Through the Azerothian Looking Glass: Mapping In-Game Preferences to Real World Demographics

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ABSTRACT
Examining how in-game behavior preferences map onto real world demographics provides important empirically-derived insights into how to match game-based mechanisms to target demographic segments. Using behavioral and demographic data from 1,037 World of Warcraft players, we use multiple regressions to provide this mapping. Given current interest in "gamifying" applications, we believe these findings are relevant for both gaming and non-gaming research.

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In-game behaviors; gamification; player demographics.

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H5.m. [Information interfaces and presentation (e.g., HCI)]: Miscellaneous;

INTRODUCTION

Research in online games hints at a fascinating irony in their "massively multiplayer" social dynamics—that their affordances and scope shape a culture of being "alone together" [2] and that it is precisely the disparity in motivations for playing that causes tensions to emerge among players [1]. This research underscores a crucial point about gamers; they play the same game for very different reasons.

Studying this intersection between in-game preferences and real world demographics using quantitative methods has historically been a challenge. Most game companies closely guard their server data for marketing and competition reasons. And access to in-game data alone does not reveal the player demographics without an additional survey component. Nevertheless, as more and more applications incorporate gaming mechanisms to enhance user engagement and behavioral outcomes, it is important to gather empirical data on how in-game preferences are related to real world demographics. Just as some examples of this "gamification" trend, game-based mechanisms have been implemented in chemotherapy compliance (e.g., Remission), loyalty reward programs (e.g., My Starbucks Rewards), and finding protein folding solutions (e.g., Foldit). Indeed, this trend is expected to permeate even corporate business applications and Gartner [3] has predicted that by 2014, 70% of Global 2000 companies will have at least one gamified application.

Empirical data linking in-game preferences with real world demographics would provide insight into 3 issues relevant to CHI at different stages of game and gamified application development:

1) In designing and developing game-based elements, which game mechanisms should be prioritized given a target audience? Quantitative data would allow us to provide a framework for this mapping.

2) Given the variety of options and choices within a game, can we dynamically emphasize different game elements to a user given their demographic? This dynamic tailoring would allow us to maximize engagement with different users.

3) And finally, after a game or gamified application has been deployed, how might adding or removing a game mechanism impact a community at the demographic level? Again, an empirical mapping would allow predictive modeling of how different demographic segments might react to the change (in terms of retention and new players).

Previous research in this area has tended to rely on self-report data, linking demographics with player motivations [4,5,6,9] (although the Virtual World Exploratorium [7] and the PARC PlayOn group [2] are notable exceptions). Without in-game data, it is difficult to assess how well those findings generalize to actual in-game behaviors. Nevertheless, this research in player motivations is consistent in finding that men are more driven by achievement motivations [6,9]. Data on the other motivation factors are more mixed. For example, two studies found women to be more engaged with social factors [6,9], while another two studies found that women were less likely to be motivated by social interaction [4,5]. It is worth noting, however, that the former studies emphasize in-game socializing, while the latter studies emphasize real-world socializing—a distinction that may have contributed to the different findings.

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It is also worth noting that there are even fewer data points on age differences in gaming motivations since most studies have used small or college-based samples. [9] is an exception, finding that younger players are more achievement-oriented, and that age in fact explains more variance than gender does.

For this paper, we conducted a study that paired behavioral data from the online game *World of Warcraft* (WoW) with self-report demographic data to directly examine the links between in-game preferences and real world demographics. We also included additional demographic variables beyond gender and age to provide a broader demographic profile mapping, such as marital and child status, regular playing times, and number of days spent playing. Given that past research provides few consistent anchor points (beyond the gender and age differences in achievement), it is more sensible to approach the behavioral mapping as open research questions. Thus, while we expect male and younger players to prefer achievement-oriented activities, we do not make any specific hypotheses regarding social or immersion factors.

METHOD

WoW is a popular online role-playing game set in a fantasy context. Since the dynamics and game-play of WoW have been previously described in the CHI literature [2,8], we will only emphasize aspects of WoW that are particularly relevant to our study.

There are two reasons why in-game data from WoW is unique. First, Blizzard (the developers of WoW) have decided to release in-game data to third-parties via a web portal known as the Armory. The Armory provides over 3,500 variables for each active character. Second, behavioral variables in WoW are provided in meaningful hierarchies and categories. This is in contrast to systems like Second Life where the sandbox nature of the environment makes it difficult to create a set of meaningful behavioral variables. Thus, in Second Life, the system only captures raw metrics such as distance moved and number of other avatars within a certain radius—metrics that are difficult to map to meaningful behaviors. In WoW, on the other hand, many meaningful behaviors are captured. For example, the Armory provides variables on hugs given and deaths by falling from high places.

