

Business Intelligence in World of Warcraft

Thomas Debeauvais, Cristina V. Lopes, Bonnie A. Nardi
University of California, Irvine
{tdebeauv, Lopes, nardi}@ics.uci.edu

Nicholas Yee, Nicolas Ducheneaut
PARC, Palo Alto
{nyee, nicolas}@parc.com

Abstract—Games have evolved from the arcade coin slots of the 70s to Massively Multiplayer Online games (MMOs) costing hundreds of millions of dollars to develop. Often, MMO budgets only start to break even years after they launched. Hence the need to acquire and retain players, and have them spend extra money in the game by buying virtual items. Hence the need for business intelligence (BI) in MMOs. Beyond its economic and marketing use, BI can also provide feedback and guidance to game designers about their systems and the players they are designing these systems for.

From a cross-cultural dataset of 2865 World of Warcraft players, we look at two BI aspects of importance to MMOs: retention and (virtual) gold buying. We introduce three retention metrics: the weekly play time, the stop rate, and the number of years playing WoW. The typical gold buyer is a middle-aged competitive man with a full-time job who does not play with real-life relatives.

Index Terms—business intelligence, data mining, gold, MMO, retention, World of Warcraft

I. INTRODUCTION

In this work, we look at two aspects of business intelligence in MMOs: retention and real-money transactions.

A. Retention

“If you build it, he will come”. This line from the movie Field of Dreams, has been transformed into “If you build it, they will come” by developers of Massively Multiplayer Online games (MMOs). Some in the game industry consider that having players try the game at launch is easy [1], [2]; the main problem is to make players stay. This question belongs to the business intelligence domain of MMOs. In MMOs, the goal is not so much to have as many consumers buying the game as possible but to have them playing the game as long as possible. This is important for two reasons.

The first, and most straightforward, is pecuniary: the game publisher wants to maximize the return on investment. And investments in MMOs are quite significant. Developing an MMO costs hundreds of millions of dollars [3] and running it quickly adds up: the game servers, the team of system administrators, the customer support in call-centers, in-game, and on forums, the yearly expansions adding new content, and so forth. That is why only selling game copies at launch is not enough. Hence, since the mid 90’s, MMO publishers have opted for subscriptions to generate revenue not only at launch, but also throughout the game’s life cycle. In the 2000’s, the free-to-play model emerged, in which players could play the game for free, but were given the possibility to purchase virtual items with real money. Although these business models are

very different, they share one thing: they need the customers to stay.

The second reason is game design, a.k.a. fun. After all, the MM of MMO stands for massively multiplayer; if only a few players are connected, the game is not fun anymore. Certainly the player can play “solo” in the early and mid-game of an MMO [4], but the end-game content is nearly always designed for groups ranging from 5 to 200 players. Our previous work has found that unless the game design is adjusted, an MMO with a low population bores or frustrates its players [5]. Moreover, if business models now allow some players to buy overpowered items, crush other players, and buy their way up the game ladders without trouble, other players may not find the game fun anymore. Hence there is great interest for game designers to understand which mechanics keep players playing, and which make them buy extra game content. This understanding is even more important for game designers as executives seldom consult them about whether the game can remain fun when the business model is changed.

There has been limited research related to online game retention. For instance, Day has suggested that online games such as The Sims Online could “keep player retention high” if the developers could perpetually “implement new features and alter the game in response to customers’ playing habits” [6]. Kuo et al. compared two Taiwanese social games [7]. For a particular player, their simple and straightforward retention metric consists of how many interactions the player had had with other players.

Knowing why players leave is as important as knowing why they stay. When Feng et al. analyzed the EVE Online player population, they noted that when the game opened, 30% of the players left within a month, and 70% left within a year and a half [8]. Moreover, the retention rate for new players decreased over time: after two years, the rate of newcomers leaving within a month increased to 75%.

A first step for framing the study of retention in MMOs is to look at player satisfaction. However, all the articles dealing with player satisfaction are only focused on the real-time measurement and modeling of “fun” [9]. They do not take a business intelligence approach.

A more appropriate framework may come from the business literature, such as the one proposed by Hennig et al. [10]. In that framework, the relationship between customer satisfaction and retention is based on three factors: 1) the customer’s perception of quality (i.e., being able to compare the product to the competition and having customer standards), 2) trust,

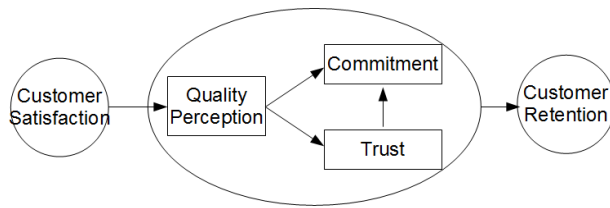


Fig. 1. A conceptual model of the satisfaction-retention relationship (adapted from [10])

and 3) commitment. This model is shown in Figure 1.

Perception of quality in an MMO has, to our knowledge, never been mentioned in the game studies literature. According to expert MMO game designers, however, World of Warcraft (WoW) is the MMO known for having set the MMO genre standards. It did so in polishing the features found in previous MMOs such as EverQuest [11], [12].

Trust in the context of online games has been mentioned by Gao et al., although their work focused more on websites than stand-alone game clients [13]. This is a domain that needs more work.

Commitment is the portion of retention we focus on in this paper. Previous works have studied the level of commitment of players toward their guild [4], [14] but not towards the game as a whole.

Both publishers and designers have an interest in player retention. And with the growing adoption of free-to-play business models including real-money transactions, they also have an interest in knowing which players buy, and why.

B. Real-Money Transactions

In 2009 and 2010, several major MMOs such as Lord of the Rings Online, Dungeons and Dragons Online, and Champions Online, switched from a “pay-to-play” business model with monthly subscriptions to “free-to-play.” In mid 2012, EA was also discussing switching its \$200-million Star Wars: The Old Republic MMO from a subscription model to a free-to-play model. Why have so many MMOs started with a subscription model to find out, a year or so after launch, that a free-to-play model is more appropriate? And what is free-to-play exactly?

In the early 2000s, the game industry realized that some players were ready to spend more in the game than the monthly subscription fee they were already paying, as can be seen in Fig 2. Since some customers were not spending the maximum amount they were ready to, companies were “losing revenue” [15]. This is how free-to-play and freemium business models appeared: players are given the possibility to spend as much money as they are ready to in the game.

Free-to-play MMOs generally offer an online shop where players can buy virtual goods for real money. The action of buying virtual items with real money is called Real-Money Transaction (RMT). In 2010, the RMT market in the US generated \$2.1 bn [16]. RMT brought \$230,000 per month to the MMO Puzzle Pirates. Although only 10% of its free-to-play players bought anything, the average revenue for each

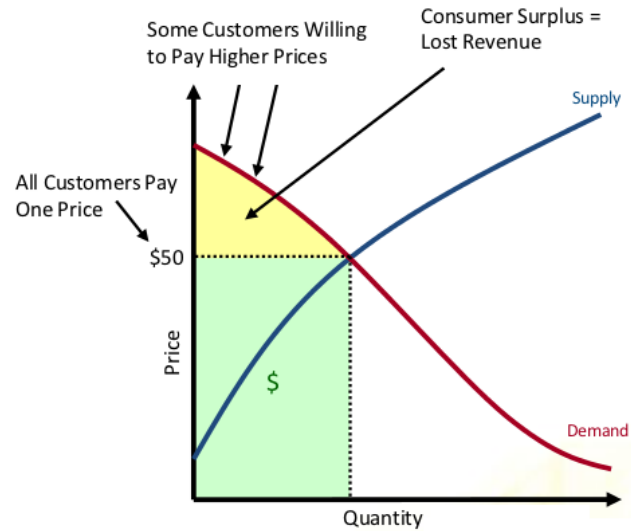


Fig. 2. The “lost revenue” of the subscription model. Adapted from [15].

of those paying users was \$50 per month [17], more than three times the monthly subscription fee for World of Warcraft.

As of 2012, four types of products can be bought through RMT: time, power-ups, cosmetics, or in-game currency.

Time is sold to players of social games such as Farmville in the form of items that accelerate the speed of the player’s crops. Players who use such items can keep playing instead of waiting hours, days, or sometimes even months, for their plants to grow.

Power-ups may give their buyers an advantage over players who did not buy them, but they also sometimes benefit the player without being detrimental to other players. In the MMO Ragnarok Online, for instance, both kinds of power-ups can be purchased.

Cosmetics such as avatar customizations are often the only RMT provided in competitive multiplayer games such as League of Legends: this type of RMT is the only one that preserves the game’s balance.

In-game currencies are used by players within the game to buy skills or equipment for their avatar. Players receive virtual currency when accomplishing quests, killing foes, or trading with other players. Therefore, players with richer characters have an advantage over players with poorer characters. For some players, virtual wealth is not only a means to play better, but also a game in itself: undercutting, client-furnisher relationships, and pushing competitors out of the market are economic strategies reported by players and designers alike [18], [19], [20].

In spite of their multiplayer gameplay, Farmville and League of Legends do not let their players exchange virtual items or currencies within the game to a great extent; there is no in-game economy. In MMOs, however, players can trade items with each other, and an in-game auction house is often in place for players to sell their surplus of equipment. From there, there is only one step for players to agree, in real life, to buy or sell

to each other virtual gold for real money.

