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The psychological functions of avatars and alt(s): A qualitative study

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ABSTRACT

Prior research has shown that approximately 50% of active participants in the 3D virtual world of Second Life have one or more secondary avatars or "alts" in addition to their primary avatar. Thus, these individuals are operating a "multiple or poly-identity system" composed of a physical self, a primary avatar, and one or more alts. However, little is known about the functions these virtual identities serve for the virtual-world user. The current study involved qualitative analysis of semistructured interviews with Second Life participants ($N = 24$) who had a primary avatar and at least one alt. Interviews were coded to examine the functions that primary avatars and alts served. Eight functions—seven suggested by previous research on virtual world identity and one that emerged from analyses—were reflected in a large majority of the transcribed interviews and are described in the article. The current findings add to our understanding of how multifaceted identity systems operate, as more individuals augment their physical self with a set of virtual identities.

1. Introduction

Prior research has shown that a significant portion of participants in the 3D virtual world of Second Life operate one or more secondary or alternative avatars (often referred to as "alts") in addition to their primary avatar (PA). In the first study to examine the phenomenon of multiple avatar accounts, Ducheneaut, Wen, Yee, and Wadley (2009) found that the average user of Second Life has a total of three different avatars per account – a PA and two alts. Similarly, Foss and Gilbert (2009) administered an Alt Usage Questionnaire to 225 participants who had been residents of Second Life for more than 6 months and found that approximately half of them operated one or more alts in addition to their PA. Subsequently, a study by Gilbert, Foss, and Murphy (2011) yielded specific estimates of alt usage among the overall user base of Second Life: 18% of participants had 1 alt, 14% had 2 alts, 7% had 3 alts, and 12% had 4 or more alts. Thus approximately 50% of experienced Second Life users operate what can be termed a "multiple identity" or "poly-identity" personality system composed of three or more constituent identities – a physical self (PS), a PA, and one or more alts.

According to a popular source that provides Second Life metrics[1], this platform has become the most prominent, adult-oriented, persistent 3D virtual world with a global user base of over 35 million accounts. Within the platform, users, in the form of avatars or customized 3D representations of the self, are able to socialize, explore, work, engage in creative projects, form intimate relationships and, in general, to participate in a persistent 3D world that acts as an alternative context for human interaction. In recent years, the growth and psychological complexity of Second Life has attracted the attention of social scientists and a body of research on the psychology of avatar use has begun to develop (see, for example, Behm-Morawitz, 2013; Guitton, 2012; Kafai, Fields, & Cook, 2009; Kim, Lee, & Kang, 2012; Lomanowska & Williams, Kennedy, & Moore, 2010; Guitton, 2012). However, within this emerging literature, very little is known about the dynamics of multiple identity systems across the physical and 3D virtual realms and a number of central questions regarding their operation have yet to be addressed. These include: How do the constituent identities that make up the multiple identify system interact to form a complex psychological structure? Do the virtual personas have different functions relative to each other and the physical self within this cross-realm psychological organization?

A review of the literature on identity in online virtual worlds suggests the presence of at least seven psychological functions of primary avatars and alts within a multifaceted identity system operating across the physical and virtual realms. Three of these core functions of avatar identities are specific to the PA, three are tied to alts, and one is a common or joint function of PA and alts.

With respect to primary avatars, the first function carried out by the PA is to *maintain a persistent identity in the virtual world*. This involves establishing stable connections to other avatars and the virtual community as a whole by having a consistent name, appearance, set of activities, and group affiliations. As Jakobsson

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[1] http://danielvoyager.wordpress.com/sl-metrics/.

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(2002) noted, despite the flexibility of identity in online worlds, "there exists a social pressure in virtual worlds to maintain a stable primary identity" (p. 74). Furthermore, Childs (2011) argued that the concept of a constant or persistent identity in virtual worlds is similar to the physical world notion of "nominal identity" described by Manders-Huits (2010), whereby a fixed set of identifiers are associated with a person so that he/she can be recognized or distinguished by others and by society in general.

A second function of PAs is to *extend the physical self (PS) into the virtual world*. This involves taking on physical or personality traits that are consistent with traits possessed by the PS, or engaging in activities within the 3D environment such as employment or education that mirror activities that the PS is engaged in within the physical world (Evans, 2011; Wallace and Maryott, 2009).

The third function carried out by the PA is to *enhance the PS within the virtual world*. This is reflected in the tendency of primary avatars to embody a more youthful and attractive appearance than their physical self (Ducheneaut et al., 2009), convey more positive personality characteristics (Bessiere, Seay, & Kiesler, 2007) and, in general, to express a more authentic or idealized version of the self (McKenna, Green, & Smith, 2001; Przybylski, Weinstein, Murayama, Lynch, & Ryan, 2012).