Achievement Categories

Furthermore, WoW has an internally-defined mapping of in-game actions into 6 high-level achievement categories. These categories provide parsimonious metrics of in-game preferences. These categories are:

- **Quests:** Goal-based missions that have been designed to be completed by individual players without much difficulty or unexpected complications. Quest completions provide small rewards.
- **Exploration:** Systematic geographical exploration of the game world that provides no functional reward.
- **PvP:** Competitive, player-vs-player activity. Can be 1-on-1 duels or group-based battles.
- **Dungeons/Raids:** Team-based collaboration that requires moderate to high time investment, contains moderate to high risk, but provides large rewards.
- **Professions:** Non-combat crafting skills that individual characters can develop and master to produce usable goods and equipment.
- **World Events:** Thematic, seasonal, story-based events that provide cosmetic rewards. For example, a lunar New Year event provides quests for a brocade-style dress and decorative fireworks.

While these achievement categories do not cover all aspects of in-game behaviors (e.g., no chat data is processed), they nevertheless cover a broad selection of in-game preferences. For example, these categories cover both collaborative and competitive activities, combat and non-combat activities, and individual and group-based activities.

Participants

To collect data for this study, we used an online survey to recruit participants and gather demographic information, followed by extracting Armory and in-game data for those participants' characters in WoW. The study was advertised in high traffic websites and forums dedicated to WoW (e.g., WoW Insider). Altogether, 1,037 WoW players participated in the study, of which 762 were male and 273 were female. The average age was 27.03 (SD = 8.21). Participants were asked to list their active characters. Each player had on average 2.79 characters (SD = 1.51).

Real World Demographic and Play Pattern Variables

The following demographic variables were collected in the self-report surveys. We specify the numeric codings as they are used for the regression analysis reported later. The demographic variables were: 1) gender, coded as male (1), female (0), 2) age, 3) marital status, coded as single/divorced/widowed (0) and partnered/married (1), 4) child status, coded as no (0) and yes (1).

Additionally, play pattern variables were derived from a LUA-based script deployed within the game client. Every hour, the script runs a "/who" command for characters in our study and notes whether the character was observed online. The script was deployed from 03/2010 to 09/2010. This data allowed us to map out the playing patterns of players over the 6-month period (and including the career data accumulated prior to the study period). We created 4 daily time segments (keyed to server time) and calculated the ratios for these 4 segments: 1) midnight (12am-6am), morning (6am-12pm), afternoon (12pm-6pm), and evening (6pm-12am). Thus, a 0.80 in evening would mean that over the course of 6 months, a player spent 80% of their playing time in the evening hours. And finally, we calculated a "unique days played" variable based on this data.

In-Game Behavioral Variables

A scripted XML collection tool was used to collect the relevant Armory variables on a daily basis. To create a player-level aggregate variable across their characters, we added up the achievement category scores and total scores across characters, and then divided the category total by the full total for each category. In this way, we derived 6 category ratios for each player. For example, a 0.25 in the Quest category would mean that across all of a player's characters, 25% of their achievements are in the Quest category. Since players who spend more time playing have completed more achievements (correlation between days played and total achievement score is $r = .45$, $p < .001$), these ratios avoid any confounds with character level and time spent playing the game.

RESULTS

To examine the relationship between the achievement category ratios and the real-world demographics and play pattern variables, we conducted a series of multiple regressions using the achievement ratios as the dependent variables. The regressions allow us to precisely see the unique contribution of each variable, as well as the overall significance of each model. The latter is an indicator of how well in-game preferences can be predicted on real world demographics alone. For each regression, we use a table to concisely present the significant standardized coefficients. Complete results (including the non-significant findings) are presented in a web appendix.

We found that older players and players with less playing time preferred quests in WoW (Table 1). Given that quests do not need to be scheduled and can be completed alone, it makes sense that players with less flexible schedules and less playing time would prefer them. Similar to earlier research on playing "alone together" [2] illustrating a multi-tier approach to social engagament, WoW also provides a casual path alongside its more time-intensive raiding option.

Variable	Beta	t	p
Age	0.27	7.16	0.00
Days Played	-0.16	-4.31	0.00
Adj. $R^2 = 0.9$, $F[1016] = 11.57$, $p < .001$			

Table 1. Multiple Regression results for Quests

In terms of the Exploration category (Table 2), we found that this activity was preferred by female players, by older players, and by players who often play in the morning. The gender and age coefficients are consistent with the earlier reported gender and age effects on the appeal of goal-oriented achievement in games. Given that exploration in WoW does not directly lead to functional rewards, this pattern makes sense. Again, WoW illustrates that it is possible to build game mechanisms for very different demographics side by side via branching options.

