be offered at extremely generous conversion rates to the US Dollar. Is that necessarily the most optimal practice?

Justification of the Problem:

In the “Effect of Face Value on Product Valuation in Foreign Currencies”, Priya Raghubir and Joydeep Srivastava dive into people’s spending behavior when using foreign currencies.

Currencies that are worth more than the home currency are fractions, as they result in a function such that foreign currency is a fraction of a unit of home currency. On the other hand, currencies that are worth less than the home currency are multiples, as they result in a function such that foreign currency is a multiple of a unit of home currency. In this study, Raghubir and Srivastava compare and show how people’s spending behavior and willingness to pay is directly impacted by whether the foreign currency is a fraction or multiple of their home currency.

From my own experiences, I had predicted that people using foreign currencies that are multiples would be more likely to overspend. This is a result of the Monopoly money phenomenon, in which people psychologically treat foreign money like play money. Having lived in Mozambique where the conversion rate is 60 Metical’s to 1 USD as well as travelling through South Africa where the conversion rate is 13 Rands to 1 USD, I felt comfortable with this hypothesis. On the other hand, currencies that are fractions would result in people being uncomfortable with the units of denomination, resulting in either overspending or underspending depending on the person's tolerance for risk. Yet through the 6 experimental studies in this paper, Raghubir and Srivastava showed that people are likely to overspend in the

case of currencies that are fraction, and likely to underspend in the case of multiples. I was immensely curious to see if this would hold true for games, which instead of foreign currency, uses in-game currencies. If so, then in-game currencies are not optimized for customer willingness-to-pay, and games may be able to generate far more revenue and profits through changing their respective in-game currency from being multiples to fractions of the US Dollar.

Hypothesis:

My hypothesis is that the finding in willingness to pay found by Priya Raghubir and Joydeep Srivastava in which there is overspending by people using foreign currencies that are fractions of their home currency and underspending by people using foreign currencies that are multiples of their home currency will also hold true for cryptocurrencies and in-game currency. Thus commercially, games would be able to generate more revenues if the in-game currency that people make in-game purchases functions such that the in-game currency is a fraction of a unit of the home currency.

Approach to Identifying Willingness to Pay:

The typical way to identify willingness to pay of participants is through the Becker DeGroot Marschak Method, or BDM (Breidert). This is a mathematically proven effective way to study behavior for willingness to pay based on the Vickrey auction which can take out incentive bias from a study. However, there are two primary reasons for why I elected to not use the BDM method. Firstly, the logistics of having to provide incentives makes the process very costly. To provide the actual incentive to have a better idea of how participants might react, they would need to either be able to take the good in-person or have the good shipped to them. Having the good be taken in-person would ideally happen in the Ross Behavior Lab, which has limited capacity, and requires further budgeting which could be going towards running more trials. Secondly, the budget limits the types of incentives available to the participants. The goal of the questionnaire is to have items that are relevant to purchasing behaviors of gamers, thus driving for participants to be acting upon similar motivations as games that make in-game purchases. Examples of these motivations can include social distinction or aesthetics, both of which require items that are unlikely to be cheap. While games might be selling items that are not expensive, the experiment is meant to be broader in scope, and to not sample only gamers that play a specific game. As such, the items themselves must be universal while creating these motivations, leading to difficulties in budgeting for items for the participants. As the experiment does not allow participants to keep items, they express their willingness to pay for, the experiment will use a direct questionnaire in which participants are paid through MTurk for taking the questionnaire itself. With this methodology, the questionnaire will directly ask participants what they would be willing to pay and make sure to note that the questionnaire is asking for the maximum willingness to pay for each item.

In the questionnaire, I will be asking for the participants maximum willingness to pay across four items. The participants will first answer their maximum willingness to pay for the four items in US Dollars, which serves as the control, as it is the home currency of all participants. To show causal effects, the willingness to pay in all other mediums of payments will be compared to data from US Dollars. Next, to test how maximum willingness to pay is affected by whether or not a different medium of payment is a fraction or a multiple of the home currency, participants will be answering their maximum willingness to pay in both cases. They are to be randomized to answer their maximum willingness to pay for either a fraction or multiple that in the form of a cryptocurrency, foreign currency, or made-up in-game currency. If they were asked to answer for a currency that is a fraction, then the next will be a multiple, and vice versa. In addition, participants will be randomized for a medium of exchange that is not the same as the medium of exchange that they have already answered. For example, if the participant has already answered their maximum willingness to pay for US Dollars and a cryptocurrency multiple, then they will be asked their maximum willingness to pay for a foreign currency or in-game currency multiple.