A fourth function, one that is shared with that of the alt, involves *diversifying the PS in the virtual world* by adopting a different (though not necessarily enhanced) gender, race, age, personality, or lifestyle – a process termed "identity tourism" by Taylor (2002).

With respect to the possible functions of alts, the existing literature is extremely limited. However, an empirical study by Gilbert et al. (2011), which also noted the four avatar functions previously mentioned, suggested three possible functions of alts or secondary avatars. The first is to *diversify the PA*, which involves the alt engaging in identity tourism (as described above), such that the alt takes on characteristics that are different from those of the PA. The second alt-specific function is to maintain the anonymity or *"anonymize" the PA.* This function involves creating an alt so that the user is able to be in-world privately, without his or her virtual friends and acquaintances being notified. Finally, alts can function to *multiply the PA's virtual presence* for pragmatic purposes. Because the primary avatar and an alt can be in-world simultaneously (if either two computers are used or one computer is enabled to run two virtual world viewers at the same time), the alt can assist the primary avatar with tasks that are more easily accomplished by a dyad, such as testing a product or an animation that is intended for use by two avatars (such as a dance or sexual animation for a couple), or working in a virtual club or shop while the primary avatar is exploring or socializing.

Efforts to understand the workings of multiple identity systems across the physical and virtual realms are important for two reasons. First, according to Kzero[2], a UK market research group that publishes quarterly population data on various segments of the 3D universe, worldwide avatar accounts in persistent 3D worlds exceeded 2 billion in 2013, up from approximately 400 million at the end of 2008 and 1.1 billion at the end of 2010. Given the rapid rise in virtual world participation, and the previously noted tendency for users to operate multiple accounts, it is inevitable that the number of poly-identity systems occurring across the physical and 3D realms will significantly expand. Second, the growing use of 3D identities is co-occurring with the proliferation of digital personas in 2D platforms such as social networking sites. Thus, the presence of multiple identity systems across the physical and 3D realms may be embedded within a larger, emerging tendency to distribute the self, and create multifaceted systems of identity, across a complex array of 2D and 3D digital platforms (Gilbert & Forney, 2013).

Given proliferating digital personas and multifaceted identities, the effort to understand the functions served by constituent identities operating in the physical and 3D realms is a constructive development. However, although the extant literature suggests the functions described above, no study has empirically examined whether these functions exist and how prevalent they are in a single investigation. Thus, in order to advance our understanding of multi-component identity systems across the physical and 3D realms, the current study investigated whether, and to what extent, the avatar and alt functions described above were reflected in a set of in-depth interviews with Second Life users who operate multiple avatars.

2. Method

2.1. Participants

Participants ($N = 25$) were Second Life users. They were recruited via posted announcements in the Second Life Events Calendar, notices sent out to heads of large groups representing major constituencies in Second Life (e.g. social, business, educational, and artist networks), and word-of-mouth communication and offered 1000 Lindens (virtual currency equivalent to approximately four US dollars) as an incentive to participate. To take part in the study participants needed to be at least 18 years old,[3] have sufficient English proficiency to participate in an in-depth interview in English, and to have been a resident of Second Life for a minimum of 6 months to ensure a depth of knowledge of the virtual platform. In addition, they had to have at least one alt in Second Life in addition to their primary avatar.

One female participant did not appear to understand the interviewer's questions and thus was dropped from the sample. The remaining sample ($N = 24$) consisted of 18 females and 6 males who ranged in age from 18 to 64 ($M = 34.3$, $SD = 13.9$). The racial/ethnic distribution of the sample was 71% ($n = 17$) White, 13% ($n = 3$) Other/Mixed Race, 8% ($n = 2$) Hispanic, 4% ($n = 1$) African American, and 4% ($n = 1$) who did not report racial/ethnic background. Participants reported having been Second Life users for an average of 4.4 years ($SD = 1.7$). In addition to their primary avatar 67%, ($n = 16$) had one alt, 21% ($n = 5$) had two alts, and 13% ($n = 3$) had three or more alts.

2.2. Procedure

Individuals who expressed interest in the study were contacted by an interviewer via in-world instant messaging to arrange a mutually convenient time to conduct the interview. All interviews took place in the interview area of a virtual psychology research laboratory located within Second Life. When a participant's avatar arrived at the lab, the participant was queried regarding their physical world age, English competency, and their duration of residence in Second Life. Individuals who met these screening criteria and expressed interest in the study reviewed an informed consent form online (housed on a 2D website) and provided their consent electronically.

The interviews that followed were semi-structured, with the interviewer using a protocol composed of open-ended questions (Appendix 1) and probing for additional information when needed.

