Uses of Multiple Characters in Online Games and Their Implications for Social Network Methods

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ABSTRACT

In most sociotechnical systems, individuals are tracked through user accounts. This paper explores the various ways in which people create and use multiple user representations, specifically in online games. Using 8 years of population data from a popular multiplayer online game, EVE Online, we examine how multiple character creation and use occurs at scale and how operationalization of individuals between accounts and characters impacts methods. We suggest that conceptualizing participants in online games based on the assumption that one character equals one individual can lead to incorrect analyses regarding the demographics or behaviors of the population. Additionally, social network analysis suggests that a character-centric, rather than account-level, viewpoint can change the results of statistical relationships with network metrics such as eigenvector centrality.

Author Keywords
Multiple profile maintenance; online games; social network analysis; user representations

ACM Classification Keywords
H.5.3. Group and Organization Interfaces–Web-based Interaction

INTRODUCTION

In most sociotechnical systems, an individual must create a user account to contribute. Frequently, we see the technology industry – and even occasionally academia – accept that trace data tied to one account represents the holistic experience of one individual. Especially as more and more systems track people's metadata, engineers and researchers continue to adopt user profiling and other aggregated empirical techniques to more accurately reconstruct individual's experiences.

However, some individuals that participate in online systems decide to create multiple representations of themselves by generating more than one user account. In the literature, this practice is known as multiple profile maintenance, and we call the implementation of user identification in sociotechnical systems "technical user representation." These representations are then used for a variety of reasons, though usually each is set aside for a distinct purpose. For instance, one person may create a more-private personal Twitter account to share updates with friends while maintaining another public, work-specific account. While some research has been conducted on why people separate these traces across multiple accounts, little research has empirically examined *how* people separate these accounts.

Studying how people use multiple technical representations is important for understanding identity practices, but these uses also have important implications for social science methodologies and theories. If people create multiple representations of themselves, researchers should be aware of how these practices might impact their interpretation of trace data.

Games constitute one approach to understanding the behaviors of separating experiences across different technical user representations. Players can create multiple avatars and interact with the game environment or other players in varied ways, generating different sets of trace data across these virtual characters. Frequently, games catalogue each avatar under one account per individual, uniting the characters under a common login, even though they represent distinct personae in the game world (especially since the player often cannot use more than one character at the same time).

Our motivation is to understand how the two different representations of a person within a game world (account and character) impact our understanding of behaviors in sociotechnical systems. In this paper, we focus on two research questions, the first informing the second:

RQ1: How do players use multiple characters, and do players create similar experiences (and trace data) across multiple characters?

RQ2: When players use multiple characters, how do these uses affect analyses of trace data and interpretation of behaviors?

In this paper, we use the case study of one massively multiplayer online game (MMOG) to study multiple character use. First, we survey the literature on multiple account use; in particular, we analyze the current game literature's approach to multiple character use. We then examine the entire population of players using a dataset comprising over 8 years of server logs since the game's

launch. In this data, we look at the adoption rates of multiple characters by players of different demographics in relation to their relative gameplay experiences. Using these empirical insights, we then analyze how trace data from multiple technical representations impacts research methods for interpreting sociotechnical behaviors. We specifically look at social network structures and how account and character perspectives differ. We conclude with a discussion of the impact that using character- and account-level data may have on the theoretical interpretation of individuals' behaviors in sociotechnical systems.

RELATED WORK

Systems for defining users – be it through usernames, account numbers, or other means – exist in almost every sociotechnical system. Many scholars have challenged how technologists envision and construct "the user" (for a proper overview, see [27].) Still, these critiques go a step beyond the basic implementation and applications of technical systems and models for user identification [1] which by themselves remain complicated. It is not just a question of who the user could be [25] but how the user is defined at a technical level. Individuals can create one or multiple accounts, these accounts can be frequently or rarely used, and some accounts can even be spoofed to appear like individuals (e.g., via social media bots or online MMORPG gold farmers [20]). Yet we still rely on knowing "individuals" through these technical representations.

Multiple Profile Maintenance

When individuals in sociotechnical systems split their lived experience across multiple accounts, this is known as multiple profile maintenance (MPM). MPM suggests that people create alternate technical profiles because of boundary regulation and privacy management.

The ability for one person to create multiple representations complicate knowing individuals through account representations. Many types of decisions result in the creation and maintenance of multiple profiles, especially for communication technologies. Gross's study [12] of multiple email accounts illustrates how users exhibited a range of motivations, from wanting a variety of usernames to separating spheres of daily life (e.g., family, friends, work, etc.). Stutzman & Hartzog [36] find similar decisions in studying individuals' MPM on the same social network site: privacy remained the primary concern, followed by identity management, utility of separated accounts (to coordinate activities), and adherence to social norms. Leavitt [21] has also shown that people will adopt additional temporary accounts to share momentary information that they do not want linked to their primary account.

"Main" vs. "Alt" Characters in Video Games

Online video games provide another context for the creation of multiple "profiles." While communication technologies are frequently used for personal communication, video games represent another domain of technical representation, founded in entertainment experiences. Because games can revolve around achievement, players may also use game profiles to boast about their accomplishments in addition to self-presentation (e.g., through avatars). While these players will not necessarily create multiple technical usernames – because it is difficult to sign in and out of game interfaces, and occasionally you may need to set up separate financial information on each account – they may generate multiple characters to experience different parts of a game in varying ways (for example, to see what kind of persona or role they wish to take on in the game world).

In game parlance and in the literature, the most-played character is dubbed the "main" while any additional characters are known as "alts" (for "alternative" characters). The context of games therefore provides different motivations for creating distinct and separate character representations.

Ducheneaut and Moore [9] present a qualitative framework for thinking about main and alt characters. Some games provide robust and diverse character customization, while others restrict the player to only a few preset options. While players may choose a range of characters to play and maintain over time to explore different parts of the game, character creation is also a social factor in online multiplayer gameplay, as people need to form balanced groups to progress through certain areas. As the authors point out, though, switching between characters introduces some difficulties: if the alt character is far away at another location in the game world, smooth transitions between characters, in order to maintain social balance in a group, can be cumbersome.

Furthermore, because characters can be customized, some players connect with them on a personal level (see, for example, Hitchens, Drachen, and Richards [13]). Williams, Kennedy, and Moore [43] also note that players adapt certain characters for personal exploration through roleplaying: one desire in using certain characters noted by players in interviews revolves around "construct[ing] character histories and fantasies," meaning that players could create multiple characters to explore different experiences within the game world. Poor and Skoric [29] illustrate cases of particular guilds where individual players actually housed multiple characters ("The 1,026 characters were spread over 550 user accounts, for 1.86 characters in the guild per account, but this is most likely a long-tail situation, where some players were heavily invested in [guild #1] across multiple characters and some players casually made a character and found a guild to join. [Guild #2] had 42 characters and was more focused, with only 16 user accounts, for an average of 2.6 characters per account...").