In choosing what will be the fraction and multiple tested, we had to focus on looking into cryptocurrencies and foreign currencies. The key was to find a multiple and fraction that was comparable, and which also had both a foreign currency and a cryptocurrency that was trading at similar levels to both the multiple and the fraction chosen. The closest I could find was roughly around 2.7 versus 0.4, and so I decided to round to 2.5 versus 0.4 as they would be reciprocals of one another. The experiment tests for foreign currencies, as this forms another control to test for the results from the study by Raghubir and Srivastava. If the results are the same as what was

found in that study, it provides another comparison point to demonstrate that it is the conversion rate being a fraction or multiple of the US Dollar, and not the type of medium of exchange, that leads to causal differences in behavior. In choosing what foreign currencies to use, I found at 2/9/2020 that the Omani Rial (OMR) traded roughly 0.38 OMR to 1 USD, and that the East Caribbean Dollar (XCD) traded roughly 2.70 XCD to 1 USD. This would match well with two cryptocurrencies, Kyber Network (KNC) which traded roughly at 2.814 Kyber Network (KNC) to 1 USD, and XTZ Tezos (XTZ) which traded roughly 0.376 XTZ Tezos (XTZ) to 1 USD. In addition, to both cryptocurrencies being similar to their foreign currency counterparts, they are both relatively unknown and should not elicit recognition compared to other cryptocurrencies such as Bitcoin or Ripple. Through also including cryptocurrencies, we can further compare how people might perceive willingness to pay with digital in-game currencies. In addition, there have been, and still are games which allow for purchases through the usage of cryptocurrencies. Could the popularity of cryptocurrencies act to legitimize the usage of in-game currency? Or could it also possibly be a substitute for in-game currency? For the gaming company Zynga, this looks to be possible, as it now allows gamers to make in-game purchases using bitcoin (Airguide Business). Taking it a step further would be Unikoin Gold which aims to be the universal gaming and e-sport cryptocurrency of choice (Unikrn/CoinCircle).

For the in-game currency, I made up the name FortLegend Game-Bucks (FLGB), which is an amalgamation of League of Legends and Fortnite currency. To control for how the name itself might affect purchasing behavior, the experiment uses the name for both multiple and fraction cases. As such, it was essential to make sure to set the experiment so that participants will not have both fraction and multiple for in-game currency.

Finally, at the very end of the questionnaire, I will be collecting demographic information on the participants. To better understand the population of the study, I want to know how age group, gender, and the participants' familiarity with any of the mediums of payments might affect behavior. In addition, it works as a check to ensure proper following of research regulation. I will be checking to make sure that all participants have an US IP Address, and are over 18 years of age, as should be required with MTurk.

Reasoning for Item's Chosen:

Across the board, the items in the questionnaire must be goods that people would want regardless of demographics such as gender, age, sexual orientation, and if they play a specific game. As such, it is hard to use actual digital items found in games as both the utility and non-utility items are typically relative to the game itself, or the experience and social community of the specific game. So, the idea is to identify items that drive behavior relating to the motivations found by purchasers of in-game features of games. To do this, I used the framework created by Marder et al to analyze whether the items that I have chosen are pertinent to the items sold in freemium games. The big key from this framework is that motivations driving the purchasing behaviors of the gamers are not mutually exclusive, and thus, each item chosen in the questionnaire will be analyzed from the perspective of all three motivations.

The first good presented is the Adidas Superstar Shoe which is marketed as essential and timeless to both male and female outfits. In terms of hedonistic motivations, aesthetics, or the classic design of the shoe stand out to me as a primary reason for why people (including myself) have this shoe in my wardrobe. A social motivation that could impact willingness to pay could be social distinction, as Adidas has a huge family of fans and supporters. The motivation

stemming from utility, in which people need casual shoes for streetwear, is a theme with this shoe. Combining these motivations, I predict the Adidas Superstar Shoe to be a good comparison point as a physical and visible item compared to the following digital or more luxurious items.

The second good presented is a Subscription to Netflix, which is similar to the Adidas Superstar Shoe in that the motivations surrounding the utility it provides stand out. Yet it is also a digital platform, and so I thought it would be interesting to look into if there might be any differences in perception between physical and digital goods. In addition, hedonistic motivations surrounding the purchase of a Netflix subscription include the aesthetics of the Netflix experience or perhaps self-gratification in rewarding oneself through access to an entertainment system. Social Motivations could include social distinction, as there are a huge amount of Netflix subscribers leading to its importance in popular culture. Furthermore, there are specific shows and movies that are only available on Netflix, which creates social separation between those with subscriptions and those without the service.

