Body and Mind: A Study of Avatar Personalization in Three Virtual Worlds

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ABSTRACT
An increasingly large number of users connect to virtual worlds on a regular basis to conduct activities ranging from gaming to business meetings. In all these worlds, users project themselves into the environment via an avatar: a 3D body which they control and whose appearance is often customizable. However, considering the prevalence of this form of embodiment, there is a surprising lack of data about how and why users customize their avatar, as well as how easy and satisfying the existing avatar creation tools are. In this paper, we report on a study investigating these issues through a questionnaire administered to more than a hundred users of three virtual worlds offering widely different avatar creation and customization systems (Maple Story, World of Warcraft, and Second Life). We illustrate the often-surprising choices users make when creating their digital representation and discuss the impact of our findings for the design of future avatar creation systems.

Author Keywords
Virtual worlds, avatars, customization, personality.

ACM Classification Keywords
H.5.1. Artificial, augmented, and virtual realities.

INTRODUCTION
Virtual Worlds (VWs) are immersive 3D environments that enable large numbers of users to interact with one another over the Internet. While VWs have a diverse range of purposes, they can be separated into two broad categories: game-based worlds (also known as Massively Multiplayer Online Games or MMOGs, such as World of Warcraft) and social worlds (e.g. Second Life). The popularity of both types is undeniable: recent estimates report millions of subscribers for the most successful environments [17].

One of the defining characteristics of VWs is how users are represented. In almost all cases, social interactions are mediated by an "avatar", a virtual body created by users to project their identity and actions into the world [8]. These interactions are therefore based on a simulated face-to-face metaphor [9], with users "puppeteering" a virtual body to control fine-grained actions such as their gestures, posture, or eye gaze. But an avatar fulfills more than communication needs: it is also a visual representation of the user, a "tangible" embodiment of their identity. The choices users make when creating (and later when customizing) their avatar will have repercussions on their interactions with other users: selecting black hair, dark Victorian clothing and piercings is obviously making a different statement than opting for an athletic, tanned body in a swimsuit (these examples are far from extreme: the diversity of avatar choices in highly-customizable worlds like Second Life is truly amazing – the screenshots in [8] are good examples).

Researchers have long been fascinated with the link between online identity and offline self. Early on, online spaces were described as "laboratories for the construction of identities" [16, p.184] enabling users to experiment with various aspects of their personality. Recent work [2] shows that users realize some aspects of their "ideal selves" through their avatar, which may have positive implications for those with low self-esteem. Research has also examined other issues related to identity and avatars, such as gender and ethnicity swapping [6, 10].

It is important to note, however, that avatar creation systems differ widely across VWs. For instance, users can control their height and weight in Second Life but not in World of Warcraft (both are pre-determined based on the race of the character); users can choose between ten different races in World of Warcraft, but not in Maple Story; etc. If VWs are platforms for identity exploration, as the research mentioned above suggests, it is logical to assume that the range and type of body modifications allowed by a given avatar system will affect how users construct their online identity. But surprisingly, little data is available to understand how users interact with avatar creation systems, and the consequences avatar creation tools have for a user's eventual online appearance. Most published work on the affordances and limitations of avatar customization systems has focused on technical aspects (e.g. how to make more realistic-looking virtual bodies [21]), not on the *interface* that enables users to create an identity for themselves (for a notable exception see [12]).

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Recent work in the CHI community has investigated the social and cultural dynamics of virtual worlds [3, 4, 11], with some focus on avatars [see again 9]. However, the latter is mostly concerned with how avatars are used as communication channels (e.g. using gestures, body language) rather than with how these virtual bodies are created and customized.

In this paper, we report the results of a survey designed to address this research gap. Our questionnaire, administered to more than a hundred users of three virtual worlds with widely different avatar creation systems, focused on two as-yet unexplored areas: 1) an evaluation of current avatar creation and customization systems, in terms of their usefulness and usability; 2) the link between an avatar system's features, the eventual avatar created by the user, and this user's physical and psychological characteristics.

METHODS

The virtual environments selected for this study were Maple Story (MS), World of Warcraft (WoW), and Second Life (SL). These three worlds have a large number of subscribers worldwide and provide avatar customization systems ranging from simple to quite complex (see Figures 1-3). The worlds also have different purposes, from gaming (WoW) to socializing (SL) and hybrid of both types (MS).

We designed a questionnaire divided into three parts. In addition to answering our questions, participants were also asked to upload a screenshot of their avatar to our server, which allowed us to put our participants' answers in perspective by conducting our own visual assessment of their digital appearance.