Additionally, the authors note that reputation plays a large role in alt character use. Because on a technical level creating an alt character results in restarting in the game world, newer characters are not tied to older, more advanced ones: for some players, this results in a loss of in-

game status. In the past decade, multiplayer games – especially competitive ones – have suffered because advanced players will create new accounts, or "smurfs," to easily beat newbies under the guise of inexperience. Williams, Kennedy, & Moore [43] note that main characters also define reputation not just in terms of accumulated statistics but also position in a game ecosystem: because main characters tend to be the representations with the most minutes, this avatar tends to determine the server on which the player's set of characters resides. Other issues with alts revolve around griefing and trolling, where players will create alternative representations of themselves to interact with others in devious or detrimental ways, taking advantage of reputation (or lack thereof) to mess up others' experiences [3]. Consalvo [7] points out that alts introduce anonymity and complicate reputation; however, some games have shaped alt use with functional mechanisms, for instance allowing friends to identify each others' alts or in some cases limiting what people can do with them because they cost additional subscription money to use.

Demographics can play a role in character representations. Men and women may exhibit differences in character creation, due to different in-game motivations (like combat or roleplay), financial situations, maintaining anonymity, etc. [22,40]. As an example, female players often find themselves facing harassment or other cultural barriers within predominantly male games [10]. As a result there may be an incentive to avoid "feminine" behaviors or avatars in some online games in order to circumvent these issues [31]. Second, players from different locations may differ in character creation. Players may approach exploring a game differently depending on the geographical and cultural context of play outside and inside the game. Frequently, players from different geographies are placed in different servers (a process known as sharding), in order to preserve quality play and reduce lag. However, cross-cultural interactions can produce tensions [37]. Finally, players from different age groups may differ in character creation. Younger players tend to have more free time to play, though older players may have more financial resources to spend on games. Styles of gameplay also change as players age, with older participants generally drifting away from violent elements of the game towards more strategic parts of the overall experience [11]. These contexts lead us to hypothesize:

H1. Players that are male will create more characters.

H2. Players that are from English-speaking countries will create more characters.

H3. Players that are younger will create more characters.

The creation of a character – or even switching between multiple characters – may also depend heavily on technical and social entry and exit costs [14]. Communities depend on high entry costs to gate the admittance of new members and maintain order through social norms, and members of communities face exit costs by losing access to the resources and social connections of the group. Games involve similar costs in that new players must learn the norms of the player ecosystem, and older players – by creating new characters – potentially lose out on markers of reputation, accumulated resources, and coded connections to other players and groups. The game mechanics and code of particular games may also affect decisions around costs: for example, some games only allow a set number of character slots to be filled, and older characters must be deleted to create new ones. Many games also have imposed limitations on how far players can progress, so restarting the game with new characters is a way to continue exploring the game world without encountering boredom through non-progression at the highest achievable levels, though again this introduces a potential loss of reputation. Social activities in games may also relate to character creation. When players interact in team and guild settings, they sometimes coordinate with each other to create certain characters that will fulfill tasks and goals. Players' positions in a social network may also relate to the amount of characters they create, as they become more involved with influential and well-connected people [30,32]. These contexts lead us to hypothesize:

H4. Accounts that are well connected to other well-connected accounts (have higher eigenvector centrality) will create more characters.

Multiple Characters in Research Methods

While the use of main and alt characters in video games revolves around many gameplay experiences, it also becomes a confound in conducting game research.

Some research uses alts for context and triangulation in understanding player motivations and experiences. For example, Nardi and Harris [26] use alts as a method in their ethnographic research for exploring the variety of individuals' game experiences in World of Warcraft (Ducheneaut et al. [9] uses a similar approach). Focusing on the role of collaborative social in WoW, they note that some players that pursued this trajectory in the game felt that playing at the highest-achievable level was not as fun as surveying the diverse range of characters and their respective classes, roles, and lore, even if it meant essentially starting from scratch. Some players even found pleasure in creating new characters and helping other new players that they encountered, drawing from their previous experiences.

More recently, as game research adapts trace data for various analyses [41] the question of multiple characters grows into a larger issue of interpretation: namely, if the translation of one character equals one human. This is especially problematic when researchers use games as proxies for general human behavior [10]. While alt characters play an important role in the exploratory and social experiences of online video games, they also introduce complications in research about understanding

Unit of Analysis	Discusses Alts?	Operationalization
Account	Yes (6 total papers)	Uses most-played character (or, if several, most recent) [[42]]; All characters collapsed into meta-values [40]; Aggregated data across characters into account-level statistics (though unclear how) [16]; Identified main character per player [30]; Connects characters to accounts in network analysis [2]; Uses primary character (most time spent playing) [38].
Account	Yes, but… (1)	But does not consider multiple characters per player in analysis [24].
Account	No (4)	Only uses total hours played per player [5]; Uses account-level variables, but uses characters to create network for analysis, and removes housing network ties between characters on same account [34]; Only uses time & play sessions across all characters [4]; Only methods discussion, but no mention [45]
Character	Yes (1)	Uses all characters (though includes limitation about nested characters per player) [33]
Character	Yes, but… (4)	Uses characters but without accounting for alts (even when mentioned) [17]; Character-level calculations but unclear if accounted for alts [8]; Creates ties between characters (but as 'players') [15]; Characters on teams, but doesn't account for multiple alts (though mentions occurrences in discussion) [28].
Character	No (3)	Uses sample of characters (unclear how many characters per player, and refers to 'players') [18]; Uses characters based on account-identified gold farmers [20]; Uses characters with account-level demographic data [32].
Unclear	No (2)	Pairs player- and character-level data with no mention of multiple characters [23]; Seems to use characters (though discusses as players) [35]

Table 1. Survey of "alt" character discussion in game literature employing server log data.

mediated experiences. As Nardi and Harris [26] note, "[I]t is common to have alts which the logging [of social ties in a research study] cannot account for. Because of alts, offline friends may still play together, providing a highly social experience. We had several such cases among our informants. Friends at different levels continue to chat. And a lower level player may request advice or assistance from a higher level friend." Wood et al. [44] note that players can have multiple alts, but in their discussion of methodological issues in online game research, they do not actually discuss mapping multiple alts to individual players as a problem.