[2] www.kzero.co.uk/blog/universe-charts-q2-2013/.

[3] In addition to asking participants to report their age in the study, the Second Life terms of service require participants to be at least 16 years old and to provide credit card information to verify their age at sign up. However, online research provides no definitive mechanism for verifying participants' ages. That said, nothing in our interviews led us to suspect that participants did not meet the age requirement.

Participants were first asked to describe their primary avatar, then their physical self, and then each alt. For each of these constituent identities, participants provided information about physical attributes such as gender, body type, and race/ethnicity; personality attributes as defined by the Big 5 Personality Inventory (John, Donahue, & Kentle, 1991); and social attributes such as relationship status, sexuality and sexual experiences, and the prevalence of friendships. Additionally, participants were asked to report on the ways in which they used their PA and Alt(s) (e.g., did they perceive their PA as a form of role-playing, and why did they use their Alt instead of their PA). Given the breadth and depth of the assessed content, the interviews tended to be quite long, with an average length of 129 min (*SD* = 35.8).

At the conclusion of the interview, participants were thanked for their involvement in the study and 1000 Lindens were electronically transferred to their Second Life accounts. All interview transcripts were then exported from Second Life Chat (an in-world function that stores recent conversations) to a *Microsoft Word* file for coding.

2.3. Coding

Code development: Coding schemes were developed using theoretically driven (“top-down”) and to a lesser extent data driven (“bottom-up”) approaches (Braun & Clarke, 2006). With regard to theoretical approaches, the seven functions suggested by prior research summarized in the Introduction section were used to frame code development and yielded seven codes. In addition, the interview data suggested that an additional code, *Reverse Enhancement*, was needed to account for a function that had not been previously proposed but that was consistent with existing research on the outcomes of virtual world participation (a point that is elaborated on in the Discussion). Specifically, this additional function—which we refer to as “Reverse Enhancement”—involved cognitive, social, emotional, or physical benefits to the physical self that participants perceived as resulting from their virtual world activities. This function was different from the others in that it emerged from the data itself (bottom up analysis) and importantly, while the other functions all referred to activities and experiences that took place *within* the virtual environment, Reverse Enhancement involved outcomes that transferred to the physical world. Thus, as depicted in Fig. 1, Reverse Enhancement was included as an eighth item in a proposed model of functions that could be served by PAs and Alts.

Code development proceeded as follows: Our research team, comprised of the authors, read and discussed a small subset of interviews ($n = 4$) and identified statements that were illustrative of each element in the model. Coders then worked in pairs to code each of the four transcripts, with each pair working independently of the other. When a disagreement occurred in coding, members of the coding pair discussed the disagreements and clarified the coding categories in order to resolve the disagreement. This process occurred iteratively, one transcript at a time for four transcripts until stable definitions, examples, and coding rules for each code were achieved. Descriptions of each code along with examples are summarized in Table 1.

Coding: After establishing coding rules, two coders independently coded all of the remaining transcripts. In this final coding, a small number of disagreements occurred between members of the coding pairs. These were discussed with the lead author and resolved to consensus.

Because coding decisions were reliant on comparisons with the physical self, coders had to first generate a profile of each participant before they could accurately code a transcript. Using the template depicted in Table 2, coders noted (a) physical characteristics (including gender, body type and age), (b) cultural background/race/ethnicity, (c) personality attributes, and (d) social/occupational roles, activities, relationships, and sexuality for the physical self, primary avatar, and alt, respectively. Table 2 reproduces a condensed version of a profile for one participant. The role of the template was to facilitate comparisons between the physical self, primary avatar, and alt and thus reduce cognitive load and memory demands for coders. With the profile as a guide, each “turn” (defined as a change in “speaker”) in which the participant was the speaker was coded for all of the coding categories listed in Table 1 (with the exception of Maintain Persistent Identity). For every turn, coders made a Yes/No decision about whether each code was represented in the participant’s statement(s). Thus, a turn could receive more than one code or none at all. In contrast to the other seven codes, Maintain Persistent Identity was coded holistically, based on an overall assessment of the entire transcript, rather than as a line-by-line assessment of turns. In this case, coders made a Yes/No judgment as to whether the interview as a whole suggested that the participant had created a stable persona within the virtual world.

3. Results

Quantitative analyses of the data were used to examine the extent to which the interviews supported the eight coded functions; qualitative analyses were then used to explore ways in which each of the functions were manifested.