The third good present is a Gucci Sweatshirt, which is the most luxurious item of the four. In terms of utility, it is merely a hoodie, but still typically commands a high price, leading to further emphasis upon hedonistic and social motivations in purchasing behavior. Of the hedonistic motivations listed, novelty in the purchaser's wardrobe, if the person purchasing does not have any other Gucci items, can be a primary reason for wanting to purchase. A buyer may also enjoy the aesthetics, either of the item or of the brand. Of the social motivations listed, emphasis on visual authority and social distinction is what makes this item so compelling as a luxury item.

The brand is both expensive and rare, which makes the wearer belong to a special social group of

people that can afford this level of luxury, alluding to the overall success and superiority of the individual.

The fourth and final good presented to questionnaire takers is the option to take up a service in which a professional photo editor helps to seamlessly photoshop outfits of your liking onto a recent picture of your choice. The biggest reason for using this specific example is because of the uncertainty that I expect participants to have in trying to discern a valid price for the service. In all of the other examples, participants probably have somewhat of an idea of how much a brand or an item should typically cost. However, in this case, this is a service where I do not expect for participants to have any previous experience with this particular scenario and have to use their own judgement to evaluate the price of a service. This is most similar to the case in video games in which the game developers are offering virtual goods that are very difficult for gamers to value and be able to put a price upon. In addition, the motivations driving participants to want to purchase this service can still be categorized into the framework that we have been using from B. Marder et al. Hedonistic motivations in this case mostly revolve around self-expression, with novelty and aesthetics being two primary drivers of behavior. The same aesthetics and novelty that come from self-expression can also be driven by social motivations stemming from desire for social distinction as well as visual authority.

Concerns for the Questionnaire:

In putting together, the methodology of the questionnaire on Qualtrics, there were many tradeoffs and considerations in the framing of the questions and the design of the questionnaire. Games normally have the prices already listed out for the items that they are selling to their customers. But to give an anchoring point could lead to anchoring bias that might sway the

