

10,000 Gold for 20 Dollars: An exploratory study of World of Warcraft gold buyers

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ABSTRACT

Buying virtual currencies with real money from a third-party often violates the terms of use of online games. This study quantitatively investigates players who buy in-game gold from a third-party in World of Warcraft. A cross-cultural survey dataset of 2865 players reveals that differences between Asian and Western players are negligible compared to differences across genders, job categories, and play motivations. Our findings have implications for the design and study of interactions between players and virtual currencies.

Keywords

World of Warcraft, online games, virtual currency, demographics, Real-Money Transactions

Categories and Subject Descriptors

H.5.1 [Multimedia Information Systems]: Artificial, augmented and virtual realities

General Terms

Design, Human Factors.

1. INTRODUCTION

In Massively Multiplayer Online games (MMOs), players receive or spend the game's virtual currency when accomplishing quests, killing foes, or trading with other players. Some avatar skills or pieces of avatar equipment can only be bought using the game's virtual currency. 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 [7, 12, 22].

In a Real-Money Transaction (RMT), players purchase virtual goods or virtual currency for "real" money like dollars or euros. In the early 2000s and before, selling packaged game boxes to the

end-user used to be the main source of revenue for game companies. Nowadays, the RMT market generates \$2.1 bn per year in the US alone [26]. As of 2011, three types of free-to-play business models have emerged; players can buy time, power, or cosmetics. Facebook social games such as Farmville sell time to players 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 for their garden to grow. At the other end of the spectrum, competitive multiplayer games such as League of Legends only sell cosmetic avatar customizations to preserve the game's balance. In-between, some free-to-play games sell power-ups that give buyers an advantage over customers who play the game without buying them.

In spite of their multiplayer gameplay, Farmville and League of Legends do not let their players exchange items within the game to a great extent; there is no in-game economy. In MMOs, however, items can be exchanged between players. MMOs make it possible for players to amass virtual gold and items and sell them to other players for real money. Collecting gold and selling it for real money is called gold farming, and it often violates the game's terms of use. Second Life is one of the very few multi-user virtual worlds that allow players to freely buy and sell virtual goods with each other for real money.

Although estimates vary, more than 100,000 gold farmers worldwide are estimated to *work* in MMOs [8]. 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 [18]. Despite the illegality and stealth of gold farmers, gold farming has been the topic of several studies. Dibbell interviewed workers in a Chinese gold farming company in 2007 [8], and Doctorow went to China as well to write his fictional novel plotting the birth of a gold farmer trade union [9]. However, not all the players who make money from selling virtual goods are Chinese – many are actually born and live in developed countries in North America or Europe [7]. A more quantitative approach has been taken by Keegan et al. to analyze the in-game social networks related to gold-farming activities in Everquest 2 [16].

Previous work has also 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 [20]. Although the Chinese government has taken actions against the illegal activities of gold farmers [17], some Chinese prisons have been reported to force their convicts to farm gold [28]. As their virtual currencies are gathering more and more attention, game companies would certainly like to keep the game economies under control.

Therefore, it comes to no surprise that more and more MMOs provide infrastructures where players can buy virtual items for real

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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 they were doing since 2007 [13], 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 [11]. 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 [2]. 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 *WoW*, a pay-to-play MMO, players can not buy virtual gold from the game company. However, players can buy *WoW* gold from gold brokers on auction websites such as Ebay [7]. 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. They found that while some players 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 [29]. Yee's *Daedalus* project reports the proportion of MMO players buying gold for real money from a 2005 online survey [31]. 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.

2. METHOD

In this section, we provide some background on the game itself and describe our player sample as well as the questions asked in the online survey we conducted.

2.1 World of Warcraft

World of Warcraft (*WoW*) is a fantasy role-playing MMO developed by the game company Blizzard Entertainment. As of November 2011, *WoW* is the MMO with the largest active subscriber base: 10.3 million player worldwide [14]. In *WoW*, 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 and killing monsters are the only activities rewarding the player with gold coins (simply called gold in the rest of this paper).

As of 2011, *WoW* is one of the few popular MMOs to successfully remain with a traditional subscription-based model. Therefore, gold farming violates the game's terms of use [3]. Yet, there is a surprisingly high player demand for RMT. According to Dibble, when Blizzard banned 50,000 gold farmer accounts in 2006, the cost for 100 in-game gold coins went from \$6 to \$35! [8]

2.2 Player Sample

An online survey was organized by the last two authors. Links to this survey were sent to mailing lists from their previous studies, 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. The 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 our study, therefore Europeans were not sent this questionnaire.