Sampling of characters can duplicate individuals by using more than one of that player's characters. It is also unclear on an empirical level how often and how much alt characters are played and how much they would skew distributions of gameplay data. Notably, Williams et al. [42] remark, after using only one character per player (or most recent characters if multiple characters were used often), that:

> This [decision] highlights the need for better controls when considering low-centrality players. A metric reflecting a player's centrality over a longer period of time for example would have been particularly useful. Also problematic was the confound of main versus alt characters. Most WoW players have multiple characters even when they primarily play only one. Yet these alts were counted as equivalent in our initial player census efforts. Their mere presence helped establish cut-points for what a high- or low-centrality player is. So, although we are confident that our high-centrality players are high because we set a high numerical floor for them, we are hesitant to offer strong conclusions about the roles and habits of low-centrality players.

To test whether accounts and characters impact social networks, we also hypothesize:

H5. Account-level networks will result in different statistical coefficients than character-level networks.

Furthermore, statistical analyses employing character data might not necessarily account for the personal limitations of playing multiple characters (e.g., having to play one at the expense of another). While some peer-reviewed research accounts for multiple characters, not all publications do, and sometimes it is difficult to even parse if, and which, characters belong to which players. For instance, Williams et al. [42] use only one main character per player, because they admit that they "were not able to separate real-life players from the multiple characters they played" (344).

In Table 1, we present a summary of how research that employs analysis of game server log data has dealt with the multiple-character issue. Overall, there has been no holistic consensus about proper methods to account for multiple technical representation use. Therefore, in the rest of this paper, we focus on the implications of these uses in operationalizing behavioral analysis in MMOGs. We present empirical analysis of players drawn from a population sample – every character ever created – in one popular multiplayer game. From this foundation, we then show how the distinction between accounts and characters impact methods for studying social interactions in these types of games, using social networks as a point of comparison. Afterward, we conclude with a discussion of these differences on our theoretical understanding of multiple technical representations.

DATA

This paper uses the case study of EVE Online, a massive multiplayer online game. EVE was created by CCP Games and launched in 2003; as of early 2013, the game boasts of 500,000 dedicated, paying subscriptions.[1]

EVE is a space-based MMORPG, where players pilot a character through various galaxies, encountering numerous worlds and thousands of other players. The game provides the choice of creating a detailed custom avatar in one of four unique "races": Gallente, Amarr, Caldari, or Minmatar. Unlike other MMORPGs, where the player must spend time exploring the world and attacking enemies to level up ("grinding"), EVE allows players to select one skill every 24 hours and set a countdown timer to train on that skill (though the account must have at that point paid for an account subscription). Players explore the world as their skills progress. However, you can only be logged into one character at a time, and to train the skills of multiple characters at the same time, you must pay additional in-game or real currency (or create another account with an entirely separate character).[2] The game is notorious for its initial difficulty: many video game players have left the game after a few days because of its steep learning curve. Also, EVE also runs on a single server. Unlike over games, where players are usually separated by geographic location to reduce server load, all characters inhabit the same game world and have the potential to interact with each other.

Variables	**Counts/Percentages** *(some NAs not included)*			
Gender	Male 5109617	Female 282068		
		5.231%		
English-Language Countries	English 2767040	Non-English 2624645		
		48.68%		
Years Old	(1978) 941895	24 & Under 1676794	25-29 1230823	30+ 1542173
		31.10%	*22.83%*	*28.6%*
	Min	**Max**	**Mean**	**SD**
# Characters	1	407	1.875	2.289707
N = 5391685				

Table 2. Account demographics for account population.

[1] http://www.eurogamer.net/articles/2013-02-28-eve-online-500k-subscribers-and-what-ccp-learnt-along-the-way

[2] http://www.reddit.com/r/Eve/comments/2ovg7i/quick_question_on_multi character_system/

For this paper, we analyzed a dataset of game server logs from EVE Online, collected and provided by CCP. The dataset spans over 8 years of server logs, from May 06, 2003 to July 06, 2011. The dataset represents an anonymized population of EVE players, along with demographic data (gender, age, location) and aggregated gameplay data (active account [Y/N], minutes played, skill points earned, teams joined, etc.), in addition to a snapshot of the character friendship (directed edge) network taken on the last day of the collection period. In total, we look at 5,391,685 players accounts that created an account to play the game at some point, as well as 10,110,558 characters created by individuals using those accounts.

This paper presents a holistic account of players and their characters, though some data cleaning occurred. To bin accounts into clusters, we removed outliers based on excessive minutes played or number of friends in the network.

ANALYSIS

Our analysis of the EVE player population is split into two sections: first, we look at comparisons of player demographics from all characters. This examination sets an empirical baseline for multiple technical representations at scale. Then, we look at a sample of active players to compare their demographics, gameplay statistics, and social network connections, showing how methods should deal with account- and character-level differences for players who use multiple representations.

Player Population

First, we present descriptive statistics of all player accounts, shown in Table 2.

Players may create as many characters as they want, but EVE restricts accounts from keeping more than 3 characters active. Players may delete prior characters in order to create new ones. The mean number of characters created is 1.875, and the highest number of total characters created by any one account in our dataset is 407. The number of players with N characters follows a long-tail distribution: there are 3,485,807 accounts with only 1 character, 879,636 accounts with 2 characters created, and 521,560 accounts with 3 characters created. There are still 193,340 accounts that had created 4 characters (meaning they had deleted one to open up a character slot). 64.65% of accounts created only 1 character compared to 35.35% that created more than one.

When players sign up for EVE and create an account, they are asked basic demographic information, like, gender, location, and date of birth. Like other MMOGs, the gender skews toward male, but there are only about 5% self-reported female accounts.

EVE boasts a single server on which all players reside; while the most accounts identify as residing in the United States (1,834,541, or 34%), the top ten countries also include the United Kingdom (515,655), Russia (422,810), Germany (371,582), Canada (267,670), China (254,998),

France (134,565), Australia (128,370), Sweden (122,459), and the Netherlands (98,395). A number of teams in EVE draw players from similar geographies and languages, but the major language of the game remains English. Based on these self-reported locations, we coded the major English-language countries (United States, United Kingdom, Canada, Australia, and New Zealand) to compare English-language accounts' practices in character creation.

Calculating players' ages is complicated. When players sign up for an account on EVE, they are asked to input their date of birth. However, the form presents the year 1978 as the default year. A significant portion of accounts input their year as 1978, meaning that these accounts may be inaccurate as far as reporting the age of the player. Therefore, we separated any account with 1978 in the analysis. Accounts that input 1978 as their year of birth may be an artifact of accounts that were created quickly with no intention of playing (and therefore there may be a correlation with the default birth year with one-character accounts).