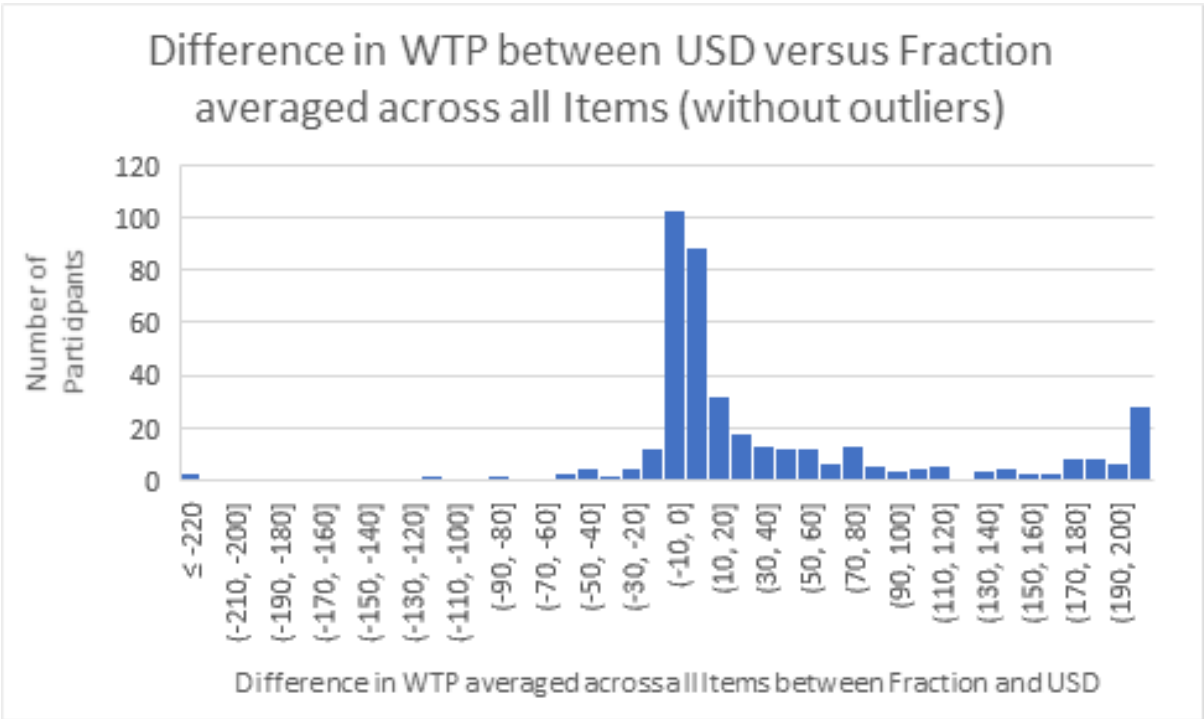
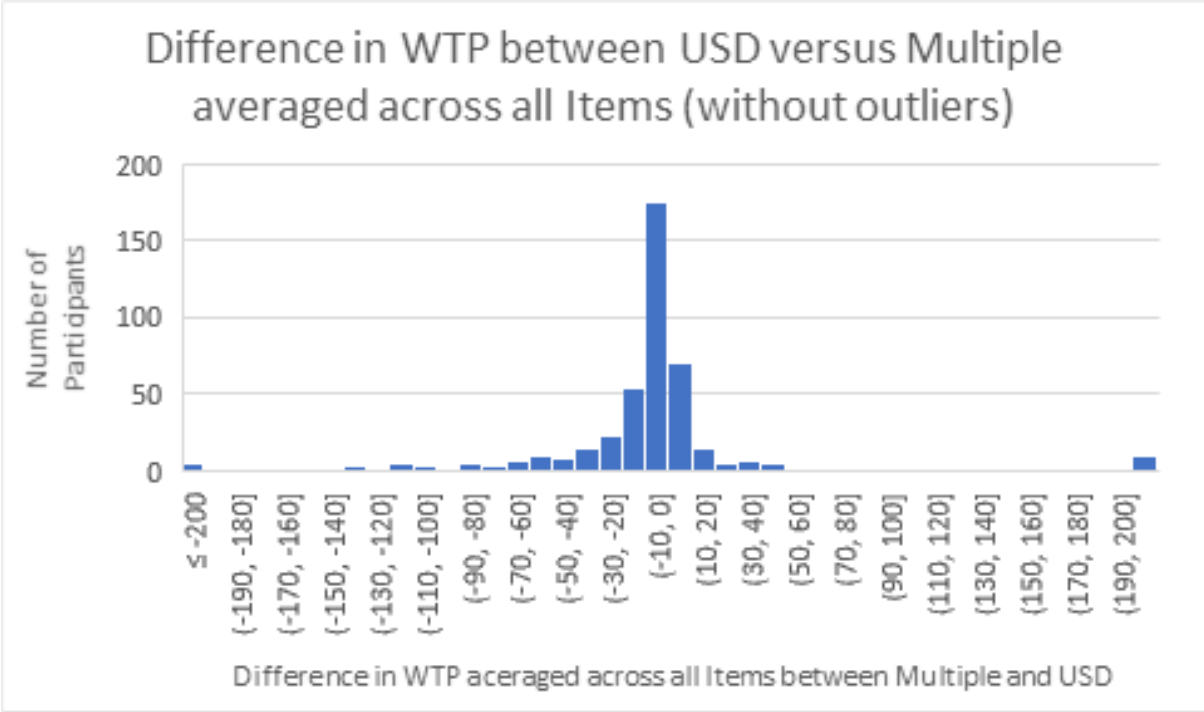
behavior of participants in the questionnaire that will adjust their maximum willingness to pay to match what they see. Ultimately, I made the choice that it would be better to understand how people might value a digital service with minimal baseline in valuation, which is the goal of photo editing service. With that decision made, I kept the lack of an anchoring point consistent for the rest of the experiment. Another question that I was unsure about was the matching of the fraction to multiple. Is 0.4 of $2/5$ comparable to 2.5 or $5/2$? I had made the decision because I felt the reciprocal would help to even out complexity and size that could be other factors in willingness to pay. But it is unclear whether that standard really holds true for how people behave.

Acquiring and Filtering Data:

To be able to acquire the data, I created the questionnaire asking for maximum willingness to pay through Qualtrics. From there, I used MTurk to be able to pay for responses of the questionnaire from a myriad of participants. I have inserted validation into the Qualtrics questionnaire to push for answers for all questions, but to further make sure the data is usable, I have also installed further questions to filter across the responses.