Although the survey was only targeted at those two populations, respondents from 48 countries speaking a total of 47 languages took 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 our respondents are women, and the average respondent is 28 years old ($\sigma = 8.8$). These two values echo previous studies on MMO players [30, 32]. Respondents play on average 23 hours per week ($\sigma = 15$), a number that seems consistent across MMOs [30]. A more detailed breakdown of the weekly play time distribution is provided in [6]. 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 expansions.

2.3 Questionnaire

Respondents were asked three types of questions: **general demographics** (such as age, gender, country of residence, marital and job categories, languages spoken, years of formal education, and a standard big 5 psychological traits question list), **WoW-specific** (e.g. main character in a guild, number of years playing *WoW*, taking a break from the game, and canceling one's subscription), and **patterns of play** (including MMO play motivations, playing with real-life acquaintances, having ever made a real-life friend or partner from the game, number of years playing MMOs, having ever played on a private server, and defining oneself as casual or hardcore). 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?".

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 [32]: 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.

In the following of the paper, we refer to the rate of gold buyers for a particular player category as the number of respondents in that category who report having bought gold, divided by the total number of respondents in that category.

	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 1: Age, weekly play time, and ratio of players who bought gold across genders and regions

3. RESULTS

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 [31]. 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 6 years, the number of MMO subscriptions has more than tripled [27].

Compared to the 14% of WoW players who ever bought gold, only 10% of the Puzzle Pirates MMO players bought virtual items in 2009 [15]. Social games report between 1 to 20% of their players engaging in RMT [21, 23]. Hence WoW players seem an interesting demographic to observe with respect to RMT.

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 [5]. 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 paper, we center our analysis on buying gold. For relations between retention (leaving and coming back, weekly play time, WoW experience) and play motivations (socializing, achievement, immersion), see [6]. For more on the social and demographic features in themselves, see [25]. In the remaining of the paper, 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 3. We finish by employing a multivariate logistic regression model.

3.1 Demographics

Overall, men report having bought gold twice more often than women ($c^2(1, 2841) = 31.11, p < .001$), as seen in the last column of table 1 above. Looking at regional differences, Asians are as likely to buy gold as Westerners ($c^2(1, 2850) = .13, p = .93$). 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 ($c^2(1, 872) = 2.12, p = .31$).

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 2 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

	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 2: Age, hours played per week, and ratio of players who bought gold across job categories (top) and education level (bottom)

most 12% of part-time employees, students, home-makers and unemployed respondents do ($c^2(5, 2499) = 18.12, p < .001$).

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 ($c^2(5, 2853) = 57.78, p < .001$).

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 2, 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 ($c^2(5, 2853) = 105.66, p < .001$). Possibly, they may 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 2, 11% of respondents still in high school or college buy gold, a number consistent with the student row of the top part of table 2. 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 grand-children.