Active Accounts & Character Triads

While some studies have examined alt use qualitatively, no studies have looked at alts at scale. More importantly, comparison *across* alt characters has not been conducted. Below, we look at accounts that have created multiple characters, in particular accounts with three characters, to look at how demographics interact and to show comparisons across characters.

Active accounts are any that pay to sign in to the game at the time of the dataset snapshot. Amongst active accounts with characters in active character slots, there were 156863 accounts with 1 character, 123899 accounts with 2 characters, and 132228 accounts with 3 characters. Our regressions and network comparisons draw from all active accounts and characters, but to compare trace data across characters, we specifically focus on comparisons of accounts with 3 active characters.

In EVE, players are able to hold active characters in three slots and any previously-created characters must be deleted to make room for new ones. Players can delete characters, but they will be marked as not active, and therefore are not included in this analysis. Characters that remain in an active slot, even with 0 minutes played, are still considered active characters. Characters also are tagged with a character rank, or the relative order in which the character was created on the account. To combine these concepts of activity and rank, consider an account that created 5 characters in its lifetime. If this account deleted the second and third characters, the active characters for this account would be first, fourth, and fifth.

Rank 1	Rank 2	Rank 3	Total Number of Accounts
1	NA	NA	3485807
1	2	NA	540881
2	1	NA	338755
1	2	3	159021
1	3	2	147734
2	3	1	84186
2	1	3	82934
3	2	1	58408
3	1	2	51743
1	4	3	22848
1	4	2	21929
1	3	4	19730
1	2	4	17784
2	1	4	11268
2	4	1	10063

Table 3. Most Common Permutations of Character Rank.

	Min	Max	Mean	SD	Median
Characters	3	227	5.386	4.23	4
Minutes	0	3299412	145071.29	144963.59	102548
Friends	0	5939	53.134	70.14	33
Gender	1	2	1.961	0.194	2
English Language Country	1	2	1.437	0.496	1
Years Old (Bin)	1	4	3.093	1.035	3

Table 4. Descriptive statistics of account-level variables.

For context about character creation in relation to active character use, in Table 3, we show which characters in order of creation per account (based on the top 15 combinations) have been held in the top 3 ranked character slots (by most minutes played). Overall, the first 3 created characters are the most played, and even more the first character created tends to be the most played overall. Only until the 10th combination of characters do we see a 4th character appear (meaning that one character at some point was deleted that had fewer minutes than the 4th).

Dependent Variable: ***Number of Characters Created***	
Minutes	1.0000759***
	(0)
# Friends	1.0015790***
	(-0.00002)
Gender [a]	1.1274052***
	(-0.005)
Country Language [b]	0.9791297***
	(-0.002)
24 and Under[c]	0.8405719***
	(-0.004)
25-29[c]	0.9297656***
	(-0.004)
30+[c]	0.9435625***
	(-0.004)
Constant	2.3569338***
	(-0.006)
Observations	391,669
Log Likelihood	-735,826.70
Note: *p<0.1; **p<0.05; ***p<0.01	
N = 412,990	
[a] Reference category= Female	
[b] Reference category= English-Speaking Country	
[c] Reference category= "1978" default year	

Table 5. Negative binomial regression predicting number of characters created.

Comparing Demographics

Earlier, we presented descriptive statistics showing for each account in the game the self-reported demographics of players. To show the relationship between those demographics, we ran a negative binomial regression to predict the count of characters created by active player accounts. We relate account gender, country language, and age to each other, controlling for minutes played total and number of friends total for all characters on the account.

In Table 5, we show the incident rate ratio (or exponentiated beta; with standard error in parentheses). These results support all three of our hypotheses (H1-H3). The model demonstrates that creating more characters is significantly related to (H1) being male (exp(β) = 1.127, or 1.127 times more likely per increase in # characters), (H2) being from an English-language country (exp(β) = 0.979, or 0.979 times less likely to be non-English per increase in # characters), and (H3) being a younger player (exp(β) = 0.840, or 0.840 less likely to be the default 1978 when compared to 24 and Under). Further, creating more characters was significantly related to our controls: more minutes played and more friend connections made (though the coefficients for these variables were very small).

Comparing Gameplay Across Character Use

To look at the differences across gameplay experiences, we first bin accounts by character use.[3] We use active accounts that have three active character slots filled. Ordering each character by the total number of minutes played per account, we employ unsupervised k-means clustering to separate player accounts into k=5 clusters based on the total number of minutes played per character[4]. This technique resulted in an automatic separation, based on the relationship *across* characters, between accounts that primarily play with 1 character (in low, medium, and high amounts), accounts that mainly use 2 characters, and accounts that use 3 characters. The distribution of accounts in each of these clusters is presented in Figure 1 below. This allows us to break all active accounts into five binned groups for further analysis.

Time: Minutes & Skillpoints

The k-means algorithm separated each of the five clusters based on minutes per active character. In Figure 2, we illustrate the breakdown per character of minutes played based on these clusters. As we described above, we see the breakdown of the clusters illustrated: one group of low engagement accounts, two groups with accounts that focus on one character (medium and high minutes of play, respectively), one group that focuses on two characters, and a final group that focuses on three characters.

Next, we examine accumulated skill points. In EVE, players can train particular skills of their characters in order to progress further through various parts of the game. Unlike other MMORPGs, players in EVE do not attack enemies to level up. Instead, they activate a timed countdown. Players can walk away from this "training" and even shut down their computer while the countdown progresses. However, only one character per account may train a skill at a time (unless the user pays money to do more). Still, higher numbers of skill points act as another marker of dedication to a particular character. We show total skill points per character per cluster in Figure 3.

[3] Using accounts with three created active characters allows us to more-easily compare across character trace data. We recognize that accounts with two characters could be compared as well, but accounts with three active character slots illustrate a good range of single, double, and triple character use cases.

[4] Five clusters were chosen based on the results of calculating principal components in a scree plot.

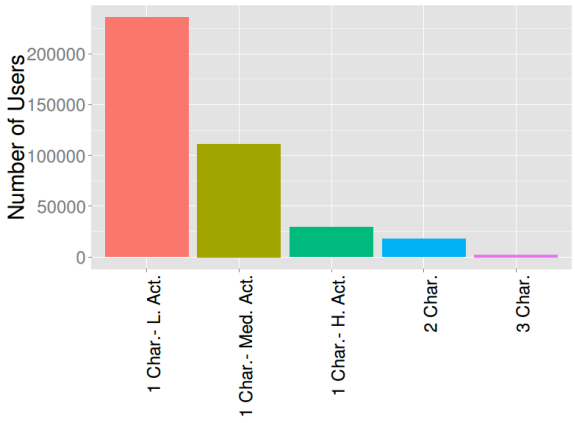

Figure 1. Number of accounts per cluster.