3.1. Quantitative descriptive analyses

The majority of participants (83%) maintained a persistent identity in Second Life. The three that were not coded as doing

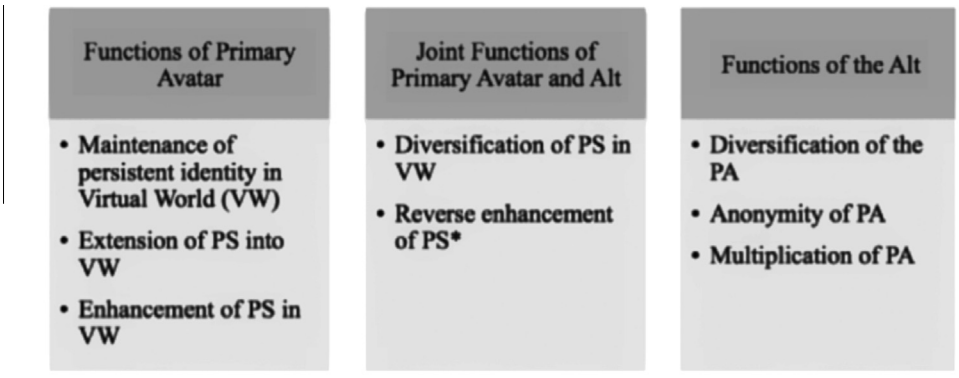

Fig. 1. Multiple personality order: the functions of Primary Avatars (PA) and Alts (ALT) relative to the Physical Self (PS) and to each other.

Table 1
Code definitions.

Code applied to:	Code	Definition
PA	Maintain Persistent Identity	Reflect an enduring or "persistent" identity within the virtual world to maintain stable connections to other avatars and the virtual community. This persistent identity is accomplished by having one's name, physical appearance, occupation, hobbies, and contact information be consistent, so others can know and identify the PA in the virtual world. This code includes statements about who the PA is and any roles, qualities, or traits described as unchanging
PA	Extend PS	Extend the real self into the 3D virtual arena by preserving characteristics (e.g., age, height, weight, appearance and personality features) or engaging in virtual activities (e.g., employment, education, hobbies, and relationships) that have physical world correlates and correspond to activities that he or she is engaged in within the physical world. This code addresses any aspect of the PS that is carried over to one's virtual world identity
PA	Enhance PS	Enhance the real self within the virtual arena by embodying more positive qualities than the RS (e.g., a more youthful or attractive physical appearance, more positive personality characteristics, and expressing one's truer, hidden, "ideal self.") The code applies to statements that are ***explicitly*** aspirational or explicitly indicate a more positive evaluation of the PA over the RS
PA or ALT	Diversify PS	Diversify the person's physical world identity within the virtual realm by adopting a different gender, race, physical ability, age, marital status, sexual orientation, or personality. In contrast to Enhance PS, this code refers to alternations in identity elements that are not explicitly described as "better" than the PS
ALT	Diversify PA	Diversify the PA's identity within the virtual realm by adopting a different gender, race, physical ability, age, or persona. Like Diversify PS, this code refers to alterations in identity elements that are not explicitly described as "better" than the PS
ALT	Anonymize PA	Maintain anonymity within the virtual world. This function involves creating an alt about whom all or some of one's acquaintances are not aware. This code addresses statements about using an alt in the virtual world so that one cannot be recognized or judged, for example to spy, cheat on, seduce a virtual romantic partner, or frequent a venue perceived as embarrassing
Alt	Multiply PA	Multiply one's virtual presence for pragmatic reasons. This function involves using an alt to assist the PA or other alts in performing tasks that are more easily accomplished by a dyad such as helping the PA test an animation intended for use by two avatars (e.g., a dance or sexual animation), sharing inventory across virtual identities, or populating a shop or club to improve in-world search results
PA or ALT	Reverse Enhancement	Enhance the wellbeing of the PS through participation in the virtual world. Wellbeing of the PS can be enhanced in a different domain: cognitive (e.g., the PS learns something through PA/alt), social (e.g., the PS begins positive real-life relationships with people met in SL), physical (e.g., the PS has better physical health because of activities in SL), or emotional (e.g., the PS is less depressed or lonely)

Note: PS = Physical Self; PA = Primary Avatar.

so frequently altered important identifying characteristics of their PA, such as age, gender, or body type, to an extent that would make it difficult for others to recognize them as a consistent identity. Furthermore, in support of the model, the vast majority (between 75% and 100%) of participants mentioned each of the eight functions at least once during their interviews (Fig. 2). Of particular note, Reverse Enhancement, the only code that emerged from bottom-up analyses and extended effects of virtual-world engagement to the physical world, was mentioned at least once by 100% of participants. In the subsequent section on "Qualitative Analyses," examples are provided to illustrate how participants discussed the specific functions.