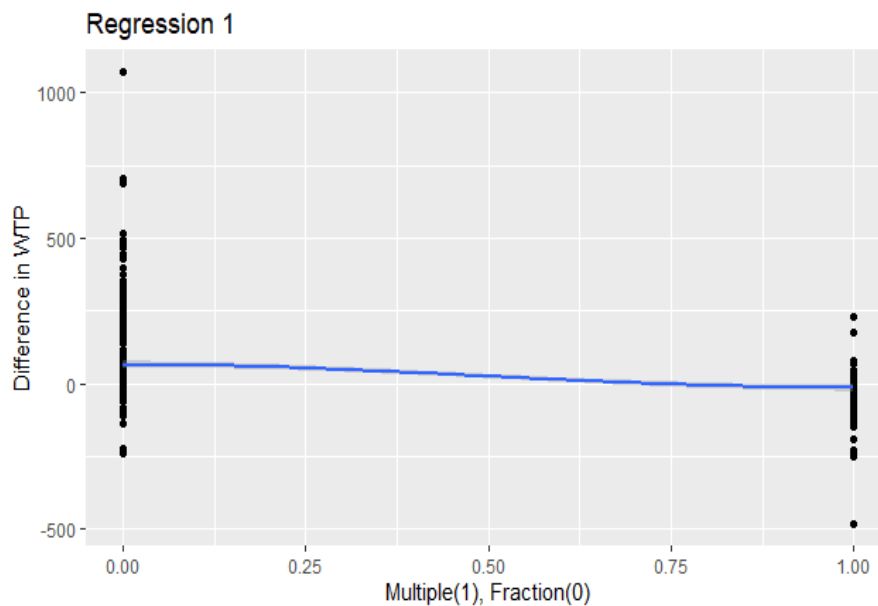
In the questionnaire, I have inserted a written question: “Did you attempt to stay consistent in your willingness to pay for the same items? Why or why not?” This is immensely useful for filtering across responses as it tests both whether the participant reads the questions, as well as if they can speak and understand English. Through scouring through the results from this written question, I was able to effectively cut down the number of participants whose data I would use from 692 to 441 responses. Looking at the data, some of the data points just did not make much sense. As such, to delete the data points in which the participants clearly did not understand the

question, I compared the difference between the maximum willingness to pay in US Dollars averaged across the 4 items with both the currencies that are denoted as a fraction and multiple of the US Dollar. From there, I deleted all data points in which the participant has a $\pm 200\%$ difference in what they responded for their willingness to pay in either the fraction or multiple as compared to what they had said for the US Dollar. Through this method, I was able to further eliminate 109 responses from the data. Altogether, this step led to a cut down to 332 participant responses. Of this number, there were 103 occurrences in which the participant had a maximum willingness to pay over 200% for the currency denoted as a fraction, 18 occurrences in which the participant had a maximum willingness to pay over 200% for the currency denoted as a multiple, and an overlap of 12 responses. It was interesting to note that every occurrence in which the difference was $\pm 200\%$ happened to be greater than 200%. As the 200% mark was quite arbitrary, this shows that of the responses that I was eliminating, this step would reflect a larger decrease in the maximum willingness to pay in the currencies denoted as fractions as compared to the multiple. Through creating histograms to visualize the data before filtering this step of the data, the effect becomes apparent.



Results:

In analyzing the data, there are three primary questions that I am looking to address. The first is whether there is a difference in willingness to pay based on whether the currency presented is a multiple or a fraction of the home currency. To simplify for both whether there is a difference, as well as how large of a difference, a currency denoted as a fraction or a multiple can cause on willingness to pay, I held all other categories equal. This meant averaging the willingness to pay across all items and not segmenting with currency type. To run the regression, we put whether the currency is a fraction or a multiple as a categorical variable. In this case, if the participant were answering with a multiple, the data would process it as 1. Looking at the regression chart listed below, the line for difference in willingness to pay slopes downwards from the data points in fraction, to the multiple.



This is better shown through looking at the descriptive statistics. From running the linear regression, we see that if the currency is a multiple rather than a fraction, the difference in willingness to pay between what the participant answered in average across all four items is expected to drop by \$80.5 US Dollars. Considering that the average difference in willingness to

pay across both multiple and fractions is 32.625, and that the median is 0, this is quite a sizable difference. However, it is also important to investigate both the standard error as well as the adjusted R2. Being that the linear regression was run using categorical variables, both the standard error and the adjusted R2 will point towards the data not being statistically significant. Even so, running the regression still gives a useful baseline for understanding whether or not there is a difference in spending behavior depending on whether the currency is a multiple or a fraction.

```

Descriptive statistics
=====
                        Dependent variable:
                        -----
                        Difference
-----
MF                        -80.5***
                          (8.1)

Constant                  65.4***
                          (5.7)

-----
Observations              664
R2                        0.1
Adjusted R2               0.1
Residual Std. Error      104.7 (df = 662)
=====
Note:                      *p<0.1; **p<0.05; ***p<0.01