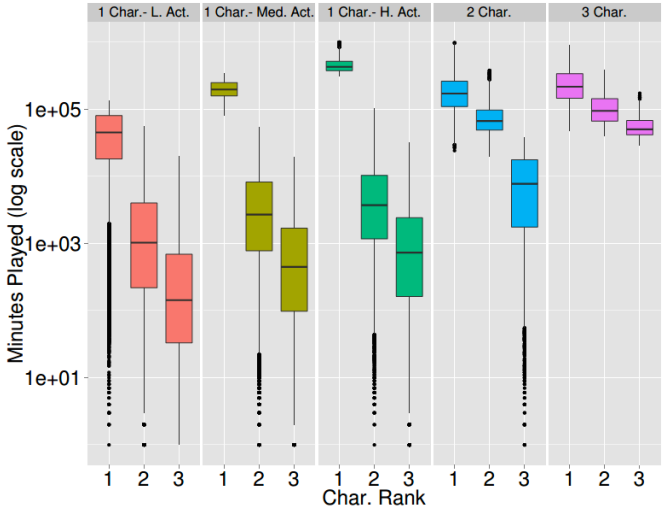

Figure 2. Distribution of minutes played per active character across clusters.

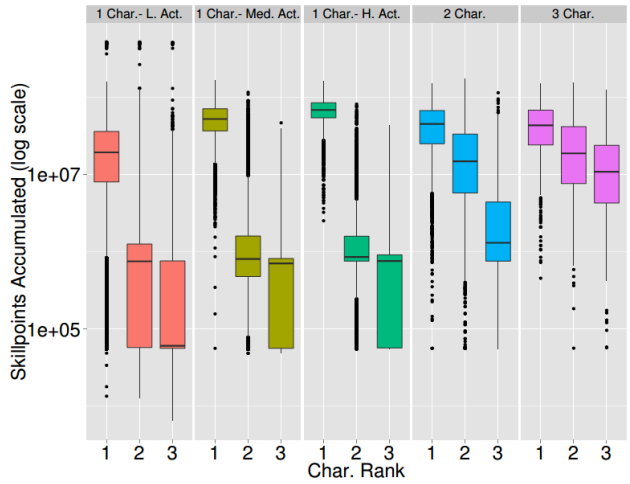

Figure 3. Distribution of skillpoints per active character across cluster.

Avatar: Gender & Race

Avatars play an important role in MMORPGs, because they are the visual representation of the player in the game world. Most modern games provide advanced customization of avatar design and fashion, and avatars do not need to correspond to out-of-game human characteristics. Therefore, different avatar designs across multiple characters may act as a marker of exploration of different facets of a game. We compare multiple characters regarding differing in-game character design.

While most games tend to revolve around male or female avatars, players do swap the gender of their characters compared to the gender of themselves. Research has shown that men tend to change avatar gender more than women [19] though both sides exhibit this behavior to a small degree. In Figure 4 and Table 6, we show how character gender changes across multiple characters. For each cluster, and for all character pairs, we see that most of the time players will stick with the same character gender.

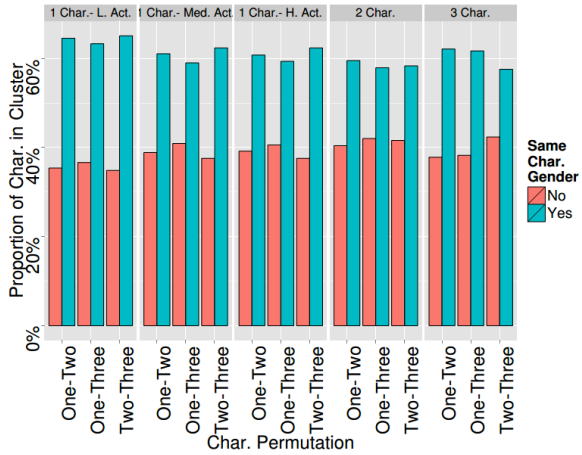

Figure 4. Differences in paired-character gender choices for accounts with three active character slots.

Characters 1 & 2	Characters 1 & 3	Characters 2 & 3	N
Same	Same	Same	58421
Different	Different	Same	25843
Same	Different	Different	24894
Different	Same	Different	22902

Table 6. Most common permutations of character gender.

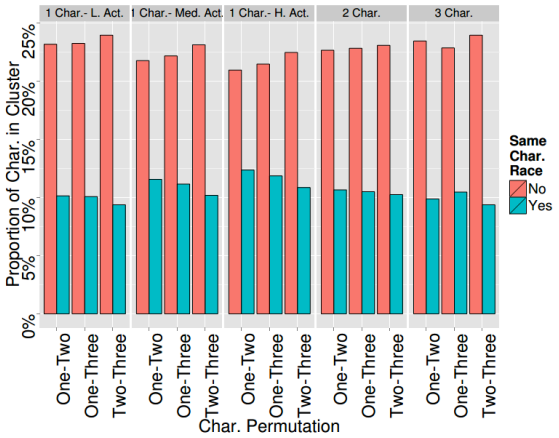

Figure 5. Differences in paired-character race choices for accounts with three active character slots.

Characters 1 & 2	Characters 1 & 3	Characters 2 & 3	N
Different	Different	Different	46003
Same	Different	Different	24104
Different	Same	Different	23318
Different	Different	Same	20221
Same	Same	Same	18414

Table 7. Most common permutations of character race.

Character race is another mechanic through which players can explore different aspects of the game world. Unlike gender, in MMORPGs a character's race, lineage, and other sociocultural attributes tend to be more diverse and imaginative. Frequently, game designers will link a character trait like race to different or at least varied gameplay styles. This is the case in EVE, where different races lead to different classes of ships and other gameplay content. In Figure 5 and Table 7, we explore how character race changes across multiple characters. For each cluster, and for all character pairs, we see that most of the time players will alter their character's race.

Relationships: Team Diversity & Social Network Structure

In many multiplayer online games, players are given ways to express connections to friends, enemies, and teammates.