As an indicator of how frequently each function was mentioned, we computed the number of turns that contained each of the codes for each participant; then, for each code, we computed the average number of turns that the code was mentioned. Fig. 3 (left *y*-axis) shows the codes' frequency of occurrence (in descending order, with the exception of Reverse Enhancement, which is placed at the end of the *x*-axis). On average, participants devoted the most number of turns talking about diversifying their PA, followed by extending and diversifying the PS. In contrast, Multiply PA was the function that was mentioned the least frequently (range: $M = 28.7$ turns, $SD = 18.0$ for Diversify PS/PA to $M = 3.4$, $SD = 3.9$ for Multiply PA). In addition, to obtain a measure of the amount of talk participants devoted to each function relative to the other functions, we computed the ***percent*** of turns in which each code occurred (i.e., the number of turns in which a code was mentioned divided by the total number of turns and then multiplied by 100, for each participant). Fig. 3 (left *y*-axis) also plots the average percent of turns that each code was mentioned. These measures provided a coarse indicator of the degree of emphasis that participants gave to each function; in the absence of data that directly assesses the importance of each function relative to others, this analysis provided a preliminary clue in that direction.

3.2. Qualitative analyses

Qualitative analyses were used to explore the *range* of ways in which participants discussed and/or manifested each function. In the interview examples that follow, all physical and avatar names have been omitted in order to preserve the participants' anonymity in both the physical and virtual domain. Moreover, for brevity, in some cases text that was not relevant to the function being described was omitted. These omissions are denoted by bracketed ellipses ("[. . .]"), to distinguish them from ellipses that participants themselves used. Finally, our clarifications of participants' abbreviations and comments are also provided in brackets. Barring these few exceptions, comments were reproduced verbatim (with abbreviations as well as grammar/punctuation errors left in tact) in an effort to preserve the natural voices of participants.

Extend PS: With regard to Extend PS, participants extended many different aspects of their PS into the virtual world. These included physical traits such as gender and race/ethnicity, personality traits, sexual behaviors/orientations, and activities/interests. For example, one participant stated, "*I'm always female, and always my real life age 23"* and that her PA's personality was, *"Just like my real life personality... strong, independent, out-going, funny."* Another stated that her PA was *"sensitive, because i am a sensitive mushy person."* Activities that were extended from the physical to virtual worlds ranged from listening to music to sexual practices.

Enhance PS: Not surprisingly, enhancement of the PS included improving one's physical appearance and/or health. For example, one female participant who described her PS as "heavyset" and 64 years old stated, "*my PA is my mind and spirit with a great body that is 100% perfect and healthy.*" In addition to enhancement of physical traits, personality enhancements—especially aspects of personality that were relevant to social interaction—were also frequently mentioned. For example, one participant noted, "*Though i am an introvert RL [Real Life], SL [Second Life] lets me express myself*

Table 2
Sample Participant Profile. The table reproduces a condensed version of a profile for one participant.

	Physical Self	Primary Avatar	Alts
(a) Physical (including identification of gender, body type and age)	• Age: 34 • Female • Average body type	• Age: 25 • Female • Slender body type • Black hair • Cherry tattoos • Vampire	• Age: 25 • Female • Slender • Teal hair • Has different tattoos • "Neko" – human cat
(b) Culture, Race, and Ethnicity	• Caucasian	• Caucasian	Race not specified
(c) Personality	• Funny, sassy, perfectionist, serious at times, caring, playful • Both curious and cautious	• Playful, sweet, sassy, with a touch of teasing • Both curious and cautious—open to new experiences but it depends what they are	• Created first alt as an escape from PA because PA was a popular host • Fun, friendly, teasing, playful, outgoing, energetic, with a splash of adventurous, artistic, curious but can be cautious, open to new experiences depending on the situation
	• Semi-organized and easy-going	• Organizing with an easy-going sense	• Does not let people close unless sure of what they are wanting
	• Semi-energetic depending on how she is feeling	• Energetic and loves meeting new people	• Energetic; no problem approaching strangers
	• Very friendly at times	• No problem approaching strangers and starting conversation	• Secure and confident
	• Semi-confident but not overly sensitive	• She only experiences anxiety when a staff member doesn't show up to work; never gets angry but is sensitive • Secure and confident in her abilities	• Friendly and compassionate
(d) Social and occupational roles and activities, relationships, sexuality	• Activities: Music, reading, traveling, spending time with the family, cooking, games • Chatting with friends	• Activities: Breeding horses, cats, hosting, hanging with friends • She has been in a prior relationship and is sort of in one now; it takes a lot for commitment	• Activities: Create pictures, hang with friends, go clubbing, listen to music and explore • Not in a relationship and hasn't before
	• Married—not interested in relationships before she met her husband	• Heterosexual and has not been with many partners	• She is heterosexual but has had no sexual experiences
	• Heterosexual and hasn't been with many people before husband	• Close friends are important but not all get to be friends with her	• Spends as much time on alt as PA
	• Does not consider PA to be better but more free to be herself	• Does not have much difference than real self other than the vampire part	• On this one to avoid being hounded
	• PA has helped her rediscover herself without being held back • Was raped at age 16 by a friend	• PA is an extension of self with looks that are a blend of her PS	• PA is a poplar hostess and sometimes she likes to get away from it as alt • Anonymity is the main function-only very few know it is her • Hostess and club manager for 2 years (Mandy's Mansion)