Amassing large amounts of a virtual currency and selling it for real money is called gold farming. Gold farming generally violates the game's terms of use. Although estimates vary, more than 100,000 gold farmers worldwide are estimated to *work* in MMOs [21]. These hordes of gold farmers may alter the game's economy by making some resources scarce, thereby unbalancing the game as a whole. Some have even linked gold farming to account or identity thefts [22]. Previous work has shown that many WoW players from the US and Europe stereotype gold farmers as poor Chinese men working in 12-hour shifts in sweat-shops [23]. Although the Chinese government has taken actions against the illegal activities of gold farmers [24], some Chinese prisons have been reported to force their convicts to farm gold [25]. As their virtual currencies are gathering more and more attention, game companies would certainly like to keep the game economies under their control so that they can make profits out of them, or at least keep their game balanced.

Therefore, it comes to no surprise that more and more MMOs provide infrastructures where players can buy virtual items for real money from the game companies themselves. As an example, RMT used to be forbidden and actively combated in the futuristic space-MMO EVE Online. Instead of hunting down gold farmers and banning them from the game, as had been done since 2007 [26], the company behind EVE Online decided to handle the RMT demand themselves. In 2009 they started selling a virtual item paying for a month of a player's subscription [27]. Instead of buying from third-party gold farmers, EVE Online players who are looking for in-game money would buy that item directly from the game company and sell it in the game to other players, happy to spend virtual instead of real money to keep their subscription going [28]. Other examples of successful RMT business models are the big-budget fantasy role-playing MMOs Lord of the Rings Online and Dungeons and Dragons Online. Both switched from subscription-based to freemium business models with RMT shops under control of the companies.

In most free-to-play online games, players can legally buy virtual currencies from the game company itself. In most subscription-based MMOs such as WoW, players can not buy virtual gold from the game company. However, players can buy in-game gold from gold brokers on auction websites such as Ebay [18]. Gold farmers usually do not sell their gold first-hand – a middleman, associated with multiple gold farmers, is generally in charge of brokering gold to buyers through a website supporting Paypal and credit card payments. Some players also report buying gold from real-life acquaintances because they trust them more than online sellers [29].

But as more and more game companies are embracing RMT as a new source of revenue rather than a threat to game balance, it becomes more and more important to understand the player motivations for RMT. Wang and Mainwaring previously conducted ethnographic interviews of Chinese online game players in Summer 2007 to study their relationships to virtual currencies [29]. They found that while some players



Fig. 3. Screenshot taken in WoW.

view buying gold with real money as cheating, others do not even draw a boundary between real and virtual currencies: both are real and can be used to buy play time or virtual goods. Yee's Daedalus project reports the proportion of MMO players buying gold for real money from a 2005 online survey [30]. Our study aims at shedding more light on the disregarded phenomenon of buying virtual gold when it is forbidden by the game's terms of use, as is the case in WoW.

II. WORLD OF WARCRAFT

World of Warcraft (WoW) is a fantasy role-playing MMO developed by the game company Blizzard Entertainment. WoW is interesting to study from the retention and RMT perspectives for the following reasons.

WoW is big. As of June 2012, WoW is the Western MMO with the largest active subscriber base: 9.1 million worldwide[31]. WoW is active in Asia, with 4 million Chinese players [32], Europe, North and South America, and Oceania. As of 2012, some 350 game servers are available for China, 250 for North America, 100 for European English speakers, 80 in German, 35 in French, 20 in Russian, a dozen in Spanish, a dozen for Oceania, half a dozen for Brazil, and 3 for Latin America¹. WoW is a game played worldwide.

WoW's design is typical. In WoW, like in most fantasy-based MMOs, players can wander in a large virtual fantasy world, kill mythical monsters, complete quests, socialize with other players in guilds, or fight against each other in arenas or battlegrounds. Completing quests, killing monsters, and selling items in the game are the only activities rewarding the player with gold coins (simply called gold in the rest of this paper). Since most of the MMOs are based in fantasy worlds, WoW provides a typical MMO setting. We give a screenshot of the game in Fig 3.

WoW is old. WoW has been out since 2004. A brand new MMO may want to attract as many players as possible, and retain them for a few months, or maybe a year. In WoW, the player base has kept increasing since its launch until 2011, when it has started to decrease. As of 2012, WoW has been

¹Judging from <http://us.battle.net/wow/en/status> and its European and Chinese equivalents.

losing subscribers at a faster pace: between the first and second quarters of 2012, the number of subscribers went from 10.3M in March [33] to 9.1M in June [31]. Players of an old MMO have had opportunities to leave the game, come back, and leave again as expansions were added to the game. Studying an older MMO also allows for longitudinal studies.

WoW is subscription-based. As of 2012, WoW is one of the few large and popular MMOs to successfully remain with a traditional subscription-based model. Players can pay for their subscription manually every month, per semester, or yearly. Players may choose to be billed automatically every month, and they can stop the automatic billing at any time. It is financially interesting for Blizzard to keep players' subscriptions going while they're not playing anymore, but players may prefer a lively and populated virtual world. For instance, some players on under-populated WoW servers have complained that they could not find enough of the rare materials required for crafting. Those materials are generally traded between players in the auction house, and a lack of players means a shortage of supply.

WoW players have a strong demand for RMT. Even though gold farming violates the game's terms of use [34], there is a surprisingly high player demand for RMT. According to Dibbell, when Blizzard banned 50,000 gold farmer accounts in 2006, the cost for 100 in-game gold coins went from \$6 to \$35! [21] Moreover, Blizzard has been experimenting with RMT by selling virtual pets for \$10 and mounts for \$25 in its store².

III. SAMPLE AND QUESTIONNAIRE

In this section, we describe our player sample as well as the questions asked in the online survey we conducted.

A. Player Sample

An online survey was organized by the last two authors. The first two authors discussed with them the addition of several questions such as taking a break from the game, cancelling one's subscription, and the type of guild players belong to (eg guild of real-life friends, military personel, or based on religious beliefs). Links to this survey were sent to mailing lists from the last two author's previous studies (the Daedalus project [35] among others), broadcasted on social media like Facebook and Twitter, and posted on gaming websites (such as wow.com or wow insider) and forums from Taiwan, Hong-Kong, and the US between March and May 2010. A total of 2865 respondents took the survey. The last two authors composed the survey in English and had it translated in Traditional Chinese for the Hong-Kong and Taiwan respondents. Although their spoken dialects differ, both Hong-Kongers and Taiwanese can read and write Traditional Chinese since they learn it at school. Mainland China was not targeted by our study for logistical and administrative reasons. Europe is part of the next phase of the study, therefore Europeans were not sent this questionnaire. The first author conducted the entirety of the statistical analysis with advice from the other authors.

Although the survey was only targeted at those two populations, respondents from 48 countries speaking a total of 47 languages have taken the survey. Therefore we classify respondents who took the Chinese survey as "Asians", since they comprise a diverse population from East Asia. Similarly, we call respondents of the English survey "Westerners". Our sample contains 76% Westerners and 24% Asians.

Around 31% of respondents are women, a rate higher than typically found in earlier MMO studies (24% in 2010 [36], 20% in 2009 [37], 14% in 2006 [38]). We do not think our data are biased in this regard since close to 50% of all gamers are female [39] and the studies mentioned above show a consistently proportion of women increasing over time.

The average respondent is 28 years old ($\sigma = 8.8$), a value also echoed by previous studies [37], [38]. Respondents play on average 23 hours per week ($\sigma = 15$), a number that seems consistent across MMOs [37]. Based on our experience of the game, most players tend to spend noticeably less time in the game two to six months before expansions are released. They also tend to spend considerably more time in the game right after expansions are released. Thankfully, our survey was conducted 17 months after the third and 8 months before the fourth WoW expansions.

For more details about the demographics of the data, see [40].

B. Questionnaire

We collected three types of data:

- **general demographic data** such as age, gender, country of residence, marital and job statuses, languages spoken, years of education, and a standard big 5 psychological traits question list
- **WoW-specific data** such as the weekly play time, whether the player's main character is in a guild, the number of years playing WoW, having taken a break from the game, and having cancelled one's subscription
- **patterns of play** including MMO play motivations, playing with real-life acquaintances, having ever made a real-life friend or partner from the game, the number of years playing MMOs, having ever played on a private server, and defining oneself as casual or hardcore.

To measure the MMO play motivations of respondents, we asked them to rate the importance of 15 game elements on a 5-point Likert scale. These standard elements come from Yee's MMO player motivation model [38]: five deal with achievement (e.g. "Becoming powerful"), five with socializing (e.g. "Chatting with other players") and five with immersion/escapism (e.g. "Feeling immersed in the world"). For each of the 3 motivation factors, the motivation score is the average of the scores of the 5 items dealing with this factor.