Participants were first asked questions about their use of the character creation interface in their world of choice. We asked how much time participants spent creating their "main" avatar, and which customization features they paid most attention to (e.g. body type, face, clothing…). We also asked how satisfied they were with each customization feature, which ones were most important, whether or not each feature offered enough options, and which features they would like to have but were missing.

In the second part, we asked our participants to rate a large number of statements about their avatar using a standard 5-point Likert scale. Example statements include "I make avatars that stand out as much as possible" or "I make avatars that reflect a popular trend." These statements (defined in previous research, see [7]) were used to understand the thought process governing avatar customization for each user. Our participants were then asked to compare themselves to their avatar along a number of dimensions, both physical (e.g. height) and psychological (e.g. assertiveness). The latter was accomplished using a methodology identical to the one described in [2]. We then tried to assess our participants' level of attachment to their avatar by having them rate statements such as "I would be sad if this avatar were deleted by accident" or "I would be willing to sell this avatar to another user."

Figure 1. Character creation interface in WoW (available options have been magnified in all figures)

Figure 2. Character creation interface in Maple Story

Figure 3. Character creation interface in Second Life

Finally our participants were asked to conclude the questionnaire by providing us with a broad range of demographic data. In particular, we asked our participants detailed questions about their physical appearance (e.g. age, height, weight, hair color…) as well as their personality (through a version of the Big Five personality test, again as

in [2]). We used this data to compare a user's "real-world" characteristics with the avatar they eventually created under the constraints of a given world's interface.

We piloted the initial version of our study with four human factors experts (not the authors) who each had experience with at least one of the three virtual worlds, in order to ensure the readability and intelligibility of the survey questions. After revising the questionnaire according to their comments, we advertised on several online gaming forums to recruit participants. During three months of data collection, 180 respondents (89 for WoW, 50 for SL and 41 for MS) took part in our online survey. We describe the demographics of these participants in more detail below.

PARTICIPANTS DEMOGRAPHICS

Gender

We begin our examination of our participants' demographics with gender, which gives us a sense of how representative our sample is. The gender distribution of participants was 115 (65%) male and 63 (35%) female (two participants did not specify their gender). This distribution varied across virtual worlds: the male/female ratio of both WoW and MS were approximately 70/30; in SL, it was 50/50. Our gender distribution for game-based environments like WoW and MS is broadly similar to data reported earlier by other researchers [18]; in SL however, it looks as if the gender distribution is more balanced.

In addition to the gender distribution of users, we looked at the gender distribution of avatars. Each user's avatar gender was recognized by analyzing the avatar screenshot they uploaded to our server. Results from the 157 valid screenshots are summarized in Table 1 below.

	WoW	MS	SL	Total
Male avatar	37 (46%)	20 (56%)	11 (27%)	68 (43%)
Female avatar	43 (54%)	16 (44%)	30 (73%)	89 (57%)

Table 1 - Avatar gender distribution

Two trends stand out. First, it is clear that a large number of players gender-swap (confirming data from [6, 18]): we found that 38 (24%) users played a different type of gender (across these three games) compared to their actual gender. Specifically, 34 male players used a female character and 4 female players used a male. Second, gender-swapping is particularly prevalent in SL, with a large number of male players favoring female avatars.

Age

Having considered gender, we now turn to our participants' age. Unsurprisingly perhaps, the participants' age in the three selected games had different means (F (2, 175) = 67.479, $p < .001$, $\eta^2 = .435$). The results indicate that MS players (*mean age* = 18.1 years, *Std.* = 6.2) were significantly younger than both the players in WoW (*mean age* = 29.8, *Std.* = 10.5) and the residents of SL (*mean age* = 41.1, *Std.* = 9.6), the latter being significantly older than in the other two games.

We were able to explore the issue of age in more depth thanks to the avatar screenshots uploaded by our participants. Indeed, users can choose to design their avatar to look younger or older than their real age. In our survey the participants were first asked how the age of their avatar compared with their real age (1: not different at all, to 5: extremely different). We found that, according to their own evaluation, most users choose to make their avatar age only slightly different from their real age (*mean* = 2.7, *Std.* = 1.3). Since the deviation was quite large however, we looked at the uploaded avatar screenshots by splitting respondents in two groups: those who reported creating avatars of about the same age as theirs and those who did not. This revealed that while younger users indeed create avatars of a similar age, older users apparently prefer creating an avatar that appears quite different in age. More precisely, it seems as if older users generally create avatars looking younger than they are, sometimes by a large margin. For instance, several SL residents aged 40 and above had avatars looking like teenagers or young adults.

Time spent in-world and customizing avatar

Gaming experience and time spent playing were not significantly different across the three environments – see Table 2. We note that our respondents are quite experienced with VWs and that they spend a large amount of time in-world, confirming widely reported trends [e.g. 4, 19].