Guilds and social networks can be constructed as representations of these relationships. Teams are frequent occurrences in online multiplayer games, because they help retain players while also adding additional limitations to progression (namely that you need to work with other people to beat difficult areas). Games also help players

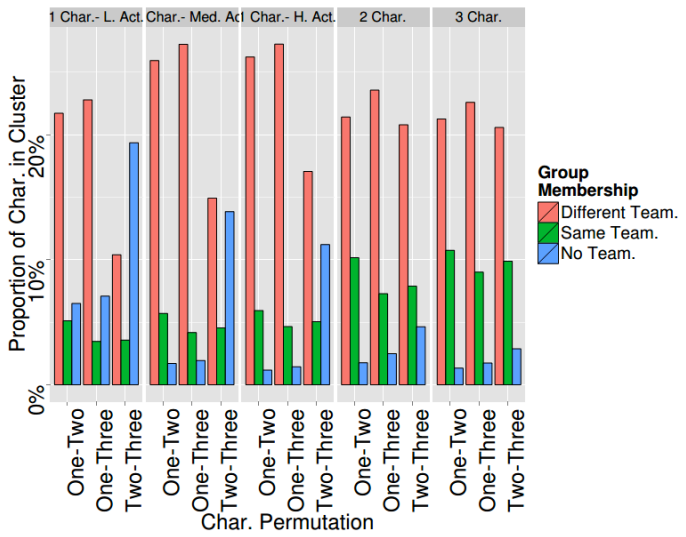

Figure 6. Number of users with characters in the same in-game organization per cluster.

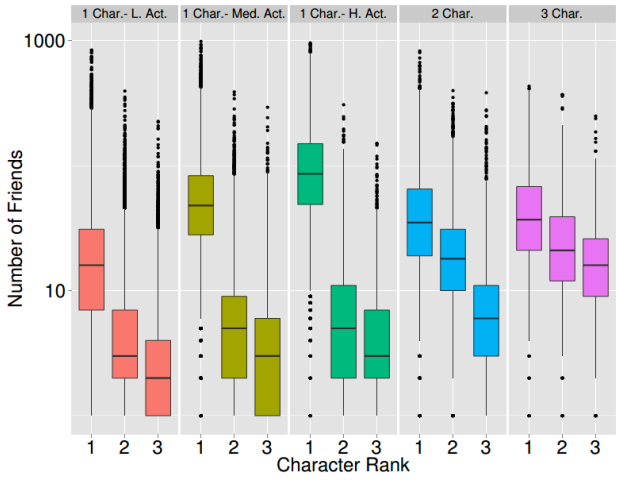

Figure 7. Number of friends per cluster.

connect with each other, through in-game chat, trade, combat, and other mechanisms for marking social relations.

In EVE, players may create their own guilds called "corporations." Corporations allow teammates to work together to collect resources and fight other teams in combat. To look at guilds, we take each character per account in each of the five clusters and compare at the time of the snapshot if each pair of characters was in the same guild, a different guild, or no guild. The results are presented in Figure 6. Overall, the data shows that as more characters are used, the placement in the same guild occurs more frequently across all three characters. Also, as fewer characters are used, the chance of one of those characters not being in any player-created guild increases.

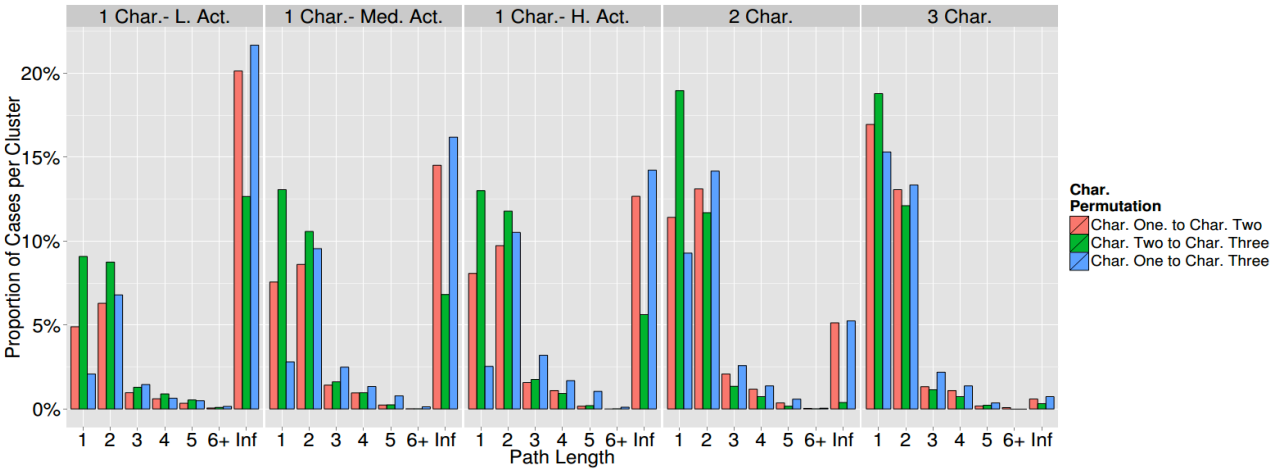

Figure 8. Path length per character pair per cluster.

In-game interactions, such as chatting with one another, trading items between players, or even sharing private living quarters can also connect players in similar networked relationships. Though little research has been conducted on players' motivations to create (or to refuse making) traces of connections between acquaintances, both offline and in-game social networks greatly impact the way that players experience games [33]. Therefore, these networks have been used as markers of social connections and proxies for social value (like social capital) [35].

Since social networks can represent an important part of the player experience, one question we ask is how much do players replicate social connections across their multiple characters. Do players keep their alts close, or do they explore far reaches of the game world using distinct and separate trajectories?

First, we look at how many friends an account's characters possess; these numbers are presented in Figure 7. Just like with minutes and skill points, we see a similar distribution of friendship numbers: for one-character accounts, the other two characters do not have many friendships with other players, while for two- and three-character accounts, friendship connections are made more frequently on the alt characters. Also, we again see accounts that are highly active with one character generally creating more friendships than the two- and three-character accounts, which fits with the results of our earlier regression.

Keeping these differences in mind, to examine the way in which characters are connected to each other in the friendship network, we created a large social network graph, where characters are nodes and edges are friendship connections. These friendship connections were any friendships established at the time of the data collection snapshot. For characters with no friendship connections, we include them in the graph as unconnected isolates. In total, there are 801,346 nodes (222,837 of which are isolates) with 6,453,627 edges.

In order to examine how characters are relatively connected in the social network, we look at "path distance" as a metric of closeness within the network. The path in a network graph is the number of edges between two nodes, and path distance generally describes how "far apart" two nodes are in a network. If nodes are well-connected, the path distance will be lower; if path distance is high, nodes are less connected (and may suffer from issues like structural holes [26]). If the user's characters are not connected within the social graph they are assigned a distance of infinity. In general players pursue a mixed strategy, forming closed and tightly knit groups with trusted companions but still reaching out and forming new relationships as a source of novelty or information [34]; however, it is unclear how multiple character use affects social network structure.