C. Sampling and questionnaire limitations

Sample biases: Links to our survey were posted on websites related to WoW, usually frequented by more dedicated players. Our average respondent may therefore report a weekly play time and play motivations slightly greater than the average

²See <http://us.blizzard.com/store/>

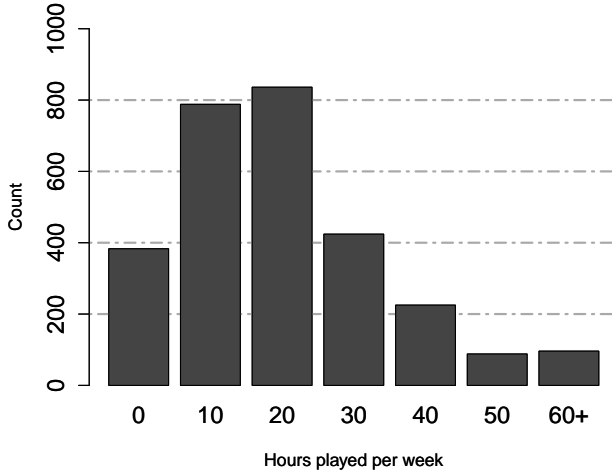


Fig. 4. Histogram of the weekly play time.

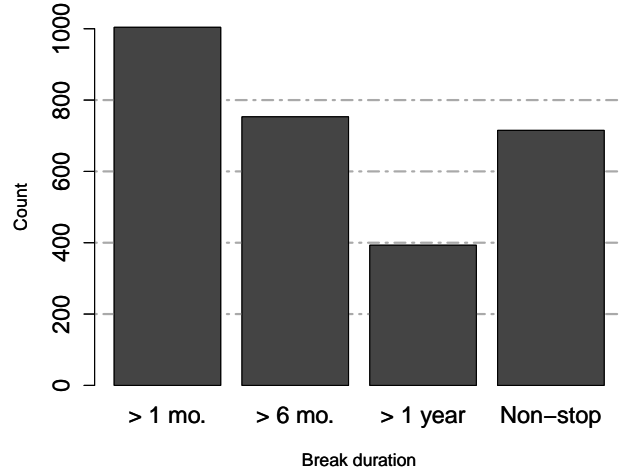


Fig. 5. Distribution of the break durations.

WoW player. Given that achievement is correlated to buying gold, the ratio of gold buyers among the 10 million WoW players worldwide may actually be lower than the one reported in this work.

Moreover, our Westerner sample does not contain enough Europeans to be considered representative of all Westerners. Only 33 respondents were retired, and only 7 Asian women report buying gold. For more significant and precise results on particular demographic categories, we need to use more targeted and qualitative methods such as interviews.

Self-reporting: Unlike non-obtrusive methods such as in-game logging of player data [41], our data is reported from players themselves and exaggerations or underestimations are not unlikely. Given that gold buying is a relatively shameful activity to report, we think that some respondents may have omitted this detail when answering the questionnaire.

IV. METRICS

A. Retention metrics

To measure retention, we introduce three metrics. Each of these metrics describes a particular dimension of player retention. We believe our metrics are a first step towards a more comprehensive model of player retention in MMOs.

The **weekly play time**, also called hours played per week (H/w), is a short-term and punctual measurement of a player's involvement in the game. As mentioned before, the average player spends 23 hours per week in the game. The distribution of the weekly play time is skewed to the right, with several players reporting playing more than 100 hours per week (see Fig 4). Previous work on EverQuest and Dark Age of Camelot players recorded similar distributions [14].

The **stop rate** is the ratio of respondents who have discontinued playing WoW and then returned to the game. Players are said to have stopped if they stopped playing for an interval of time and then came back, or if they cancelled their subscription and then reactivated it. Cable television and phone companies define "churn" as the monthly ratio of customers who stop

using their product. In our study, the stop rate can be taken to suggest a long-term player churn.

The stop rate can also be useful to compare those players interested in the game, but able to only dedicate a few hours to play during the weekend, to the more dedicated players ready to spend their days in the game for only a couple weeks straight.

We also compare the duration of the break between categories. We could have asked our respondents to give a precise duration for their breaks, or how many breaks they've taken altogether. However, people are not good at recalling precise facts dating from several years. We instead asked whether people had ever taken a break of 1 month and/or 6 months and/or a year and/or frozen their subscription.

The overall stop rate for our sample was 77%. In other words, only 23% of respondents never stopped playing. Fig 5 shows the distribution of the break durations in our sample.

The **number of years playing WoW** refers to how long respondents had been playing WoW as of Spring 2010 when the survey was conducted. At that time, WoW had been up and running for six years.

This metric is an attempt at measuring acquisition, churn, and come-backs. It measures the experience of players with the game, and allows for definitions of player generations. For instance, we can see which expansion attracted which types of players. This metric is also useful along the stop rate to triangulate findings or spot inconsistencies. For instance, players who have taken a break of 1 year, but have been playing for 10 months, may not have understood the question.

96% of our respondents have been playing WoW for more than a year, and 70% for more than three years. These numbers are consistent with recent findings of 94% and 65%, respectively [36]. Fig 6 describes when the respondents started playing WoW and MMOs. Fig 6 also shows a spike in terms of MMO newcomers in 2005, shortly after WoW came out. This spike of new players may suggest that WoW has been the first MMO for many new players in 2004 and after. Designers

from WoW and other MMOs have previously suggested that WoW has opened the MMO genre to the masses [11], [12].

B. Limitations to the retention metrics

Approximations of stop rate and duration. We mentioned earlier that we asked our respondents to pick a bin among 1 month, 6 months, and a year, for the duration of their break(s). Knowing exactly and unobtrusively the length of breaks may provide additional insights about retention. Moreover, knowing why, when, or how often people stop playing is hard, and knowing why people come back to the game might be even harder. Expansion releases can be a first phenomenon to look at; people may not play so much before expansions, as they might have explored most content or finished most dungeons. However, they return to the game after expansions have been released [42]. Our survey was conducted in Spring 2010, eight months before the release of Cataclysm, WoW's fourth expansion. Another survey conducted in March 2011 could be useful for determining whether players actually stop playing before expansion releases, and if they come back to the game after expansion releases.

Churn is an important retention metric in all online games. However, our metrics do not exactly measure churn. To be able to accurately measure churn, one would have to look at a longitudinal measure of the weekly play time, in which case churners could be those players spending less and less hours per week in the game. Churn could also be defined as the number and duration of breaks taken. Sadly, we could not ask for this in a questionnaire: people are not good at remembering how many times they did X or when they last did Y in the last 5 years.

Generalizability of our three metrics to other MMOs would require further studies. Some metrics such as the weekly play time should be taken carefully when measuring player retention. In the case of children playing an MMO such as Club Penguin, for example, parents may have more control over the player's accounts than the player herself. In this case, the weekly play time is not so much a measure of the player's will to play but rather how long the parents allow her to play. Moreover, some metrics may be more useful than others throughout an MMO's lifecycle. For instance, counting the number of years playing an MMO that just came out does not make sense.

C. RMT metric and its limitations

To be able to compare players who buy gold to those who do not, we asked the question "Have you ever bought WoW gold using real money?".

Slightly more than 14% of respondents report having ever bought gold (0.5% chose to not answer that question). In his 2005 online questionnaire, Yee found that 22% of MMO players report having ever bought gold [30]. Two reasons may explain this difference in rate. First, Yee's study was conducted on MMO players at large, not on WoW players specifically. WoW players might be less likely to buy gold than the average MMO player. Second and most likely, the average

MMO player may have changed since 2005: in 7 years, the number of MMO subscriptions has more than tripled [43].

Compared to the 14% of WoW players who ever bought gold, only 10% of the Puzzle Pirates MMO players bought virtual items in 2009 [44]. Social games report between 1 to 20% of their players engaging in RMT [45], [46]. The ratio of WoW players willing to buy virtual items seems typical.

Obliviousness of illegality: It is unlikely that our respondents do not know that buying gold is illegal – it is explicitly written in the terms of service, but most importantly, a lot of game-related resources such as forums, blogs, or the online gaming press mention it.

Breadth and depth: In our questionnaire, we only asked whether respondents had ever bought gold or not. Our next study of gold buyers will include questions about the quantity of gold bought. How frequently and when, as well as the motivations behind buying gold should also be investigated. Some players may buy their gold from a friend, while others may just turn to eBay or middle-man organizations who also provide power-levelevling services. Players' emotional responses to and attitudes about RMT should also be the subject of future qualitative work.

D. Data analysis and its limitations

Correlation versus causality: The comparisons, correlations, and regressions used in this study establish relations between variables, not causality. For instance, we found that achievement-oriented players are more likely to buy virtual gold with real money. It can be that being competitive causes buying gold, but it could also be that when players buy gold, they start being more competitive. It could also be that men (a third factor) are more achievement-oriented in general, and are also more likely to buy gold.

The only way to indicate causality in quantitative studies consists of comparing two groups similar in all points except one: the variable of interest.

V. RETENTION FINDINGS

This section is based on our previous work in [5]. Results described as significant have a p value lower than 0.01, unless otherwise specified.

A. Overall statistics

As shown in Fig 5, 35% of respondents stopped playing for at least a month, 26% for at least six months and 14% for at least a year. A one-sided t-test showed that the 25% who never stopped playing started playing WoW more recently (2.9 versus 3.7 years).

We observed overall cultural differences between Asian and Western players. Asians play four more hours per week on average, yet they are more likely to stop. Asian and Western players started playing WoW around the same time³. Table I compares Asian and Western players in terms of retention metrics. Looking at gender, another one-sided t-test indicates

³Although WoW launched in the US three months before Europe, six months before China and a year before Hong-Kong and Taiwan.