3.2 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 ($t(874) =$

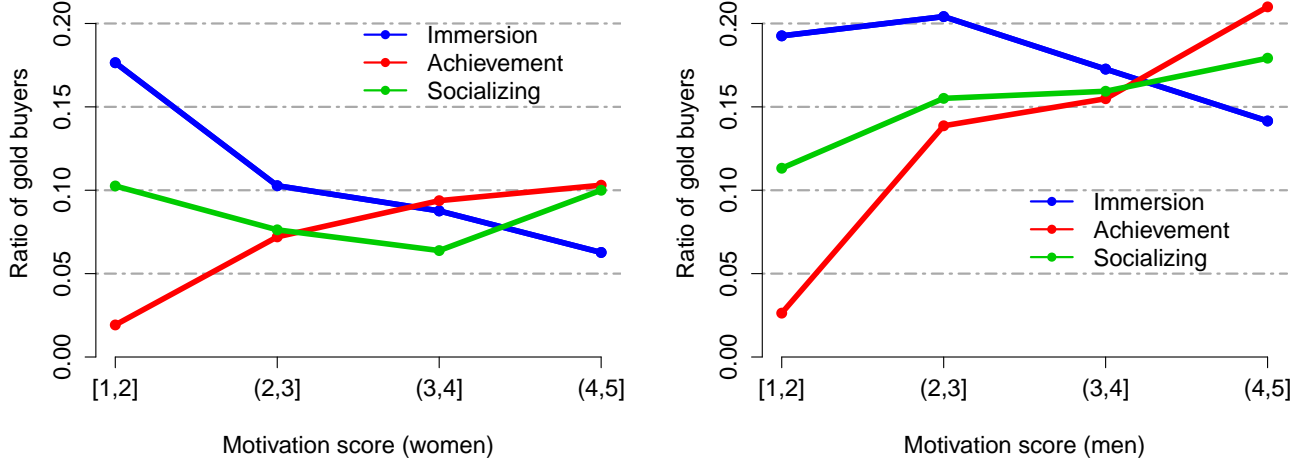


Figure 1: Ratio of players buying gold against immersion, achievement, and social motivation scores for women (left) and men (right).

	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 3: 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).

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 1, 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 are nevertheless more motivated by achievement than retired individuals or homemakers (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 [10, 19]. Whether respon-

dents 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 who they consider became real-life friends or partners (ie in-game ties) [25]. Here, we find that the ratio of gold buyers varies with the nature of the social ties. As seen in table 3, 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.

3.3 Retention

As detailed in [6], 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 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 ($c^2(1, 2850) = 14.31$, $p < .001$). Figure 2 shows that for Western players, the longer the break, the

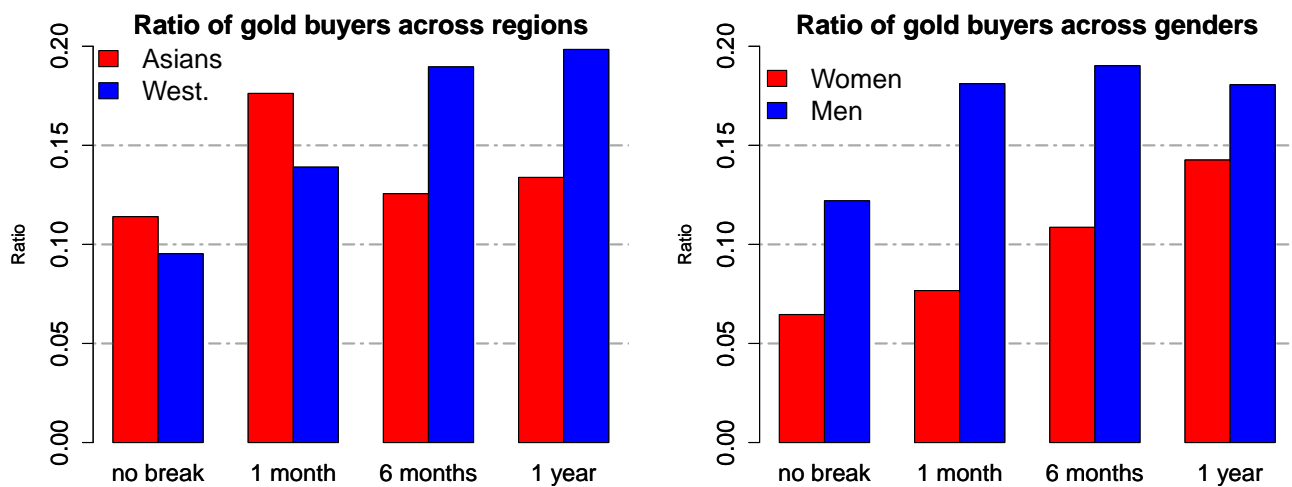


Figure 2: Ratio of players who bought gold against duration of breaks for Westerners and Asians (left) and men and women (right).

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.

3.4 More complex model

Figure 3 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 [24]. 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.

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 ($\chi^2(1, 2836) = 42.44, p < .001$) but not to buying gold ($\chi^2(1, 2830) = .02, p = .83$). 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 sub-