	WoW	MS	SL
Gaming experience (years)	2.1 (σ^2=1.2)	1.8 (σ^2=0.1)	1.7 (σ^2=1.0)
Hours played / day	4.4 (σ^2=2.3)	5.1 (σ^2=4.2)	4.5 (σ^2=3.6)
Days played / week	5.5 (σ^2=1.7)	5.6 (σ^2=1.9)	5.9 (σ^2=5.9)

Table 2 - Gaming experience and time spent in-world

However, SL residents spend significantly more time per week (F (2, 169) = 9.434, $p < .001$, $\eta^2 = .100$) customizing the appearance of their avatar (*mean* = 93 minutes, *Std.* = 209), compared to WoW players' 10 minutes (*Std.* = 15) and MS players' 13 minutes (*Std.* = 16). It is clear that avatar customization is a very important activity in SL compared to the game-based virtual environments - in fact, one could even argue that avatar customization *is* the game in SL. We also note very large standard deviations in all three environments: while some players care about their appearance enough to spend significant time customizing it, it is clear that others do not.

"Mains" and "Alts"

Before asking our participants detailed questions about how they chose to customize their avatar, it was important to assess whether or not they had one they considered to be their "main" identity (as opposed to alternate characters or "alts"). Indeed, if participants split their time between several avatars it would be more difficult to link their in-world appearance with their physical world demographics. Broadly speaking, we found that a large majority of users across the three environments focus their energy on one main avatar.

We found that many users own multiple characters: an average of 8 (*Std*. = 7.8) avatars per account. Specifically, WoW players have an average of 12 (*Std*. = 8.9) avatars and MS players have an average of 5 (*Std*. = 3.9). Because SL limits users to only one avatar per account, users have to create another account if they want to own multiple avatars. We found that each SL resident had an average of 3 accounts (*Std*. = 1.4) for creating other avatars. But it is worth noting that each SL resident designed on average 41 outfits (*Std*. = 36.6) stored in their inventory, so that they could quickly switch their avatar's appearance to another one. While not strictly "alts" (the avatar's name remain the same), it illustrates the need for a flexible appearance - a need that can be fulfilled only by creating another character in game-based environments like WoW and MS.

Although users have multiple avatars per account, 90% of participants answered positively to the question: "do you consider any of your avatars to be your main identity?" There is little doubt users can readily identify which is their main avatar and which are their alts. There are minor differences across worlds: more SL residents can identify their main avatar (98%) than WoW users (88%) and MS users (87%).

Finally, it became clear that users can not only identify one avatar as their "main" but also that they focus on it almost exclusively. Across all worlds, users spent 76% (*Std*. = 21) of their total playtime on their main avatar, 18% (*Std*. = 17) on their most-played alt, and only 6% (*Std*. = 11) on all other avatars. There are significant but minor differences between the three environments (F (2, 162) = 10.02, $p < .001$, $\eta^2 = .110$). In particular, the ratio of time spent on their "main" by Second Life residents (88%) was relatively higher than in WoW (70%) and Maple Story (76%).

Having considered our participant's demographics and gaming habits, we now turn to how they chose to create, customize and project themselves into their avatar.

AVATAR CUSTOMIZATION PRACTICES

Preferences during avatar creation

Avatar customization systems vary greatly across virtual worlds: some allow users to customize a few high-level features from a limited list of options, while others give the users almost total control over their appearance. We wanted to assess the relative importance of each customization feature to uncover which parts of a user's virtual body matter most to them. To do so, we asked players in each of our three virtual worlds to evaluate the importance (1: not important to 5: essential) of each character design feature provided by the avatar customization system in their environment of choice. Also, participants were asked how much time they spent customizing each of those features (1: almost none, 5: a great deal).

Our results show that the relative importance of WoW's five character design features were significantly different (F (4, 422) = 17.18, $p < .001$, $\eta^2 = .140$). The most important were hair style (*mean* = 4.2, *Std*. = .9), facial characteristics (*mean* = 4.1, *Std.* = 1.1) and hair color (*mean* = 4, *Std.* = 1.0). Character skin color (*mean* = 3.0, *Std.* = 1.2) was the least important feature. The rank amount of time spent customizing each avatar feature was similar to the importance. In other words, users spent the most time customizing the features they think matter most.

In MS the most important feature was, again, hair style (*mean* = 3.9, *Std*. = 1.1), followed by hair color (*mean* = 3.4, *Std*. = 1.3) and weapon (*mean* = 3.3, *Std*. = 1.5). Shoes (*mean* = 2.4, *Std*. = 1.2) was the least important feature (for all the above F (7, 317) = 5.70, $p < .001$, $\eta^2 = .112$). As before, users spent the most time customizing features that were most important to them.