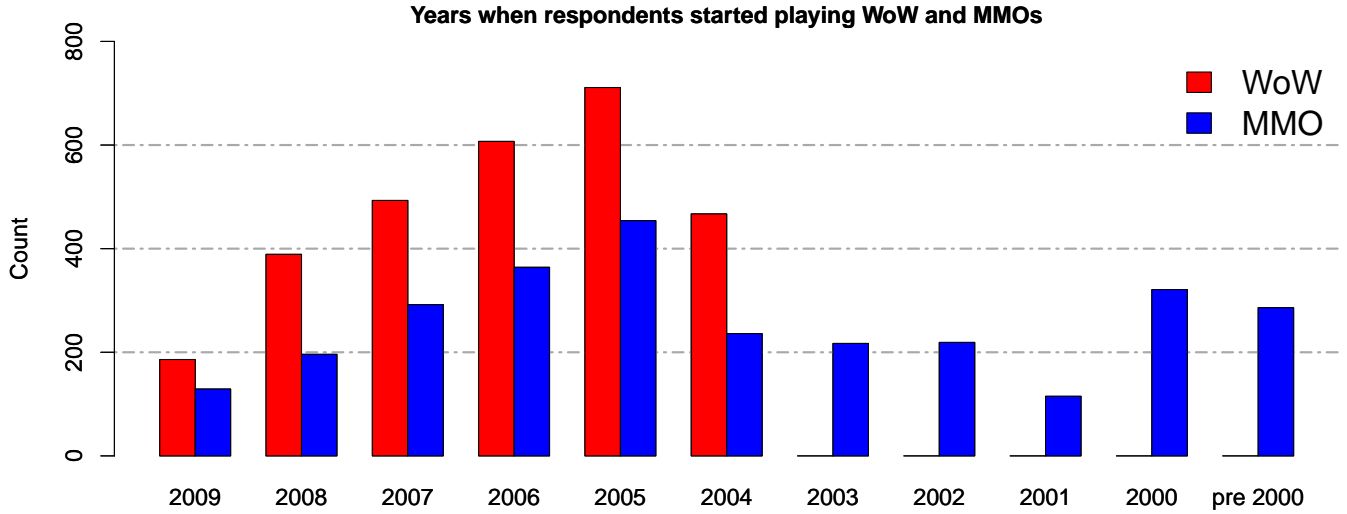


Fig. 6. Distribution of the years when respondents started playing WoW and MMOs. WoW was released in late 2004 in North America, early 2005 in Europe, mid 2005 in China.

	N	H/w	Stop rate	WoW years
Western players	2183	22	75%	3.6
Asian players	673	26	85%	3.4
Women	875	23	68%	3.4
Men	1981	23	81%	3.6

TABLE I
RETENTION METRICS ACROSS REGIONS AND GENDER.

	N	H/w	Stop rate	WoW years
Casual	819	17	83%	3.4
In-between	1792	24	76%	3.6
Hardcore	243	32	67%	3.7

TABLE II
RETENTION METRICS ACROSS SELF-ASSUMED “CASUAL”, “IN-BETWEEN”, AND “HARDCORE” PLAYERS.

women are not playing significantly more per week than males, yet they are less likely to stop. Men tend to be earlier adopters than women.

WoW players can subscribe for one, three, six, or twelve months at a time. When the subscription runs out, the account is said to be inactive; it becomes inaccessible until the player pays for more. Because it is easy to forget about renewing the subscription, players can choose a recurring subscription. When they want to stop, they can cancel their subscription.

As seen in Fig 5, stopping playing for six months or a year is common: 40% of respondents have stopped for six months or a year and then returned to the game. Among those 40%, 57% (i.e. 23% of the entire sample) never cancelled their recurring subscription. In other words, 23% of players were paying but not playing for six months or even a year! Players may know that their accounts stay in Blizzard’s databases “indefinitely”, even if they do not pay [47]. Hence it is very surprising that a quarter of respondents kept their subscription active.

B. Player motivations

People play games for different reasons. A first distinction can be made between so-called “casual” and “hardcore” players: arguably, casual players may want an easier game, while hardcore players look for more and more efficient strategies to beat the game [48], [49].

In our survey, we ask players how “hardcore” they consider themselves. 29% consider themselves “casual”, 8% “hard-

core”, and 63% “in-between”. As shown in Table II), hardcore players are less likely to stop than in-between players, who are themselves less likely to stop than casual players ($\chi^2(2, 2854) = 6.73$). Moreover, players who label themselves as hardcore tend to spend more time in the game per week ($r(2828) = .19$).

The simple and subjective distinction between casual and hardcore may be interesting in the eyes of the players, or as a shortcut for player personas. However, Bateman et al. [50] remark that the hardcore/casual distinction is a type approach to player motivation, but a trait theory such as Yee’s motivation model [51] is a better fit because it does not simply place players in black or white boxes. Rather, Yee’s model considers the extent to which players are motivated by achievement, sociality and immersion. This model relies on several years of aggregated data measuring player motivations in online games. Players have to rate from 1 (low) to 5 (high) the importance of 15 game elements including “leveling up” (associated with achievement in Yee’s model), “being part of a guild” (sociality), and “learning about the lore” (immersion). The score for each motivational factor is the average of the player ratings for all the game elements related to this particular factor.

We categorize respondents based on their three motivation scores and average the weekly play time for each category. Figure 7 illustrates the relationship between these three moti-

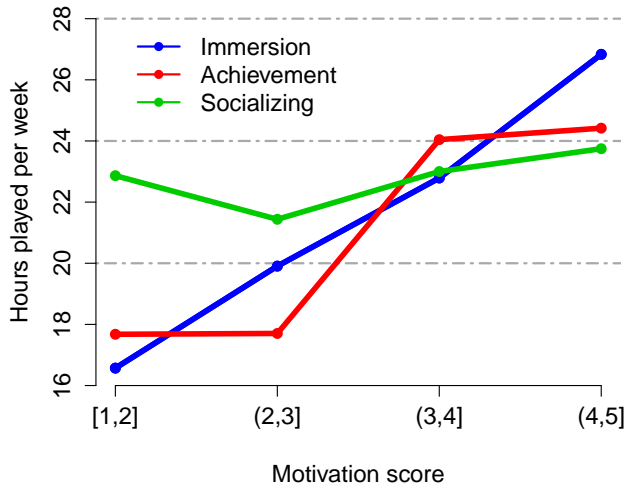


Fig. 7. Average weekly play time against the three binned aggregated motivation scores.

	Achievement	Socializing	Immersion
Men	3.6	3.7	3.3
Women	3.2	3.6	3.5
Westerners	3.5	3.7	3.3
Asians	3.7	3.5	4.0

TABLE III
MOTIVATION SCORES ACROSS GENDER AND REGIONS.

vation factors and the weekly play time. To make the graph more readable, we bin aggregated motivation scores into four categories ([1,2] for a score from 1 to 2, [2,3] for 2 to 3, and so on).

The red line, for instance, stands for achievement. Players with an achievement score below 3 belong to the first two bins, and report playing less than 18 hours per week on average. However, players highly-motivated by achievement, in the (3,4] and (4,5] buckets, report playing more than 24 hours per week. Indeed: achievement and weekly play time are moderately correlated ($r(2863) = .20$).

Achievement motivation differs by gender and region, as can be seen in Table III. Men have a significantly higher motivation score for achievement than women. Williams et al. reached the same conclusion in their study of gender in online games[37]. However, men also have a slightly higher social motivation score than women, a finding contradicting the earlier observations made by Williams et al.

In terms of regional differences, Asian players tend to be more dedicated than Western players in terms of weekly play time. The average achievement motivation score weakly yet significantly confirm this trend. Interestingly, Asian players score much higher on immersion than Western players. Further work is needed to explain in more detail which motivation factors work best for various demographic categories.

C. Guilds

The social motivation factor has a positive influence on the weekly play time and the number of years playing WoW.

	N	H/w	Stop rate	WoW years
Not in a guild	277	19	88%	3.4
Guild member	1569	22	79%	3.5
Officer or GM	1006	24	71%	3.7

TABLE IV
RETENTION ACROSS GUILD POSITIONS.

As shown in Fig 7, players motivated by socializing play longer per week. We also found that players in the upper buckets of the socializing factor were earlier adopters, but also more likely to take breaks and come back. Further research is needed to explain this finding, but socially-motivated players may be more likely to switch to other MMOs when their in-game friends switch to them. Other motivation factors such as achievement or immersion do not seem to influence the stop rate or the number of years playing WoW as much as the social motivation factor does.

In WoW, the guild is the primary in-game player structure to socialize [23], [41]. Moreover, most end-game achievements require a cohesive group of players, and guilds are the only player structure to provide such a group. Hence guilds are of particular interest for player commitment and retention. In the rest of this section, we analyze how guild characteristics influence our three commitment metrics.

Previous studies show that players in guilds spend more time per week in the game [4], [52]. In our sample, we go beyond a simple in-guild/not-in-guild dichotomy and take into account the guild position of our respondents' main character. Only 10% of respondents do not belong to a guild. 55% are basic guild members and 35% are guild officers or guild masters (GM). A one-way ANOVA using guild position as the independent variable and weekly play time as the dependent variable indicates that a higher guild rank leads to spending more time per week in the game ($F(2, 2826) = 12.90$). Another ANOVA shows that players with more guild responsibilities have been playing WoW for slightly longer than basic guild members, who themselves have been playing for slightly longer than players whose main character is not in a guild ($F(2, 2840) = 10.88$). Table IV summarizes those findings.