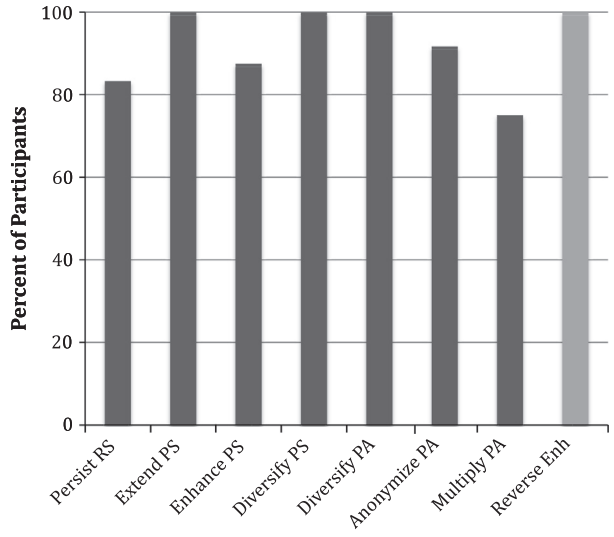

Fig. 2. Percent of participants who mentioned each function at least once during the interview. (Reverse Enhancement is placed last in lighter gray to reflect its different status from the other codes.)

to the fullest so I would say I'm very outgoing, hyper, chaotic, and goofy/comedic," while another characterized her PA as a *"more morally sound version of myself"* because in Second Life there was *"no need for instant reactions."* Indeed, some enhancements of physical traits appeared to serve social-emotional purposes as well, as in the statement: "*I think my PA is better in the sense of sexual experience and in the sense of looks, etc., because I do have a low esteem in my RL looks."*

Diversify PS/PA: Recall (as depicted in Fig. 2) that Diversifying the PS and PA were the most frequently mentioned codes. Participants described many different ways in which they diversified their physical or avatar experience, ranging from altering features that mirrored real-world characteristics (such as age, ethnicity, activities and lifestyles) to the fantastic. As an example of each of these tendencies, one female in her 20s created both a 5-year-old PA and an alt that she described as "*a big fat panda*." Diversification served a wide variety of purposes, including sexual activity or exploration. For example, the 64-old-female described in the prior section stated that she was *"not sexually active except in sl and that's fine."* In the virtual arena, her PA was *"sexually active, [and] sexual experiences have been very good."* In contrast, the female participant with the panda alt explained that she had a photography business in Second Life (further diversification of her physical persona) and

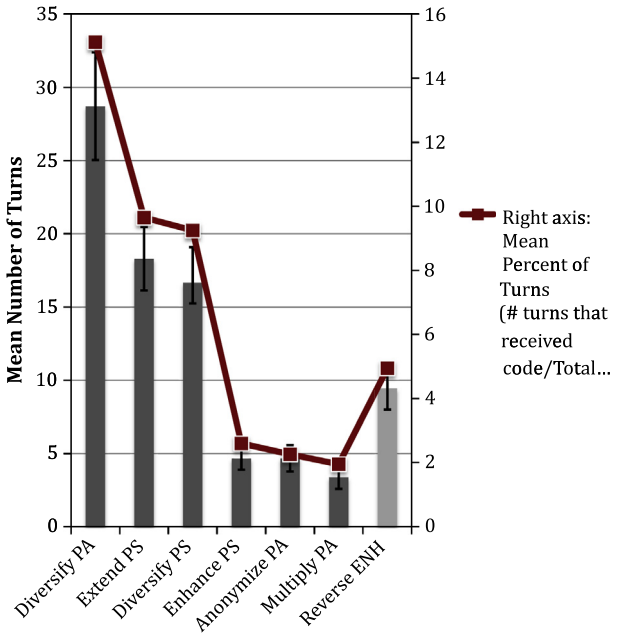

Fig. 3. Across participants, the average number of turns (with standard error bars) in which codes were mentioned.

that "*people are more relaxed with a panda and don't feel as many inhibitions on their requests and needs then they would with a child avi or with a male avi.*"