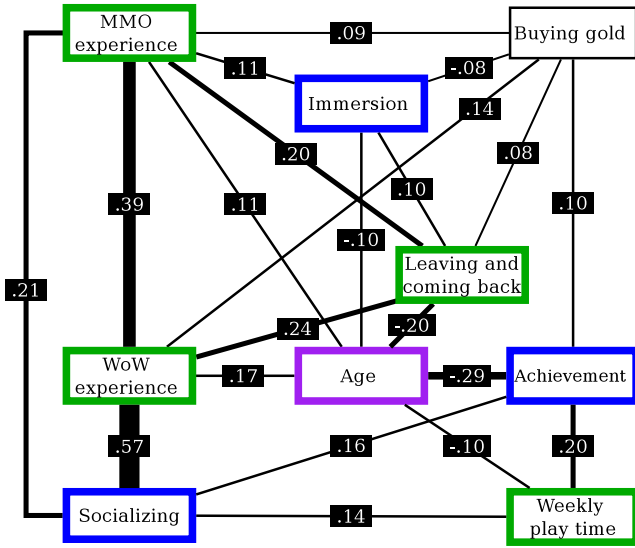


Figure 3: Partial correlation network. A vertex bearing a positive (negative) value indicates a positive (negative) correlation between two variables. Coefficients closer to 1 in absolute value indicate a perfect correlation, while 0 indicates the absence thereof. For nodes other than buying gold, only 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.

scription is significant ($p = .013$) and kept in. In the end, the 17 variables that significantly influence buying gold are summarized in table 4.

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 easier understanding, the last column of table 4 displays the probability of buying gold for each variable when controlling for all other variables. This probability is defined as $odds / (1 + odds)$ [4]. A probability of 63% for gender means that controlling for all other variables, 63% of gold buyers are men. Similarly, controlling for all other variables, 38% of gold buyers play with their sibling(s).

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

4. DISCUSSION

The average MMO player is aging: early MMO adopters have passed their mid-thirties, may have a family, and may not have as much time to dedicate to play. Less time for “hardcore” grinding

Variable	p-value	Odds	Probability
Playing on a private server	0.000	1.830	65%
Gender (Being a man)	0.000	1.696	63%
Having frozen subscription	0.001	1.477	60%
Made in-game friends	0.123	1.202	55%
Playing with spouse	0.039	0.690	41%
College education	0.014	0.684	41%
Playing with sibling	0.019	0.614	38%
Playing with cousin	0.103	0.512	34%
Achievement score	0.000	1.383	58%
Years playing WoW	0.000	1.283	56%
Extraversion score	0.045	1.142	53%
Age	0.000	1.040	51%
Weekly play time	0.100	1.006	50%
Socializing score	0.067	0.853	46%
Agreeableness score	0.048	0.850	46%
Immersion score	0.001	0.817	45%
Conscientiousness score	0.003	0.800	44%

Table 4: Odds and probability of buying gold for binomial (top) and numerical (bottom) variables when controlling for all other variables.

means more temptation to buy gold to remain competitive. MMO companies have also figured 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” [13]. Our data picture the typical gold buyer as a man, full-time employee, experienced WoW player, motivated by achievement, with possibly little time on his hands but disposable income likely to be spent in virtual gold.

“Casual” players, arguably, are those respondents who joined the game more recently and who are not motivated by achievement but rather by playing with their real-life relatives. Casual 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 [20]. 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 [1]. 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.

5. LIMITATIONS AND FUTURE WORK

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 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 14%.

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 [10], 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.

Language barrier: Our questionnaire was taken by 2865 respondents from 48 countries speaking a total of 47 languages. 2283 of them speak English and 603 Mandarin Chinese either as primary or secondary languages. Therefore, we think our questions have been relatively well-understood.

Correlation versus causality: The comparisons, correlations and regressions used in this study establish relations between certain variables and buying gold. However, causality can not be inferred from these methods. Only studies designed purposefully to compare gold buying behaviors can provide reasons why some players buy gold.

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.

Breadth: 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-leveiling services. Players' emotional responses to and attitudes about RMT should also be the subject of future qualitative work.