While 71% of guild masters and officers have taken a break, 79% of basic guild members and 88% of players whose main character is not in a guild have. The stop rate decreases significantly as players' guild rank increases ($c^2(2, 2852) = 9.27$). This result is of primary importance as guilds are group structures that can be used by players for very different reasons: achievement as well as socializing.

D. Real-life connections

Players often play WoW with people they know "in real-life" (IRL, or RL), that is, outside the game. These people can be their significant other, friends, or family members. 75% of respondents play with someone they know IRL. Considering our sample as a whole, playing with someone known IRL does not increase or decrease the time spent in the game per week, the stop rate, or the number of years having played WoW.

Distinguishing by gender, we found that compared to men, women play with people they know IRL more: 81% of women against 72% of men. Looking at regions, Asian respondents play significantly longer (5 hours per week) if they are playing with someone they know IRL.

Around 54% of respondents have met someone who became a real-life friend while playing WoW. These 54% play significantly more per week than those who never made RL friends (see Table V). They also are earlier WoW adopters. These findings are not surprising, as meeting other players and making friends takes time. Surprisingly, having taken a break is not significantly correlated with having made real-life friends from the game. Further research is needed to explain this phenomenon.

Women and Asians report having made RL friends from the game significantly more often than men or Westerners. Surprisingly, men show a higher social motivation score than women: 3.74 for men for 3.59 for women. Similarly, Westerners are more socially eager than Asians: their motivation score for socializing is a quarter of a point higher. While these findings seem to reveal region-specific self-reporting biases, further research is needed to confirm or reject them.

Approximately 13% of respondents report having met someone who became a boyfriend/girlfriend and/or a spouse while playing WoW. Those respondents play longer per week, and are also earlier adopters. Surprisingly and similarly to those respondents who made RL friends from the game, RL partners met in the game do not seem to decrease the stop rate. Women are twice more likely to meet a RL partner in the game than men (20% of women versus 10% of men). Asians report having met a RL partner in the game more often than Westerners: 18% of Asians versus 12% of Westerners.

Although some players manage to have met someone who became a real-life partner, some actually play with their real-life partner. We denote as “partnered” the respondents who report being engaged or married. Around 29% of respondents are partnered and play with their partner, while 20% are partnered but do not play with their partner. An ANOVA using the weekly play time as dependent variable shows that players who play with their partner play slightly less per week than single players, but four more hours than players not playing with their partner ($F(2, 2831) = 29.00$). They are also less likely to take a break ($c^2(2, 2848) = 6.94$). These findings reveal an interesting player segment to investigate in more details: players in a relationship.

E. Age, employment status and children

Players of different age and employment status report noticeably different commitment metrics.

Age: In our sample, 166 respondents are over 45, and among them, only 7 are Asians, so we only focus our analysis on the American players older than 45. Those players represent 8% of the overall American respondents. Although 8% is a small proportion, the senior player category is of particular interest in game studies, as in 2010, 26% of Americans over 50 years old play video games [39] and senior gamers – women in

	N	H/w	Stop rate	WoW years
Made RL friends IG	1530	24	78%	3.9
Did not make RL friends	1319	21	76%	3.2
Met RL partner IG	378	28	84%	4.0
Did not met RL partner	2485	22	76%	3.5
Single/divorced	1441	24	81%	3.7
Play with partner	826	23	71%	3.6
Play without partner	581	19	75%	3.8
No children	1800	23	100%	3.5
Play with children	127	21	56%	3.7
Play without children	435	19	74%	3.9

TABLE V
RETENTION METRICS WITH RESPECT TO HAVING MADE RL FRIENDS FROM THE GAME (FIRST ROW), HAVING MET IG SOMEONE WHO BECAME A RL ROMANTIC PARTNER/SPOUSE (SECOND ROW), PLAYING WITH ONE’S RL PARTNER (THIRD ROW), AND PLAYING WITH ONE’S CHILDREN (LAST ROW).

particular – are motivated to play online games in part because of their social aspect [53], [52]. Casual PC games have also been reported to be of interest to older audiences [6]. Hence we think the ratio of senior gamers in MMOs is likely to increase as the average MMO player slowly ages and MMOs integrate more and more social components.

In terms of weekly play time or for how long they have been playing WoW, there was no significant difference between senior and non-senior American players. However senior players are much less likely to take a break than non-senior players: 53% for seniors against 76% for non-seniors. Fig 8 indicates that there are more American senior players (159 in the blue box) than players below age 45 playing more than 40 hours per week (125 in the green box). In other words, while game companies often focus on dedicated players who play many hours and express their opinion loudly in game forums, an equally important demographic may be senior players. In our sample they occur in roughly equal numbers, and in addition, seniors play more consistently, with a lower stop rate. Consistent play may have important side effects such as continuing to recruit friends and family to play a game or to spend money in RMT. Further research is needed to study the senior demographic.

Job Status: The job status of respondents ranges from full-or part-time, student, unemployed, home-maker or retired. We group the full-time, part-time and student categories together into an “employed” category (88% of respondents). Home-makers, unemployed and retired respondents fall in the “at-home” category (12% of respondents). We hypothesize that if a player stays at home all day, he or she is more tempted to play and will actually spend more time playing. And indeed, “at-home” respondents play 29 hours per week, while “employed” respondents 22. The other two metrics are similar across the two categories.

Children: We asked respondents if they play with their children. Around 76% of respondents have no children, 5% have some and play with him, and the remaining 19% have children but do not play with them. An ANOVA with the weekly play time as dependent variable shows parents playing with their

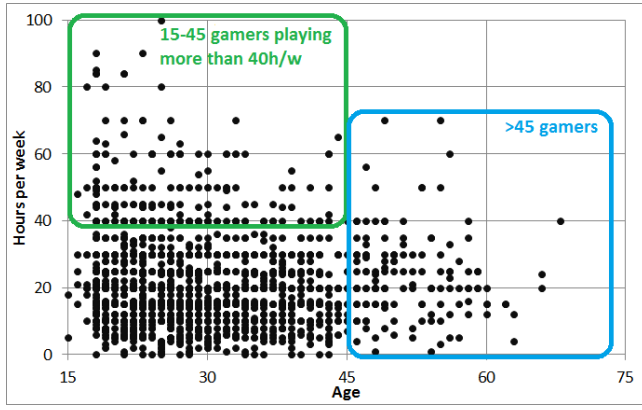


Fig. 8. Weekly play time against age for American players. There are more respondents over 45 than respondents below 45 playing more than 40 hours per week.

children play significantly longer per week than parents who do not play with their children. Similar to the partnered case, it is ultimately players without children who play the most ($F(2, 2047) = 14.07$). The stop rate is significantly lower (56%) for respondents playing with their children compared to other categories ($\chi^2(2, 2242) = 5.19$). Unsurprisingly, respondents playing with their children are significantly older than other categories ($F(2, 2049) = 360.07$). This echoes previous work from Nardi et al. who show that some parents use WoW as a way to spend time with their children [54].

VI. RMT FINDINGS

In our exploration, we look at the significant ($p < .001$) correlations between major demographic, MMO play-specific, and WoW-specific variables. Absolute values closer to 1 indicate stronger correlations, while absolute values closer to 0 indicate weaker correlation. We only keep correlations of small ($r > .10$), medium ($r > .30$), and large ($r > .50$) size effects [55]. For instance, WoW experience and socializing are very strongly correlated ($r = .57$). Negative values indicate negative correlations. For instance, younger players spend more time in the game per week than older players: Pearson's correlation coefficient is $r = -.10$.

In this section, based on previous work in [56], we center our analysis on buying gold. We first take a look at general demographic data put in relation with gold buying, and then investigate several gold buying trends suggested by figure 11. We finish by employing a multivariate logistic regression model.

A. Demographics

Overall, men report having bought gold twice more often than women ($\chi^2(1, 2841) = 31.11, p < .001$), as seen in the last column of table VI above. Looking at regional differences, Asians are as likely to buy gold as Westerners ($\chi^2(1, 2850) = .13, p = .93$). Although Western women seem twice more likely to buy gold than Asian women, the small number of Asian women buying gold (only 7 in the sample) does not provide significant results ($\chi^2(1, 872) = 2.12, p = .31$).

	N	Age	H/w	Gold buyers
Western women	739	32	23	9%
Western men	1444	29	21	17%
Asian women	136	25	26	5%
Asian men	537	23	26	16%
All	2865	28	23	14%

TABLE VI
AGE, WEEKLY PLAY TIME, AND RATIO OF PLAYERS WHO BOUGHT GOLD
ACROSS GENDERS AND REGIONS

	N	Age	H/w	Gold buyers
Home-maker	91	34	26	7%
Student	733	22	23	12%
Part-time employee	406	27	25	12%
Unemployed	226	27	30	13%
Full-time employee	1360	32	20	17%
Retired	22	53	35	32%
Now in school/college	625	21	24	11%
College graduate/dropout	1865	32	22	15%
High school grad/dropout	350	24	28	21%

TABLE VII
AGE, HOURS PLAYED PER WEEK, AND RATIO OF PLAYERS WHO BOUGHT
GOLD ACROSS JOB CATEGORIES (TOP) AND EDUCATION LEVEL (BOTTOM)

Looking at job categories, around 48% of respondents are full-time employees, while 14% work part-time, 26% are students, 3% home-makers, 8% unemployed and less than 1% retired. These numbers show the wide appeal of the game across various social categories. The upper part of table VII provides a breakdown of age, weekly play time and ratio of gold buyers for different job categories. Around 17% of full-time employees buy gold, whereas at most 12% of part-time employees, students, home-makers and unemployed respondents do ($\chi^2(5, 2499) = 18.12, p < .001$). Table VII also suggests that respondents with more disposable income, such as full-time employees or retired respondents, are more likely to buy virtual gold.