We illustrate path distance in the EVE friendship network in Figure 8. Generally, for accounts that focus on one character, we see high rates of unconnectedness (mainly due to the fact that many of the alt characters have few to no friendship connections, or if they do, they are likely isolated from the primary network component). The path length occurrences increase for two- and three- character accounts. More importantly, though, for those characters that are connected, we tend to see an account's characters connected at path distances less than 3. A path length of 1 means that characters are direct friends; a path distance of 2 means they are connected indirectly, by one other character.

Surprisingly, the results show a high rate of path distance 2, particularly for the second-to-third character pairing. This means that instead of a well-connected triad between all three of an account's characters, we see a relatively high rate of direct connection between first-and-second and first-and-third characters. In other words, instead of a connected triangle, alt accounts tend to be connected in a hub-and-spoke model (where the main account acts as a "headquarters" for the friendship connections to the other characters). In network terms, we see a higher rate of brokerage than triadic closure [34,39].

Dependent variable: Number of characters created		
	User Graph	*Character Graph*
Eigenvector Centrality	1.1250816***	0.9353637***
	(-0.025)	(-0.02)
Days Played	1.0018179***	1.0013727***
	-0.00004	-0.00004
Gender [a]	1.1525448***	1.1328196***
	-0.021	-0.02
Country Language [b]	0.9932292	1.0025698
	-0.007	-0.007
24 and Under[c]	0.9195538***	0.8846117***
	-0.014	-0.014
25-29[c]	0.9630993***	0.9379363***
	-0.014	-0.013
30+[c]	0.9843754	0.9908913
	-0.013	-0.012
Constant	3.2192247***	3.7055173***
	-0.025	-0.023
Observations	35,255	38,003
Log Likelihood	-83,504.24	-91,142.18
*Note:*p<0.1; **p<0.05; ***p<0.01*		
[a] Reference category= Female		
[b] Reference category= English-Speaking Country		
[c] Reference category= "1978" default year		

Table 8. Negative binomial regression, predicting number of characters created, in two types of social network graphs

To further test the discrepancy between operationalizations of players, we ran two regressions predicting number of characters created, first using a social network made up of characters and then a social network made up of users (with aggregated statistics). The results demonstrate a difference between networks constructed from account- vs. character-level perspectives. Subgraphs for active accounts and characters were created from this original network graph for these analyses.

Given the size of the social network, analyzing the entire structure is a challenge. However, the social context of EVE Online – namely, that players coordinate frequently in teams without interacting with many other players in the entire universe – suggests that we focus our efforts not on the entire graph but on subsections of it. Because a player may be on the periphery of the entire in-game graph but quite central or influential within their own local team, we draw subgraphs of networks from a range of in-game teams.

When calculating network centrality measurements and other statistics, we generally favor either local metrics such as degree (total number of connections per account) and clustering (how many of an account's friends are connected to each other) or establish broader centrality scores within a player's team and allies. Therefore, we chose to select 222 subgraphs, representing the largest in-game player team networks (each with over a hundred members), to establish centrality scores on a team level as opposed to the entire graph. This approach ensures that each centrality score reported represents how influential or well-connected an account is within its immediate and more-relevant social setting.

The model on the left side of the table takes every user as a node within a series of subgraphs drawn from the top teams within EVE, while the model on the right uses characters as the basic unit of representation. Most of the findings align across network models in magnitude and direction, with the exception of eigenvector centrality. In the model based off of the user graph, eigenvector centrality is positively associated (exp(β) = 1.1251) with creating more characters within EVE. Importantly, the effect is *reversed* for the character graph (exp(β) = 0.9354). Thus, we do see support for H5: that account-level and character-level network centrality coefficients will differ. This finding complicates H4 – that higher eigenvector centrality will be related to more characters – because depending on the technical user representation theory and approach applied to the statistical model, conflicting results emerge.

DISCUSSION

This paper uses the case study of a large MMORPG to illustrate the creation and use of multiple technical user representations (accounts and their respective characters). We examine a population of users from EVE Online across 8 years of player data since the game's launch, showing empirical evidence for multiple character use at scale and demonstrating – from a methodological perspective – how multiple characters can complicate statistical tests, especially when it comes to social networks.

Mains and Alts: Creation & Use, Method & Theory

The first half of this paper showed that accounts still tend to create only one character. However, it is not uncommon to fill out the three possible character slots, and there remains a long tail of multiple character use. Earlier in this paper, we pointed to scholars that had mentioned or examined alts qualitatively, showing that it was certainly a practice amongst many game players, but they could not describe exactly how common the practice was at scale. This finding confirms most of the qualitative insights from interviews and coincides with prior sampling distributions, but it is the first time a holistic set of statistics for the use of multiple technical representations has been calculated.

The question then is how much and in what ways these characters are played. Players that dedicated themselves to more than one character, as we show above, are definitely in the minority, but they provide us insight into the differences *across* characters when multiple are used. There are also distinctive differentiating trends amongst player demographics regarding character creation. We show above that there is a statistically significant difference between men and women, players at different ages, and players from primarily-English-language countries. In general, it appears

that all types of players are willing to explore creating multiple technical representations. While we do not have data related to gameplay styles, the next step in future research would be to examine demographic differences and how they relate to multiple character use as far as motivations and gameplay choices, to see how these multiple characters are used in different ways.

The second half of this paper examined how gameplay and social relationships differed across multiple character use. Looking at all active accounts that had created three characters at the time of the data collection snapshot, we clustered and generated five general categories of accounts: three that primarily use one character to varying degrees, a fourth that primarily focused on two characters, and a fifth where all three characters are used to a large extent.

Differences in Character Choice and Use

First, we explore the question of activity, related to minutes spent playing and skill point accumulated on each character. Because the clusters were generated from minutes played, we see a distinct separation related to how characters are used in comparing all three characters across the five clusters. Again, this clustering technique looks at the relationship between all three characters (so while some players may play with one character just as much as another cluster, their second and third characters differ between clusters). We also see a similar trend in relative skill points accumulated per character across the five account clusters.

The interesting insight into multiple character use related to playtime minutes and skill points is that accounts that tend to dedicate gameplay to one main character play more and gain more skill points than accounts focused on two or three characters. Of course, this finding relates back to our coverage of entry costs at the beginning of the paper: dedicating time to alts means not being able to play on the main character.