```

Secondly, I investigated into whether if there is a difference in willingness to pay based on whether the currency presented is a Multiple or a Fraction of the home currency interacted with the currency type. The difference in willingness to pay is still averaged per participant across all items, but the data will now reveal how the effect based on whether the comparison currency is a multiple or fraction changes across different mediums. This is an important step as it will help to show whether the findings that Raghubir and Srivastava showed in their study is also generalizable across cryptocurrencies and in-game currencies. Looking at the descriptive statistics of the regression, we see that multiples lead to an expected drop in willingness to pay of a bit more than 80. Additionally, compared to in-game currencies, participants working with

foreign exchange currencies pay \$2.26 more, and participants working with cryptocurrencies pay \$8.68 USD more. The adjusted R2 goes up from 0.1 to 0.13, which is still extremely low, but is still to be expected due to the usage of categorical variables in the linear regression.

```

Descriptive statistics
=====
                        Dependent variable:
-----
                        Difference
-----
MF                      -80.34***
                        (8.13)

factor(FOREX)1          2.26
                        (10.01)

factor(Crypto)1         8.68
                        (10.03)

Constant                61.58***
                        (8.27)

-----
Observations            664
R2                      0.13
Adjusted R2             0.13
Residual Std. Error    104.77 (df = 660)
=====
Note:                    *p<0.1; **p<0.05; ***p<0.01

```

Third, the analysis will be on whether there is a difference in willingness to pay based on whether the currency presented is a Multiple or a Fraction of the home currency interacted with the currency type and the item. As the items have now been spread out, the data points have increased from 664 to 2656, although for all regressions, data points are still clustered to the 332 participants. Spending behavior for currencies that are multiples lead to a drop in expected willingness to pay of \$33.7, which is much lower than in the previous two regressions. In addition, reversing the behavior seen in the second regression, once dividing for items, participants are willing to spend the most if they are using in-game currencies. In addition, standard error dropped heavily compared to before, as without the averaging across the items, the data is more fitted to the regression. On the other hand, adjusted R2 also dropped to just 3%,

which is possible despite the drop in standard error because the data is not linear and there is also the introduction of another categorical variable.

```

Descriptive statistics
=====
                        Dependent variable:
-----
                        Difference
-----
MF                      -33.7***
                        (3.6)
factor(FOREX)1          -8.4*
                        (4.5)
factor(Crypto)1         -5.8
                        (4.5)
factor(Shoe)1           1.5
                        (5.2)
factor(Netflix)1        0.2
                        (5.2)
factor(Hoodie)1         1.3
                        (5.2)
Constant                22.8***
                        (4.8)
-----
Observations            2,656
R2                      0.03
Adjusted R2             0.03
Residual Std. Error     93.9 (df = 2649)
=====
Note:                    *p<0.1; **p<0.05; ***p<0.01

```

Finally, looking across the items, the willingness to pay from highest to least goes Adidas Shoe, Hoodie, Netflix, to Photo editing service. I found this especially interesting as in terms of pricing found on the internet, the Gucci Hoodie should be worth far more than the Adidas Shoes. The digital goods of Netflix and the Photo Editing Service are priced lower than the physical goods, but I do not think it is representative of whether digital goods are priced lower than physical ones due to the inherent prices of the digital goods being much lower than the physical goods as retailed online. As for the photo editing service, perhaps the difficulty in valuation lead to participants feeling confused or unsure, leading to a lower willingness to pay. As the good most representative of what is found in actual games, I think this makes sense as virtual goods in Homescapes and League of Legends are priced below that of a monthly Netflix subscription.

Further Questions:

Overall, there are a lot of areas of experimentation in the realm of digital in-game currencies. In this experiment methodology, we focus on willingness to pay between in-game currencies that are fractions versus multiples of the home currency. However, there are many more drivers of behavior that may affect how people interact with digital in-game currencies.

The biggest area where I could see a difference between willingness to pay and whether games should adopt in-game currencies that is a fraction or a multiple would be on willingness to convert. In this study, we are assuming that switching between the home currency and in-game currency is both possible and has zero cost. This assumption does not typically hold for in-game currencies in real life. Furthermore, we are also assuming in this study that the participant already has a set amount of the in-game currency and does not have to make the conversion of the money themselves. As such, for game developers designing in-game currencies, even if there is a higher willingness to pay through the usage of in-game currencies being fractions of the home currency, it is important to study whether the in-game currency is a fraction or multiple might have an effect on a consumer's willingness to convert their home currency into an in-game currencies.

How do results differ across multiples and fractions of different sizes and complexity? Starting with fractions, would there be a behavioral difference that can be quantitatively demonstrated between a fraction over versus under 0.5? What about in the case of fractions that are very close to either 1 or 0? What about whether the fraction divides evenly, such as in the case of $2/5$, or if it is irrational, like in the case of $1/7$? On the flip side, how does the size of the multiple affect behavior? In the gaming world, very high multiples dominate. Could multiples over the size of

10 or 100 lead to drastically different behavioral patterns as in this study, which just uses 2.5? Is there any difference in behavior if the multiple is a whole number versus one with decimals?