A one-way ANOVA using the weekly play time as the dependent variable and the job category as the independent variable shows that full-time employees are generally older than full-time students ($F(5, 2835) = 258.93, p < .001$). Moreover, full-time employees can not dedicate as many hours to play as other categories: they play 20 hours per week on average, 3 hours fewer than full-time students, and 10 hours fewer than unemployed respondents ($F(5, 2823) = 22.83, p < .001$). A small negative correlation between age and weekly play time supports this trend ($r(2850) = -.10, p < .001$). Interestingly, 69% of Western respondents in our sample work part- or full-time, while only 41% of Asians do ($\chi^2(5, 2853) = 57.78, p < .001$).

Only 33 of our respondents are retired, and 32% of them have bought gold. When compared to the other categories in the top of table VII, such a small sample size with such a high rate may indicate either outliers or the presence of a very particular phenomenon. We note that retired respondents are 53 years old on average and are more likely than other categories to play with their children ($\chi^2(5, 2853) = 105.66$,

$p < .001$). Our data do not let us determine why they buy gold, but several hypotheses come to mind. First, retired respondents may have more disposable income than students or unemployed respondents, so they could be more likely to spend it in RMT. They might also buy gold not for themselves, but rather for the children whom they play with. More research with a larger number of retired respondents is needed to verify our high ratio of retired gold buyers, and whether they buy gold for their children or for themselves.

Looking at differences across education levels in the bottom part of table VII, 11% of respondents still in high school or college buy gold, a number consistent with the student row of the top part of table VII. However, 15% of respondents who went to college and 21% of respondents who left school with no more than a high-school degree buy gold ($c^2(2, 2840) = 15.9, p < .001$).

The category of respondents with no more than a high-school degree has a skewed gender ratio: the ratio of men is 10 points higher than for the rest of the dataset. If we can explain why men are more likely to buy gold, then we may also be able to explain why this category is more likely to buy gold than students, college dropouts, or college graduates.

Summary: Men buy more than women, and Westerners buy as much as Asians. Full-time employees buy gold possibly because they do not have enough time to play per week. Retired respondents may buy gold for their children or grandchildren.

B. Play motivations

Immersion: Buying gold is very weakly inversely correlated with immersion ($r = -.08, p < .001$). Looking at differences across gender, men and women are equally motivated by immersion, with motivation scores of 3.4 and 3.5 respectively ($t(874) = 2.55, p = .005$). However, the ratio of women buying gold decreases sharply with the immersion motivation score, from 18% for scores below 2 ($N = 34$), to 6% for scores above 4 ($N = 319$). As seen in figure 9, the ratio of men buying gold only dwindles from 19 to 14% for those same categories ($N = 135$ and $N = 643$ respectively). The 643 men with immersion scores above 4 are twice more likely to let RMT enter their magic circle than their 319 women equivalent ($c^2(1, 962) = 11.5, p < .002$).

Achievement: Buying gold is weakly correlated with achievement ($r = .10, p < .001$). Men are more motivated by achievement than women: their average score is 3.6 against 3.2 for women ($t(874) = 13.6, p < .001$). Looking at the respondents with an achievement score above 4, 21% of men buy gold ($N = 743$), while only 10% of women do ($N = 165$) ($c^2(1, 908) = 8.10, p < .007$). Note that among respondents with achievement scores below 2 ($N = 90$), only one man and one woman report buying gold. An ANOVA using the achievement motivation as dependent variable and the job category as independent variable shows that full-time employees are less motivated by achievement than students, unemployed, or part-time employees (score of 3.4 versus 3.7, 3.6, and 3.5 respectively). Full-time employees

	N	Age	H/w	Gold buyers
RL only	888	28	21	12%
Neither RL nor IG	404	29	21	14%
Both RL and IG	1251	28	24	15%
IG only	312	28	23	21%

TABLE VIII
AGE, HOURS PLAYED PER WEEK, AND RATIO OF PLAYERS WHO BUY GOLD VERSUS PLAYING WITH REAL-LIFE (RL) RELATIVES AND HAVING MADE REAL-LIFE FRIENDS OR PARTNERS IN-GAME (IG).

are nevertheless more motivated by achievement than retired individuals or home-makers (scores of 3.1 and 3.2 respectively, $F(5, 2842) = 14.14, p < .001$).

Socializing: Buying gold is nearly not correlated with socializing ($r = .05, p < .001$). Our experience in the game as well as previous works suggest that the most important group of players for socializing in WoW is the guild [41], [53]. Whether respondents are guild members, guild officers or masters, or simply not in a guild, there is no significant difference in terms of buying gold ($c^2(2, 2839) = 2.69, p = .21$). Therefore we need to look at other social factors, such as the nature of the social ties that respondents have with their fellow players.

Previous work on our dataset showed that around 75% of respondents play with someone they know in real-life such as a relative, a friend, or a coworker (ie real-life ties). Moreover, 55% of respondents have met, in the game, players whom they now consider real-life friends or partners (ie in-game ties) [40]. Here, we find that the ratio of gold buyers varies with the nature of the social ties. As seen in table VIII, only 12% of players whose ties are only real (“RL only”) buy gold, while it is the case for 21% of players whose ties exist only in the game (“IG only”). In-between, players with both real and virtual ties are nearly as likely to buy gold as players without ties at all ($c^2(3, 2842) = 14.16, p < .001$).

Summary: For both men and women, the ratio of gold buyers increases with achievement but decreases with immersion. Immersion exerts more influence on women’s gold buying, while achievement plays more influence on men’s gold buying. Respondents who play only with friends made in the game are more likely to buy gold than those who play only with people they already know in real-life.

C. Retention

As detailed in [56], our dataset contains three metrics relevant for MMO retention: the weekly play time, the number of years respondents have been playing WoW for, and whether they ever took breaks of at least a month, 6 months, or a year.

Buying gold is not correlated with the weekly play time ($r(2825) = .05, p < .001$). Earlier WoW adopters are slightly more likely to buy gold than more recent players ($r(2839) = .11, p < .001$). This difference may be due to the fact that earlier adopters are also more likely to take a break from the game ($r(2852) = .24, p < .001$). Taking a break is a widespread practice among players: 77% have taken a break from the game for at least a month and then

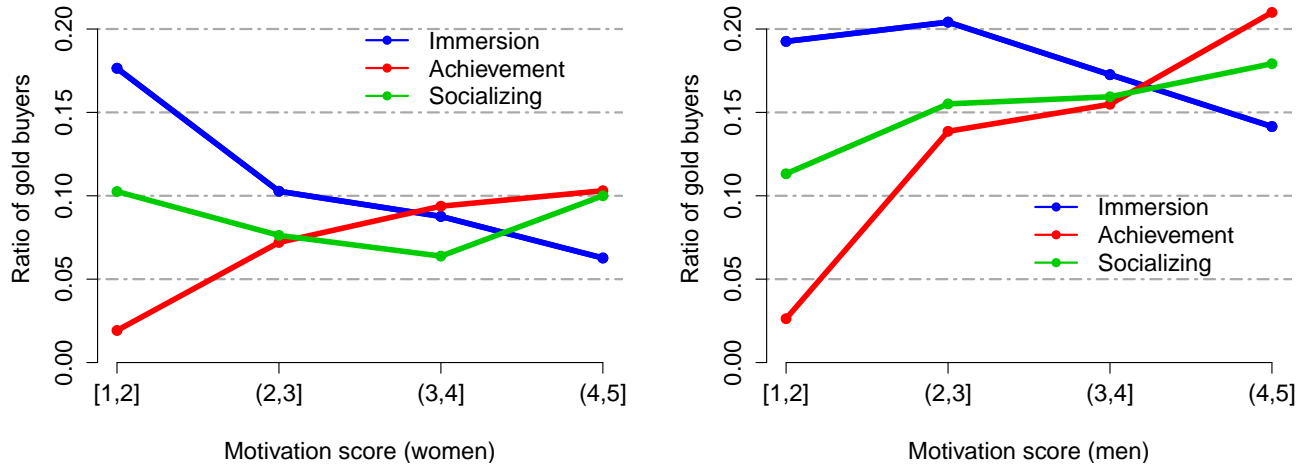


Fig. 9. Ratio of players buying gold against immersion, achievement, and social motivation scores for women (left) and men (right).