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7. REFERENCES

- [1] Diablo III auction house overview.
<http://us.blizzard.com/en-us/company/events/diablo3-announcement/index.html#auction-summary>.
- [2] EVE PLEX store.
<https://secure.eveonline.com/PLEX/>.
- [3] World of Warcraft Terms of Use.
http://us.blizzard.com/en-us/company/legal/wow_tou.html.
- [4] Agresti, A. *Categorical Data Analysis*. 2002.
- [5] Cohen, J. A power primer. *Psychological Bulletin* 112 (1992).
- [6] Debeauvais, T., Nardi, B., Schiano, D., Yee, N., and Ducheneaut, N. If you build it they might stay: Retention mechanisms in World of Warcraft. In *Proceedings of the Sixth International Conference on the Foundations of Digital Games*, FDG '11 (2011).
- [7] Dibbell, J. *Play Money*. 2006.
- [8] Dibbell, J. The life of the Chinese gold farmer.
<http://www.nytimes.com/2007/06/17/magazine/17lootfarmers-t.html>, June 2007.
- [9] Doctorow, C. *For the Win*. May 2010.
- [10] Ducheneaut, N., Yee, N., Nickell, E., and Moore, R. J. The life and death of online gaming communities: a look at guilds in world of warcraft. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, CHI '07 (2007).
- [11] Egan, J. The fight against RMT in EVE Online.
<http://massively.joystiq.com/2009/08/11/the-fight-against-rmt-in-eve-online/>, August 2009.
- [12] Gevlon. The Greedy Goblin blog.
<http://greedygoblin.blogspot.com/>.
- [13] GM Guard. The price of ISK... <http://www.eveonline.com/devblog.asp?a=blog&bid=437>, February 2007.
- [14] Holisky, A. WoW subscriber numbers down to 10.3 million players.
<http://wow.joystiq.com/2011/11/08/wow-subscriber-numbers-down-to-10-3-million-players/>, November 2011.
- [15] Hyman, P. Puzzle Pirates' James Reveals Free-To-Play MMO Revenue Specifics.
http://www.gamasutra.com/php-bin/news_index.php?story=23970, 2009.
- [16] Keegan, B., Ahmed, M. A., Williams, D., Srivastava, J., and Contractor, N. Dark gold: Statistical properties of clandestine networks in massively multiplayer online games. *2010 IEEE Second International Conference on Social Computing* (2010).
- [17] Kennedy, J. China: Gold farming couple handed down heavy sentence. <http://globalvoicesonline.org/2010/12/22/china-gold-farming-couple-handed-down-heavy-sentence/>, 2010.
- [18] Lastowka, G. ID theft, RMT & Lineage.
http://terranova.blogs.com/terra-nova/2006/07/id_theft_rmt_nc.html, 2006.
- [19] Nardi, B. A. *My Life as a Night Elf Priest : An Anthropological Account of World of Warcraft*. University of Michigan Press, 2010.
- [20] Nardi, B. A., and Kow, Y. M. Digital imaginaries: How we know what we (think we) know about chinese gold farming. *First Monday* 15 (2010).
- [21] PapayaMobile. PapayaMobile Reaches 25M Registered Users, Takes Jabs At DeNA's Mobage.
<http://www.insidemobileapps.com/2011/08/24/papayamobile-25-million-dena-mobage/>,

2011.

- [22] Pardo, R. Rules of Engagement: Blizzard's approach to multiplayer game design.
<http://wow.joystiq.com/2008/02/20/gdc08-live-from-rob-pardo-talks-about-blizzards-approach-to-mm/>, 2008.
- [23] Relan, P. Interview with the Chairman of Crowdstar.
<http://lsvp.wordpress.com/2010/02/01/interview-with-chairman-of-crowdstar>.
- [24] Rice, W. R. Analyzing tables of statistical tests. *Evolution* 43, 1 (1989), pp. 223–225.
- [25] Schiano, D. J., Nardi, B. A., Debeauvais, T., Ducheneaut, N., and Yee, N. A new look at World of Warcraft's social landscape. FDG '11 (2011).
- [26] Smith, J., and Hudson, C. The US virtual goods market 2010 - 2011.
<http://www.insidevirtualgoods.com/us-virtual-goods,2010>.
- [27] Van Geel, I., and Woodcock, B. S. MMOG data: Charts.
<http://mmodata.blogspot.com>.
- [28] Vincent, D. China used prisoners in lucrative internet gaming work. <http://www.guardian.co.uk/world/2011/may/25/china-prisoners-internet-gaming-scam>, 2011.
- [29] Wang, Y., and Mainwaring, S. D. Human-currency interaction: learning from virtual currency use in china. CHI '08 (2008).
- [30] Williams, D., Consalvo, M., Caplan, S., and Yee, N. Looking for gender: Gender roles and behaviors among online gamers. *Journal of Communication* 59 (2009).
- [31] Yee, N. The Daedalus Project, vol. 3-5.
<http://www.nickyee.com/daedalus/archives/pdf/3-5.pdf>, 2005.
- [32] Yee, N. The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence: Teleoperators and Virtual Environments* 15 (2006).