Anonymize PA: Participants who used Alts to maintain the anonymity of their PA did so to free themselves from unwanted communications by Second Life friends/acquaintances or to engage in activities that they wanted hidden from those who knew their PA. For example, one individual, when asked why she had created an alt, responded, "*i wanted to experiment with other facets of me away from people i knew.*" Another participant stated, "*I created my alt 3 months after being in SL. I wanted to run a clothing business and wanted to keep the avie I considered more 'me' separate. Plus I was a teacher here so I didn't want to stress myself out with ims [instant messages], etc.*" This individual also used her alt "*to scope out clubs n stuff I dont want to be seen in.*" Another participant stated that she used her alt primarily "*to indulge in purely hedonistic behaviors that I can't really let myself 'go' to do as [her PA]*". A fourth participant stated that she created her alt to "*catch my slbf [SL boyfriend] cheating on me.*"

Multiply PA: Participants multiplied their PA for pragmatic purposes—to increase their storage or inventory capacity in SL ("I use it for storage now, store my builds and such, also as a sort of bank, to keep my teir money and such so I dont accidentally spend it."), or to generally engage in multiple activities/interactions simultaneously. One participant stated, "while talking with you [the interviewer] I also just took snapshots of one of my customers and made a sale on the other" and "i made a male [alt] to dance with me when i got lonely").

Reverse Enhancement: Finally, as stated in the Method section, participants frequently mentioned that aspects of their PS had been improved or enhanced as a by-product of their involvement in the virtual world, a trend that resulted in adding Reverse Enhancement to the originally proposed seven functions. Furthermore, recall that every participant mentioned Reverse Enhancement at least once during his or her interview. Participants described a number of ways in which their PS had benefited from participating in Second Life, ranging from learning about themselves and others, to forming friendships, to developing aspects of their personalities that they valued. For example, one individual stated that she had learned *"new things about myself through exploration with my PA and alt."* Another stated that her PA had *"made me grow spiritually, understand things about people of the world better, change some opinions, given me new tastes in music and art..,"* while another shared that she had, *"met a bunch of new people and made friends in sl. I've learned a great deal about different areas of the world and different cultures."* A fourth individual stated, *"Hm, I'd say I adopted a lot of my outgoingness from my PA. I used to be rather shy and quiet, but after spending so much time in SL and having to get out and talk to people, its much easier for me to do RL."* Finally, in one of the more striking examples of Reverse Enhancement, a participant who self-identified as having Asperger's Syndrome, described the following benefits of virtual world participation: *"Over my time here I've forged very real friendships that have extended beyond SL long term [. . .] I use this av [avatar] as a way of understanding things that otherwise I'd have no chance of grasping."* Probed to elaborate, she explained that Second Life had helped her learn, *"How to interact with people, developing a sense of connection without worrying about things like tone of voice or body language. Things that aren't natural to me offline, here I can take my time and learn them a bit at a time."* She subsequently stated, *"I am more accepting of myself and others. I've learned a lot about diversity and being okay with being different. And I've been inspired to just relax a bit more in my rl."*

4. Discussion

The current study sought to evaluate the extent and manner in which seven functions of avatars and alts suggested in prior research were used within the 3D virtual world of Second Life. The results provided strong support that SL participants used avatars and alts to serve these posited functions. Quantitative analyses revealed that each of the proposed functions was mentioned by at least 75% of participants, with 6 out of 7 of these functions being discussed by over 80% of the sample, and half of the functions being mentioned by 100% of the participants. On a more fine-grained level, the average number of times participants referred to a particular function within an interview ranged from a low of 3.4 for Multiply PA to a high of 28.7 for Diversity PA. Qualitative analyses also provided support for the proposed functions by revealing a wide range of ways in which participants expressed each of the functions in their interview responses.

Additionally, an eighth important function emerged from the coded interview data. This function, called "Reverse Enhancement", involved physical, cognitive, or social-emotional benefits to the physical self that occurred as a result of his or her participation in the 3D environment. This function was unique in that all of the other functions involved behaviors and responses that occurred within SL, whereas Reverse Enhancement involved outcomes that transferred to participants' physical lives. Additionally, while participants appeared to use other functions such as extension, diversification or multiplication of the self in a purposeful and deliberate manner, the consequences described under this code generally appeared to be un-intentional. The concept of "Reverse Enhancement" is consistent with a number of studies that have demonstrated a relationship between virtual world experiences and positive psychological outcomes in the physical world (Behm-Morawitz, 2013; Gilbert, Murphy, Krueger, Ludwig, & Effron, 2013; Kafai et al., 2009; Kim et al., 2012; Williams et al., 2010), anecdotal accounts of enhanced functioning in the physical world brought about by participation in virtual worlds (Guest, 2008; Shomaker, 2010), and studies conducted in free-standing (i.e., non-networked) virtual reality environments that have found positive effects of avatar-mediated interaction on physical world outcomes in clinical and non-clinical domains (Ersner-Hershfield, Bailenson, & Carstensen, 2008; Fox & Bailenson, 2009; Liu, 2008;

Rizzo, Reger, Gahm, Difede, & Rothbaum, 2009; Tortella-Feliu et al., 2011; Wiederhold & Wiederhold, 2005; Yee & Bailenson, 2007).