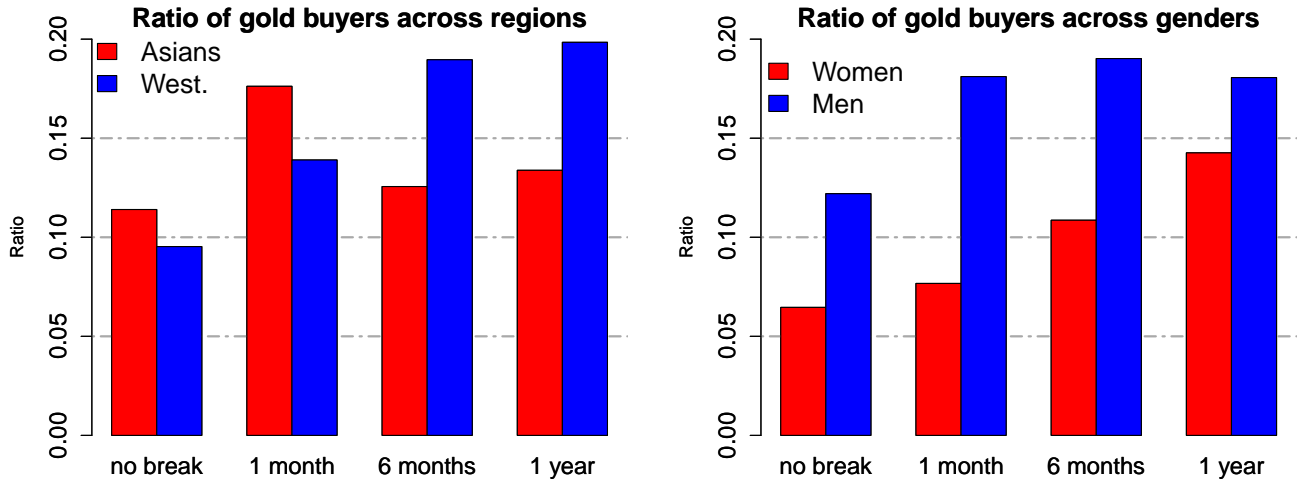


Fig. 10. Ratio of players who bought gold against duration of breaks for Westerners and Asians (left) and men and women (right).

came back, 40% for at least 6 months, and 14% for at least a year. Approximately 16% of players who have ever taken a break and then came back report buying gold, whereas it is the case for 10% of players who have never stopped ($\chi^2(1, 2850) = 14.31, p < .001$). Figure 10 shows that for Western players, the longer the break, the more likely to buy gold ($\chi^2(3, 2177) = 22.35, p < .001$). Despite Asians being overall more likely to take a break and come back, this behavior was not found among them ($\chi^2(3, 671) = 2.73, p = .37$). Possibly, when Western players who have taken a break come back, they may feel a little behind compared to other players and may be tempted by a gold bonus. The 1-month break peak of Asian gold buyers requires further investigations to be explained.

Summary: Players who have taken breaks are more likely to buy gold. For Westerners, the longer the break the more likely to buy gold.

D. Generalized linear model

Figure 11 provides a summary of the significant and sizeable correlations found so far. Most variables are correlated with at least four other variables. Therefore, determining exactly which causes what by simple comparisons such as t-tests or chi-square tests, as done above, is very difficult and careless. When multiple variables are involved, series of simple comparisons often reveal a few statistically significant differences, but these differences are due to chance only. Several methods exist to reduce the emergence of significant results due to chance only. Sequential Bonferroni corrections, for instance, adjust the required significance level with the number of comparisons performed [57]. One of the drawbacks of Bonferroni corrections, though, is their zealous dismissal of results when the number of comparisons to execute gets large like in our case.

Another method involves using more advanced statistical tools such as a generalized linear model (GLM). GLM is more rigorous than a series of simple tests because it considers all

the variables at once. GLM returns the variables most likely to predict an outcome of interest – buying gold in our case. We use multivariate logistic regression as packaged in R with the command `glm`. Since buying gold is a binomial outcome (yes or no), we add a binomial family parameter to the `glm` command.

Preparing the data: We remove from the analysis respondents who chose not to answer one or more questions, since the model would try to predict the respondents with missing values as respondents in a fictitious “missing-value” category. Some variables contain too few respondents in some of their categories: there are only 84 respondents still in high-school. Therefore, we collapse similar categories to make more precise claims. For instance, we group respondents still in K12 and high-school graduates together, and college students and graduates together. Since logistic regression only accepts numerical or binomial variables, categorical variables like education (originally with 6 different categories: K12, currently in high-school, currently in college, and so on) have to be transformed into binomial ones (high school or less = 0, college or more = 1).

Some variables with too small categories can not be collapsed, since the result would not mean anything. For instance, only 22 respondents are retired, and 91 home-makers, but each category is very different from the other. The variable “country of origin” also contains too many answers with too few respondents (2 respondents from Macau, 3 from Malaysia, and so on). Therefore we have to leave those variables out of the model.

Limitation: collapse of categories: When preparing the data for the generalized linear model, we collapsed categories such as education levels of K12 and high-school graduates together because of the too few respondents in them. However, we could have collapsed categories differently: K12, high-school, and college students together in one group, and high-school and college graduates together in another group. Our collapsing choices may have introduced noise in the analysis.

Screening variables: Given our previous analyses, gender seems to strongly influence the likelihood of buying gold, and is unlikely to cause most of the other variables. Therefore, we take gender as our main predictor. To prevent interactions between gender and other variables, we test whether each variable is correlated with the outcome (buying gold) or the main predictor (gender). For instance, a one-tailed t-test shows that the respondents who buy gold are significantly older than those who do not ($t(411) = 1.93, p = .027$), and another t-test shows that women are significantly older than men ($t(874) = 9.15, p < .001$). Therefore, age is a **confounder**: it is related to both buying gold and gender, and may confound the relation between the outcome and the predictor, so we include it in the analysis. The weekly play time, however, is related to buying gold ($t(411) = 2.53, p = .006$) but not to gender ($t(874) = .92, p = .178$). Hence the weekly play time adds **precision** to the analysis, and we also include it. As another example, the marital status is related to gender ($c^2(1, 2836) = 42.44, p < .001$) but not to buying gold

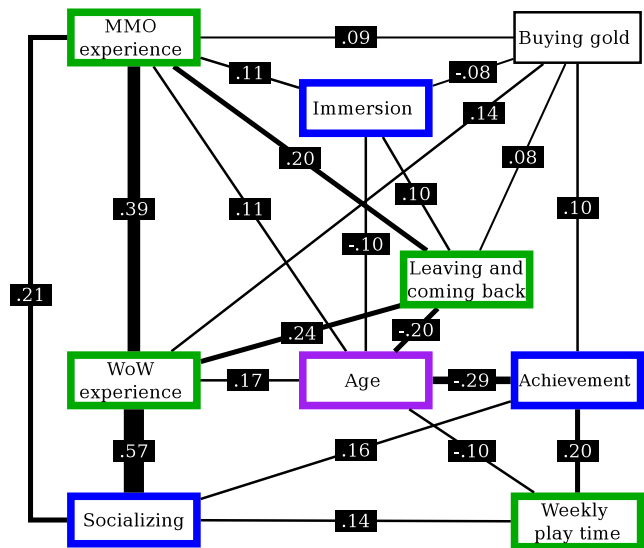


Fig. 11. Partial correlation network. A vertex bearing a positive (negative) value indicates a positive (negative) correlation between two variables. Coefficients closer to 1 in absolute value indicate a perfect correlation, while 0 indicates the absence thereof. For nodes other than buying gold, only r values above .10 in absolute value are displayed. Thicker edges indicate stronger correlations. Play motivation vertices are colored in blue, MMO-specific in green, and demographics in purple.

($c^2(1, 2830) = .02, p = .83$). Thus it would add **noise** to the analysis, and has to be left out. Variables unrelated to both gender and buying gold are also left out.

Building the model: We then run the `glm` command in R with the selected variables. The model shows that gender, our main predictor, still has a significant effect ($p < .003$) on buying gold when controlling for all other variables. We then proceed to remove all the variables with insignificant effect. For instance, taking a break of 1 month ($p = .53$), 6 months ($p = .29$), or a year ($p = .55$) are insignificant and taken out. However, having ever frozen one’s subscription is significant ($p = .013$) and kept in. In the end, the 17 variables that significantly influence buying gold are summarized in table IX.

Interpreting the results: The `glm` command returns the odds for each of the 17 variables. For categorical variables such as gender, an odds ratio of 1.696 means that controlling for all other variables, the odds of buying gold are estimated to be 69.6% higher for men compared to women.

For numerical variables such as age, the odds can be interpreted as follows: between two groups that differ 1 year in age but that are equal on all other variables, the odds of buying gold are estimated to be 4.0% higher for the older group. In other words, controlling for all other variables, the odds of buying gold increase 4.0% per year of age. Similarly, the odds of buying gold decrease by 19.3% for each point of immersion score.

Summary: Using a more advanced statistical model, gender and the three play motivations remain strong predictors of buying gold, but job category and break durations are replaced by college education and having frozen one’s subscription.

Variable	p-value	Odds
Playing on a private server	.000	1.830
Gender (Being a man)	.000	1.696
Having frozen subscription	.001	1.477
Made in-game friends	.123	1.202
Playing with spouse	.039	0.690
College education	.014	0.684
Playing with sibling	.019	0.614
Playing with cousin	.103	0.512
Achievement score	.000	1.383
Years playing WoW	.000	1.283
Extraversion score	.045	1.142
Age	.000	1.040
Weekly play time	.100	1.006
Socializing score	.067	0.853
Agreeableness score	.048	0.850
Immersion score	.001	0.817
Conscientiousness score	.003	0.800

TABLE IX

ODDS AND PROBABILITIES OF BUYING GOLD FOR BINOMIAL (TOP) AND NUMERICAL (BOTTOM) VARIABLES WHEN CONTROLLING FOR ALL OTHER VARIABLES.