Games often provide incentives through bonuses or bundles to spur purchasing behavior from gamers. For example, in the case of League of Legends, the standard conversion rate is \$5 to 650 RP. Yet if the purchaser of the RP is willing to pay \$100, they get an additional 2000 RP, or roughly \$15.40 worth of RP in the deal. Through rewarding bonuses for transactions, gamers that are looking to obtain RP may not think of the conversion rate between dollars to RP as simply \$1 for 130RP, instead choosing a different basis point that includes a bonus in making the conversion calculation.

Looking at the result from the photo editing service, perhaps there can be further work done here with the anchoring bias. All games put down prices for the virtual goods, that like the photo editing service, are very difficult for participants and gamers alike to evaluate and put an effective price tag on the item. Thus, in this case, the photo editing service could potentially be manipulated to have a higher or lower willingness to pay through using the framing effect associated with the anchoring bias to better demonstrate how gamers might react to the difficult to evaluate virtual goods with price tags already set by the game developers.

Conclusion for Monetization Efforts of Game Developers:

As mentioned on the section on further questions, the effect of a currency that is a fraction or multiple on the willingness to convert is a key aspect on analyzing how the findings of my thesis affects the monetization strategy of game developers. If willingness to convert is not affected by whether an in-game currency is denoted as a multiple or a fraction of the home currency, in-game currencies should adopt fraction conversion rates. This would lead to an effective increase

in maximum willingness to pay as demonstrated by both my research as well as what was found by Raghurir and Srivastava.

On the other hand, if the willingness to convert is affected by whether the in-game currency is denoted as a multiple or fraction of the US Dollar, then there are two areas to consider. If possible, it would be useful to test to see whether using a currency that is a fraction or a multiple have a larger effect on the willingness to convert or willingness to pay. It would also be ideal if it would be possible to test how the differences change with complexity and sizes in numeracy. If across the different scenarios, the revenue loss due to a loss in willingness to convert is more than the gain generated from an increase in the willingness to pay from having an in-game currency that is a fraction, then it could be possible to adopt an intermediate currency. In this scenario, a game developer can allow for the gamer to purchase an intermediate in-game currency that is a multiple compared to the home currency, or the US Dollar. For example, the ratio could be \$1USD for 80 of the in-game currencies. However, the intermediate currency has to then be combined to form the purchasing currency in such a ratio that the purchasing currency is a fraction of that of the US Dollar. Following up on the example listed above, the conversion rate could be such that 100 intermediate in-game currencies is equal to 1 purchasing in-game currency. This could be possible if it is marketed with the alternate in-game currency that is found through just playing the game, so that the gamer might be more receptive to having to deal with the switches. Thus, through changing up the conversion rates to make sure that the conversion is optimized with a multiple, as well as spending behavior to a fraction, the game developer can obtain optimal revenue generation with their in-game currency.

Citations

- ACI Worldwide. (June 24, 2018). Leading in-game purchases made by gamers in the United States as of May 2018, by gender [Graph]. In Statista. Retrieved April 07, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/202872/type-of-in-game-content-purchased--by-social-gamers-in-the-us/>
- App Annie, & VentureBeat. (February 10, 2016). Mobile gaming app revenue worldwide in 2015, 2016 and 2020 (in billion U.S. dollars) [Graph]. In Statista. Retrieved April 17, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/511639/global-mobile-game-app-revenue>
- Belk, R. W. (1988). Possessions and the extended self. *Journal of Consumer Research*, 15(2), 139–168.
- Breidert, C., Hahsler, M., & Reutterer, T. (2006). A Review Of Methods For Measuring Willingness-To-Pay. *Innovative Marketing*, 2(4).
- Business Insider. (March 20, 2019). Number of registered users of Fortnite worldwide from August 2017 to March 2019 (in millions) [Graph]. In Statista. Retrieved April 10, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/746230/fortnite-players/>
- Crecente, B. (2018, August 17). 'Candy Crush Saga' Earned Just Under \$1 Billion in Past 12 Months. Retrieved from <https://variety.com/2018/gaming/news/candy-crush-saga-1-billion-1202908004/>
- Essences - In-game Currency Guide (League Of Legends) • L2pbomb. (2018, August 1). Retrieved from <https://l2pbomb.com/essences-in-game-currency-guide-league-of-legends/>
- Fitzpatrick, H. (2014, December 19). Looking at In-Game Currencies. Retrieved from <https://www.gamesbrief.com/2014/12/looking-at-in-game-currencies>
- Friedman, D. (2016, February 23). How to get the most out of gambling on League of Legends' Mystery Skins. Retrieved from <https://www.polygon.com/2016/2/23/11100236/league-of-legends-mystery-skin-chests>
- Fung, B. (2020, February 14). IRS quietly deletes guideline that Fortnite virtual currency must be reported on tax returns. Retrieved from <https://www.cnn.com/2020/02/13/tech/fortnite-taxes/index.html>
- Gamasutra. (January 17, 2019). League of Legends (LoL) revenue worldwide from 2015 to 2018 (in billion U.S. dollars) [Graph]. In Statista. Retrieved April 10, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/806975/lol-revenue/>
- Hamari, J., Hanner, N., & Koivisto, J. (2020). "Why pay premium in freemium services?" A study on perceived value, continued use and purchase intentions in free-to-play games. *International Journal of Information Management*, 51, 102040. doi: 10.1016/j.ijinfomgt.2019.102040
- Holbrook, M. B., & Hirschman, E. C. (1982). The experiential aspects of consumption: Consumer fantasies, feelings, and fun. *Journal of Consumer Research*, 9(2), 132–140.