Beyond supporting the proposed set of avatar functions, the interview data offered an in-depth look at how participants used their primary avatars and alts to carry out various functions within a larger identity system. Participants revealed that different operations (e.g., executing instrumental tasks like work; manifesting specific personality traits; experimenting with new lifestyle options, etc.) were carried out by primary avatars or alts such that there was a systematic differentiation of each identity in a larger poly-identity system. In other words, rather than the proposed functions fluctuating arbitrarily, participants revealed that specific functions were assigned to each constituent identity in a way that served the operation of the wider personality organization. Thus, for example, while a participant's PA might be extending or enhancing the PS, his or her alt might be diversifying the PA and the PS by experimenting with an alternative lifestyle in the virtual world. In this way, the physical self and the two virtual identities combine to form a multiple identity system for the individual.

In addition to the tendency to differentiate the identities in the multiple identity system, the interviews revealed an effort by participants to balance the stability and diversity of their personal identity. Almost all participants sought to maintain some degree of consistency in their identity, as reflected in the finding that 83% met the criteria for Maintaining a Persistent Identity in the virtual world, so that they could be recognized as a stable and consistent presence in the virtual environment. At the same time, diversification of the physical self and the primary avatar were the most frequently mentioned functions in the interviews, thus indicating a concurrent desire for novelty and variability along with consistency in personal expression. Researchers in the fields of developmental psychology and personality have long noted that human beings desire "self-constancy", a sense that the self endures and is composed of stable dispositions and qualities (Bach, Burland, & Lax, 1986; Rotenberg, 1982) as well as a sense of novelty and diversity of self-expression (McKenna & Bargh, 1999) The present study suggests that desires for identity stability and identity variability might be fulfilled by assigning these objectives to different components of a multiple personality system as well as trying to balance these needs in the physical self alone.

5. Limitations

While the current research empirically establishes functions for which SL participants use avatars and alts, it is best viewed as a starting point for our future understanding of the relationship between virtual world users and their online personas. First, the current investigation involved qualitative analysis, including content analysis, (which involves systematic coding of qualitative data) of a relatively small sample of in-depth interviews. Qualitative techniques are useful when an area is not well studied or understood as they can reveal nuance and context that is difficulty to capture through quantitative techniques alone; however their labor-intensive nature often constrains the size of the sample that can be used. Our small sample size relative to the massive SL user-base limits our ability to generalize from the findings without further investigation. Specifically, further research is needed to examine whether these functions are indeed as widespread among the larger population and also whether the identified functions comprehensively explain the ways in which virtual world participants use their online personas. That is, do other functions emerge in a more extensive sample? Larger scale investigations can provide answers to these questions, with their construction guided by the qualitative, descriptive information provided in the current study.

Similarly, the analyses of the frequency with which functions were mentioned must be interpreted cautiously. These methods do not allow for inferences from the frequency data about the relative importance of any of the avatar functions. In other words, we were cautious not to interpret frequently mentioned functions as playing a more important role in participants' poly-identity systems than less-frequently mentioned functions. Subjective ratings of the relative significance of the individual codes would be a valuable component of a later quantitative measure of avatar functions.

The current study is also constrained by its sole focus on avatar and alt functions within Second Life. While Second Life is a logical platform to conduct an initial investigation, given that it is the most populated, adult-oriented, persistent virtual world, it would be valuable to determine whether the designated functions also apply to other persistent virtual worlds such as World of Warcraft, or any of the many OpenSim based grids, that offer users the possibility of creating multiple avatar accounts, and thus enable the creation of complex, multi-identity systems.

6. Conclusion

In sum, the proliferation of digital platforms, in conjunction with a tendency for users to operate multiple accounts within these platforms, is fueling the rise of complex systems of identity operating across the physical and digital realms. Given the growth of this phenomenon, it is important to increase our scientific understanding of how these multi-component identity systems operate. In this context, the current delineation of avatar functions within a poly-identity system operating in the physical and 3D virtual realms is a positive contribution. Future work in this area will benefit from extending the current analyses to digital domains other than 3D virtual worlds (such as social networking sites, digital gaming and on-line forums) to understand the dynamics of new, multifaceted systems of identity operating across the physical world and a complex array of both 2D and 3D platforms.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.chb.2013.11.007.

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