Playing with real-life relatives (cousin, sibling, spouse) remains a strong predictor for not buying gold.

VII. DISCUSSION

Our data indicate that the average MMO player does not follow the cliché of the youngster living in his Mom’s basement. A more appropriate persona for the veteran MMO players may be a man in his mid-thirties, in a family, motivated by achievement, but without too much time to dedicate to play.

Less time for “hardcore” grinding means more temptation to buy gold to remain competitive. This persona is echoed by some MMO companies who report that “the bulk of the [RMT] business revolves around the small time buyer, the buyer who just wants to have a little more fun without all the tedious work” [26]. Indeed, one of the personae emerging from our data as a typical gold buyer is a man, full-time employee, experienced WoW player, motivated by achievement, and with disposable income likely to be spent in virtual gold.

Our data also presents another persona for gold buying: self-declared “casual” players joined the game more recently and are less motivated by achievement than playing with real-life relatives. These players are very unlikely to buy gold. In fact, they may simply not need gold, and if they need it, it may not be worth the trouble: as of 2011, RMT remains a sensitive topic among gamer communities. Nardi and Kow show that the perception of WoW gold farmers by Western players resembles the “evil Chinese” stereotype and fits into a long-established moral panic in Western societies [23]. Buying gold, an activity directly sponsoring gold farming, is therefore often perceived as shameful. Hence players may not buy gold for fear of being discovered by real-life relatives and being asked embarrassing questions in person. On the other hand, virtual friends are easier to face through a screen, and if they disapprove, it is possible to relocate one’s avatar to another server, and start a new life, rich.

It may turn out to be beneficial – and profitable – for an online game to offer players a legal and official way to buy virtual currency with real money. Since some players turn to the black market when RMT is forbidden, companies have understood that they should embrace the demand rather than combat it. For instance, Blizzard’s next online game features an auction house that allows players to sell their virtual items to each other for real money [58]. Inter-player RMT platforms managed by game companies can certainly accommodate the motivations of their players, providing that the game designers understand their player segments.

This paper took a look at a particular type of RMT patterns: buying virtual currencies with real money. Further work is needed to investigate how the behaviors we discovered for virtual currency RMT apply to cosmetics or power-ups RMT, and which behaviors do not. Based on our experience in online games, we have found women to be particularly sensitive to avatar customizations – more so than men. They may therefore react more favorably to cosmetic RMT such as clothes, haircuts, or pets (eg hats and cute-pets in Ragnarok Online [5]). On the other hand, men may react more favorably to humorous or powerful-looking variations of existing mounts, weapons, or avatars (eg character skins of League of Legends).

Concerning retention, self-declared “hardcore” and achievement-oriented players reported a higher weekly play time and a lower stop rate. The hardcore 15 to 35 year-old gaming crowd has been well-studied by academia and our commitment metrics show that it remains a devoted player segment. However, some categories of more casual players, sometimes as substantial as the young hardcore gamers, have been neglected by both academia and industry. For instance, Pearce has been the only one so far to analyze the gaming practices of the “Baby Boomer” players [59]. Previous work has argued that both hardcore and casual player categories need to be involved and rewarded for an MMO to be successful [60]. We think senior gamers are a potent player segment to consider when designing the game.

Achievement has a predictable impact on weekly play time, confirming what has been mentioned repeatedly in works related to player motivation. More than a decade ago, Bartle’s model of player types included achievers [61]. Several years later, MMOs were said to be “hard to play” and “[not] really mass market, yet rewards were targeted and received by the most perseverant achievers from a particular player niche” [1]. Nowadays, MMOs like WoW seem to have fully understood how to manipulate reward structures to leverage achievement. “Welfare epics”, for instance, are considered consolation prizes for players unable to acquire decent-enough pieces of equipment [62]. Our data suggest that Asian players were more dedicated and achievement-oriented than Western players. As an illustration, the first WoW player to collect all achievements and “beat the game” (until Patch 3.2) was Taiwanese [63]. Asians were also earlier WoW adopters, certainly making them a very appealing market segment.

Players cannot accomplish the most difficult game contests alone; they have to gather in groups or guilds to collaborate.

Pearce characterized a “community of play” as a group of players “shifting from playing for the game to playing for the people” through “intersubjective flow” (see ch8 of [52]). Nardi and Harris noticed a similar concept of collaborative play in which players evolved from being strangers to each other to being friends [54]. Visualizing guilds as communities of play or groups engaging in collaborative play helps us understand how achievement-oriented players can participate in guild activities, even if these activities do not immediately lead to making their avatar progress. Conversely, socially-motivated guild members end up engaging in the game activities crafted by game designers (e.g., raids, quests, or PvP). Previous studies of WoW have argued that learning is a key component of social play [54], [64]. Learning how to play one’s character is the process that turns purely socially-motivated players into participants of activities crafted by game designers. Although players can collect information from forums and websites, a key way to learn remains in guilds. Ultimately, WoW guilds end up containing achievement-oriented players at least mildly interested in socializing and socially-motivated players participating in group-oriented game activities (in particular, raiding). Guilds increase player commitment because they add new play motivations for their members.

Focusing on the social motivation factor, female or Asian players seemed overall more socially-inclined than male or Western players. For instance, women or Asians reported having made strong RL connections (friends or even partners) from the game more often. Pace et al. remarked that players describe their intimacy experiences in WoW in two ways: detailed narratives called “episodes” and larger-scale descriptions called “histories” [36]. Histories require players to have played for months, maybe even years, to appear. We found that players who made RL friends and/or partners from the game started playing earlier and played more per week. This indicates that intimacy histories, as well as friendships, are written as the player spends more time in the game. Although our data did not allow us to draw any cause-effect relationship between variables, there was a clear link between commitment metrics and the strength of the ties made in the game.

Pace et al. also found that intimacy in the context of online gaming was shared between the real world and the virtual world, not occurring purely in one or the other [36]. With the introduction of the RealID service [65] in Summer 2010, and a first link with online social platforms like Facebook, Blizzard has taken a further step towards intertwining real and virtual. RealID is a utility that displays the real name of players instead of their online pseudonym. Certainly Blizzard may have understood that real life social networks can be leveraged to increase the retention of their games. Blizzard also implemented the Recruit-a-Friend feature to allow WoW players to invite friends or family members into the game [66]. When sponsoring friends through this system, each player’s characters will get experience points three times faster, and the sponsored player will be able to grant 30 levels to the sponsoring player. Moreover, each player will be able to summon the other from any place in the game world. As

55% of respondents reported playing with a RL friend and 60% of partnered players reported playing with their partner, it seems Blizzard already knows that retention can be increased in integrating players’ RL friends and partner into the game. However, only a quarter of North American WoW players with children reported playing with them. Integrating players’ children or family members (other than partner) into the game might be a path still to explore for Blizzard to increase player retention.

Referrals can consist of inviting a real-life friend to the game, or just telling her about it. Although players will likely tell their closest friends about the game they like, referrals go a step further by giving players incentives for bringing all of their friends to the game. In terms of in-game rewards, game companies should, at the first glance, reward the sponsoring player so that he does it again. But in rewarding both sponsoring and sponsored players, they can share in-game experiences together right away, and both might sponsor their other friends for more rewards. However, there may be some limitations to including RL contacts in the game. For instance, Williams et al. [37] found that when two partners play together, women are happier than men. Also, a psychology subscale was used to measure how much respondents’ level of physical and verbal aggression was when they play. Men report more aggressiveness when they are playing with their partner. This increase in aggressiveness might, in some cases, threaten a playful atmosphere, generate drama and degrade the game experience.

Intimacy, friends, and referrals also touch on the concept of trust, a component in the satisfaction framework proposed by Hennig-Thurau and Klee [10] that we used in this paper. Investigating trust through the lens of this framework to complement the commitment findings from this paper is future work. It may also be appropriate to look at the perception of quality by MMO players: what is considered a good game, and why. Answers to these questions may come from future game studies work on MMO game design.

VIII. CONCLUSION

Regarding RMT, our data show that it is a widespread phenomenon concerning certain player segments more than others. Competitive men with full-time jobs, for instance, are much more likely to buy virtual gold with real money than women who login mostly only to socialize with real-life relatives. Looking at categories of players buying virtual goods for real money not only indicates potentially profitable markets, but also different motivations to play.

We looked at player retention and RMT in World of Warcraft. Several metrics were introduced: weekly play time, stop rate, and how long respondents have been playing WoW for - a measure of early adoption. WoW efficiently wields powerful retention systems by grouping players in the same social structure, the guild, for achievement and social endeavors. The success of other people at retaining players differs between player categories (e.g., men versus women, Asians versus Westerners, or “hardcore” versus “casual”). Including friends,

partners and family members from real-life into the game seems to be a particularly effective mechanism for player retention. A senior demographic category of players aged 45+ is understudied. Our data show that they are of considerable interest to game designers and for games studies.

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