For avatar-related decisions, we do not see any great difference across multiple character use related to character gender and race. Overall, the general trend remains the same whether an account focuses on one main or multiple alts: the character gender will frequently be the same, but the character race will frequently be different. Character race directly relates to how players progress at a gameplay level in EVE: therefore, choosing different races in EVE likely reflects players' needs to explore more of the game. On the other hand, for gender, it appears that this avatar attribute reflects a personal level in the game, since gender has no impact on gameplay. This large-scale empirical finding falls in line with the qualitative and smaller survey literature on avatars, gender, and roleplay [6,19,40,43], where exploring gender is not a common practice.

Differences in Social Behavior and Networks

Finally, and most importantly, we do see differences related to multiple character use in how these characters are used socially. Just like minutes and skill points, friendships increase as one-character accounts are played more, and decrease slightly for two- and three-character accounts. We also see much better-connected characters as the number of minutes and alt characters increases. However, and this is a critical finding for the interpretation of in-game social networks: we see much more brokerage (path distance of 2, reflecting a hub-and-spoke model) than triadic closure (path distance of 1 between all three characters). This may explain previous findings which correlated brokerage with in-game success [34]. Instead of representing characters interacting with disparate parts of the social graph within a game inter-character brokerage demonstrates how a single user can use multiple characters as supports for one primary account.

The network comparison provides the most critical point in considering an individual's technical representation. The regression results presented in Table 8 generally confirm the findings from Table 5 regarding the relationship between time played and demographics to character creation. However, this table demonstrates different operationalizations of technical user representations and shows how they can influence the results of a given study.

As we stated earlier, the eigenvector results reverse given account- or character-level construction of the network. This change can be explained as an interaction between player behavior and the way eigenvector centrality is calculated. As demonstrated in Figure 10, active players tend to keep their alternative accounts adjacent to each other within the in-game social network. This inflates the number of ties between their characters and thus changes each character's eigenvector centrality, creating a correlation between an account having more characters and an account's network position. In other words: the more-active alt characters that the player has close by in the network, the higher their centrality.

To note, this result is complicated by the technical limitations put in place by the game developers. Each account is limited to only three active character slots, so a character with three alts will have the highest rate of centrality inflation but also the highest cost to creating a new character (as they will have to delete on of their existing avatars to make room for a new one). This situation results in a negative association between eigenvector centrality and total characters because as centrality is inflated, the cost of creating a new character multiplies.

Collapsing the network so that nodes represent users does away with this inflation and demonstrates that more-central players are more likely to have more characters. While the exact mechanism behind this correlation requires further study, we speculate that this may be a case where the total number of characters created serves as a proxy for experience or expertise within the game, leading to greater influence and status within the in-game social network.

Beyond time dedicated to characters, the use of multiple characters has important implications for gameplay choices and especially the interpretation of server log data at an account level. Below, we dive deeper into the differences across the gameplay clusters.

The finding about path distance has critical implications for the analysis of in-game social networks. Social network analysis can suffer from sampling and ideally should be conducted with the entire network; however, even with an entire network, multiple character use introduces a confound of ego network structure that may skew social network results significantly by inflating the rate of brokerage seen in structural surveys of in-game networks.

The phenomenon of multiple character use is an important cultural and methodological hurdle to understanding technical user representation and behavioral interpretation from server log data. Based on the results, especially when employing social network analysis, we recommend that future research control for multiple characters per account. Beyond methodology, however, sociotechnical theories should also consider these implications to a higher degree.

When we conceptualize participants within a sociotechnical system, we need to challenge the ease of mapping one individual with one user account with the evolving practices of using multiple profiles, characters, and other representations. Our theories about individual representation currently focus on a wide array of emergent practices (again, see the literature on MPM at the beginning), but on a quantitative level, we do little to support or challenge emergent practices around multiplicative identity. This paper contributes to our theoretical understanding of multiple technical representations by establishing a baseline for how often these behaviors occur and how we can further think about their influence on participants and researchers in sociotechnical systems.

Limitations

While this paper provides an empirical and methodological contribution in the use of multiple technical user representations, it does have some limitations. First, while we were granted access to a large portion of the server log data from the population of EVE players, we did not have granular, longitudinal data about in-game actions. Therefore, while we use the snapshot of gameplay statistics taken at the end of the collection period, more varied data would illuminate the variations in gameplay styles that we could not discuss in this paper. Also, additional population data across a variety of games – and especially other social media platforms, for generalizability – would allow comparisons as to how the design of account and character creation, as well as in-game mechanics, influence the rate of adoption and methods of use of multiple avatars.

Second, while players can create multiple characters, they can also create multiple user accounts. The motivations in an MMOG setting for creating multiple accounts are varied: for example, limitations on character creation, the structure of monetary transactions to pay for additional characters, or other game mechanics that limit gameplay in certain ways may lead players to adopt multiple, separate accounts. In the case of EVE, players cannot train multiple characters at the same time, so creating multiple accounts is one method to achieving better characters. Further, there is an additional financial incentive, where players can pay money to train multiple characters.[5] Finally, the cultural atmosphere of intrigue and spying within the EVE universe may prompt some players to adopt multiple accounts to hide themselves when conducting covert operations against other players. Players sometimes boast they own multiple accounts.[6] Our analysis of the dataset cannot tease apart multiple accounts owned by distinct individuals.

Finally, because we only look at server log data, we do not have insights into the motivations and strategies that players exhibit and employ when creating and using multiple character avatars. Future research could pair server log data with survey data to examine at a high level and large scale what kinds of personalities and decisions lead to the adoption of different technical identities. Another possible limitation is the possibility that one account may represent multiple people sharing characters. Further survey and interview research is needed to establish its prevalence.

CONCLUSION

People use multiple accounts, profiles, and characters for a variety of reasons, from privacy to exploration. Even as sociotechnical systems continue to evolve and introduce new designs for identity, emergent behaviors - like the creation of multiple technical user representations - will introduce unique practices and keep challenging research into human behavior. This paper explores the creation and use of main and alt characters in a massively multiplayer online game to present an empirical study of alternative character use at a population level. We show the differences across different amount of character use, particularly related to behavioral data, and argue that not accounting for multiple characters can skew the results of certain analysis, such as that of social networks.

ACKNOWLEDGEMENTS

We would like to thank Dmitri Williams and Brian Keegan for reviewing early drafts of this paper, as well as our anonymous reviewers and Eric Gilbert. Thank you also to CCP for providing the data for this paper. This research has been supported by USC Annenberg Graduate Fellowships.

5 http://www.reddit.com/r/Eve/comments/2tolq9/ccp_please_enable_the_ability_to_login_multiple/

6 For example, see http://www.reddit.com/r/Eve/comments/2zowjf/how_many_accounts_do_you_have_and_what_alts/

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