- Hughes, I. (2019, October 22). Video game currency: clever or corrupting? Retrieved from <https://www.bcs.org/content-hub/video-game-currency-clever-or-corrupting/>
- iResearch. (August 5, 2019). Mobile gaming revenues in China from 2011 to 2021 (in billion yuan) [Graph]. In Statista. Retrieved April 17, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/270141/revenues-of-china-mobile-gaming-markets/>
- LendEDU. (June 26, 2018). Share of Fortnite players who have ever spent money on in-game purchases in Fortnite in the United States as of June 2018 [Graph]. In Statista. Retrieved April 10, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/882071/fortnite-players-spending-money-in-game-purchases/>
- Madigan, J. (2019, December 19). The Perils of In-Game Currency. Retrieved from <https://www.forbes.com/sites/jamiemadigan/2019/12/19/the-perils-of-in-game-currency/#6170b15f42da>
- Marder, B., Gattig, D., Collins, E., Pitt, L., Kietzmann, J., & Erz, A. (2019). The Avatars new clothes: Understanding why players purchase non-functional items in free-to-play games. *Computers in Human Behavior*, 91, 72–83. doi: 10.1016/j.chb.2018.09.006
- Prelec, D., & Lowenstein, G. (1998). The Red and the Black: Mental Accounting of Savings and Debt. *Marketing Science*, 17(1), 4–28. <https://doi.org/10.1287/mksc.17.1.4>
- Raghubir, P., & Srivastava, J. (2002). Effect of face value on product valuation in foreign currencies. *Journal of Consumer Research*, 29(December 2002), 335–347. Retrieved from <http://www.jstor.org/stable/10.1086/344430>
- Reffell, C. (2017, September 21). How Digital Tokens and ICOs Work for Video Gamers. Retrieved from <https://crowdsourcingweek.com/blog/how-digital-tokens-and-icos-work-for-video-gamers/>
- Richter, F. (July 20, 2018). Battle Royale: A Billion-Dollar Gaming Trend [Digital image]. Retrieved April 10, 2020, from <https://www-statista-com.proxy.lib.umich.edu/chart/14793/battle-royale-revenue/>
- Silbert, J. (2019, December 9). Louis Vuitton Drops 'League of Legends' Apparel Collaboration. Retrieved from <https://hypebeast.com/2019/12/league-of-legends-louis-vuitton-apparel-collaboration-collection-accessories>
- Solomon, M. R. (1983). The role of products as social stimuli: A symbolic interactionism perspective. *Journal of Consumer Research*, 10(3), 319–329.
- Statista. (January 19, 2017). Leading reasons for in-game purchasing of virtual currency according to gamers in the United States as of December 2016 [Graph]. In Statista. Retrieved April 07, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/678783/in-game-buying-virtual-currency-usa/>
- Unikrn/CoinCircle. (2017, October 5). UnikoinGold Poised to Become the Universal Token for Esports and Gaming with Largest-Ever Gaming Token Sale. Retrieved from <https://www.globenewswire.com/news-release/2017/10/05/1141708/0/en/UnikoinGold-Poised->

[to-Become-the-Universal-Token-for-Esports-and-Gaming-with-Largest-Ever-Gaming-Token-Sale.html](#)

VentureBeat. (June 8, 2016). Value of the video game market in the United States from 2011 to 2020 (in million U.S. dollars) [Graph]. In Statista. Retrieved April 17, 2020, from <https://www-statista-com.proxy.lib.umich.edu/statistics/246892/value-of-the-video-game-market-in-the-us/>

Webb, K. (2019, December 18). More than 100 million people watched the 'League of Legends' World Championship, cementing its place as the most popular esports. Retrieved from <https://www.businessinsider.com/league-of-legends-world-championship-100-million-viewers-2019-12>

"Zynga trials bitcoins for game token purchases Zynga." AirGuide Business 13 Jan. 2014. Business Insights: Global. Web. 3 Apr. 2020.