Variable	Beta	t	p
Gender	-0.10	-3.12	0.00
Age	0.28	7.47	0.00
Time: Morning	0.10	2.94	0.00
Adj. $R^2 = 0.13$, $F[1016] = 17.27$, $p < .001$			

Table 2. Multiple regression results for Exploration

For PvP, we found a preference for this activity by male players, by younger players, by those who have children, and by those who play in the evenings. This finding is largely consistent with previous research showing that competitiveness is correlated with younger players and male players [9]. The "children" correlation was unexpected. By itself, having children is negatively correlated with the PvP ratio ($r = .09$, $p < .001$). But since older players are more likely to have children and older players are less competitive, we need to control for the effect of age to examine the unique contribution of having children. In this case, the multiple regression revealed that having children actually increases the interest in PvP.

Variable	Beta	t	p
Gender	0.23	7.79	0.00
Age	-0.30	-8.43	0.00
Child Status	0.10	2.71	0.01
Time: Evening	-0.08	-2.28	0.02
Adj. $R^2 = 0.18$, $F[1016] = 23.85$, $p < .001$			

Table 3. Multiple regression results for PvP

In terms of Dungeons and Raids, the aspect of the game with the least flexible demand on time, we found that this activity is preferred by male players, by younger players, by players who are single and don't have children, and who concentrate their playing time in the evenings. We begin to see a bifurcation with younger players and male players preferring competitive, hack-and-slash activities, and older and female players preferring non-combat activities. We will continue to see this split with the remaining achievement categories.

Variable	Beta	t	p
Gender	0.19	6.65	0.00
Age	-0.28	-7.86	0.00
Marital Status	-0.07	-2.11	0.03
Child Status	-0.08	-2.23	0.03
Time: Morning	-0.10	-3.13	0.00
Time: Afternoon	-0.12	-3.82	0.00
Time: Evening	0.08	2.53	0.01
Adj. $R^2 = 0.22$, $F[1016] = 33.13$, $p < .001$			

Table 4. Multiple regression results for Dungeons/Raids

We found a preference for Professions among female players, older players, players who play in the mornings

and afternoons, and players who play fewer days. Like Quests, we find a profile for older, more casual gamers here.

Variable	Beta	t	p
Gender	-0.20	-6.95	0.00
Age	0.36	10.26	0.00
Time: Morning	0.06	2.03	0.04
Time: Afternoon	0.14	4.52	0.00
Time: Evening	-0.09	-2.77	0.01
Days Played	-0.09	-2.55	0.01
Adj. $R^2 = 0.23$, $F[1016] = 34.42$, $p < .001$			

Table 5. Multiple regression for Professions

And finally for World Events, we found a preference for this activity among female players, and players with more playing time.

Variable	Beta	t	p
Gender	-0.23	-7.71	0.00
Days Played	0.18	4.99	0.00
Adj. $R^2 = 0.13$, $F[1016] = 18.45$, $p < .001$			

Table 6. Multiple regression for World Events

We present the overall gender and age correlations with the achievement categories in Table 7.

Variable	Qu.	Expl.	PvP	Dung.	Pro.	W. Ev.
Gender	-.05	**-.16**	**.29**	**.26**	**-.29**	**-.28**
Age	**-.25**	**.33**	**-.32**	**-.39**	**.40**	**.18**

Table 7. Correlations between gender, age, and achievement category ratios. Gender was scored as Male (1), Female (0).

CONCLUSION

The multiple regression results inadvertently hint at why WoW may be such a successful game—the game caters to very different players with different demographic and engagement profiles without forcing a particular play style onto players. Overall, the findings begin to trace out a bifurcated mapping between in-game preferences and demographics. We found that male players, younger players, and players with more time to play prefer competitive and high reward activities, which tend to have fairly inflexible time demands. On the other hand, female player, older players, and players with less time to play prefer non-combat activities that have more flexible demands on time.

Our findings also directly address the 3 design issues relevant to CHI that we mentioned in the introduction. First, these findings help designers prioritize game elements given a target audience. For example, games for younger players should emphasize rewards and competition. Second, the significant regression models show that it is possible to predict game preferences based on demographics alone. Thus, a game tutorial, knowing that the user is male, can emphasize the leader board to increase initial engagement. And third, our findings provide a framework for understanding how enhancement or removal of a game component might impact the player base at a demographic level. For example, enhancing PvP would likely increase retention of younger players.

Several weaknesses bear mentioning. First, our study only focused on one game. Future studies should further examine this mapping in other games. Second, we relied on a convenience sample, and further work will be required to understand how generalizable these findings are. And finally, our reliance on public data feeds meant that we did not have access to all possible in-game variables, such as the rich information in chat logs.

While it is easy to ask players what they enjoy via a survey, it is important to observe what players actually do in a game to make empirically-driven design decisions. Given the interest in gamifying applications, we believe our findings provide an important mapping between in-game preferences and real world demographics.

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This research was sponsored by the Air Force Research Laboratory. A web appendix listing the detailed methods and regression results is available at: http://www.nickyee.com/wmap.html.

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