Finally, the most important features in SL were the avatar's body (*mean* = 4.3, *Std*. = 1.0), torso/legs (*mean* = 4.2, *Std.* = 1.1) and hair (*mean* = 4.2, *Std*. = 1.2). Skin tone (*mean* = 3.9, *Std*. = 1.3) was the least important customization option. We found no significant difference between ratings of the seven features in SL (F (6, 334) = .85, $p > .05$, $\eta^2 = .015$), all of them having scored highly. SL users also spent a great deal of time customizing almost all of the possible character features, to the exclusion of skin tone (*mean time* = 3.3, *Std.* = 1.4).

Overall, it seems as if hair style and color are considered "high impact" features by users across the three environments, and this despite wide differences between the capabilities of each customization system: given the rich options offered by SL, for instance, it is interesting that hair style/color still ranks highly, just as it did in WoW or MS with their more limited systems. We will return to this surprising result in our discussion section.

The data presented above shed some light on user preferences when creating and customizing their virtual bodies, and how their choices are shaped (or not) by the options offered in the interface of their VW of choice. But we also wanted to explore the thought process that users go through when selecting a certain appearance for their avatar, in particular, the relationship between their offline and online identities. This would help us understand how current avatar creation tools are used to project an identity into a virtual world, and whether or not these tools could be improved to give users even better control over their

projected selves. We describe our results regarding this issue in the section below.

AVATARS AND IDENTITIES

Identity exploration: three possible factors

To explore the relationship between online and offline identities, we began by asking a range of questions assessing how much of themselves users consciously tried to reproduce in their avatar. Indeed, while previous work like [2] focused on the psychological characteristics of players and avatars, little data is available regarding their physical properties.

When participants were asked whether or not they wanted to reproduce some of their physical characteristics into their avatar, only 32% answered positively. Results differed greatly across worlds however – see Figure 4. One possible reason could be that a relatively high fidelity avatar creation system like the one in SL can motivate users to reproduce more of themselves. Another possibility could be that since WoW and MS are game worlds taking place in fantasy universes, reproducing oneself would make little sense.

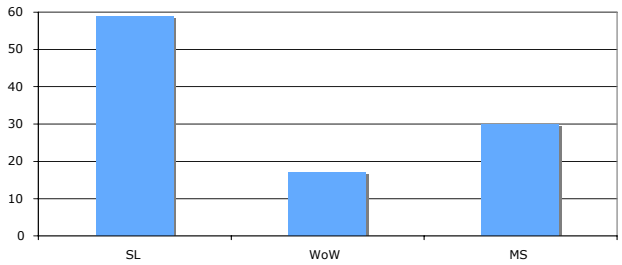

Figure 4 - Percentage of users reproducing some of their physical characteristics

Since most participants (68%) create avatars looking different from themselves, we asked several questions to assess what they wanted to achieve when customizing their virtual body. Principal axis factor analysis with pro-max rotation was then used to group the responses into high-level concepts. A Kaiser-Meyer-Olkin (KMO) measure of .664 showed an acceptable degree of common variance between the factor variables and Bartlett's test of sphericity was significant ($p < .001$), both indicating that the factor model was broadly appropriate. The analysis yielded three conceptual factors (with a factor loading of 0.495 to 0.838): *idealized self*, *standing out* and *following a trend*.

Specifically, the *idealized self* factor includes two questions: (1) I make avatars that are idealized versions of myself and (2) I make avatars that have features that I wish I could have in real life. The *standing out* factor includes three questions: (1) I make avatars that stand out as much as possible, (2) I often create avatars that have an unconventional look and (3) I make avatars that are as different from me as possible. The *following a trend* factor is based on two questions: (1) I make avatars that look like a particular celebrity or person I like and (2) I make avatars that reflect a popular trend.

In order to understand how these appearance factors differ across demographics, we first examined gender differences. We found that male and female users differ significantly on the *idealized self* dimension (t [172] = 3.69, $p < .001$), with female users more likely to create avatars that are idealized version of themselves compared to male users. Gender effects were also apparent in the *standing out* factor (t [172] = -2.56, $p < .005$): male users tend to favor avatars that stand out more than female users. There were no significant gender differences for the *following a trend* factor.

We also explored the relationship between the three appearance factors and a user's age. A correlation analysis shows that the relationship between age and the *idealized self* factor are significantly positively correlated ($r = .274$, $p < .001$). That is, older users broadly prefer creating an avatar that looks like an idealized version of themselves. There were no significant relationships found between age and the two other factors.

An ANOVA was also conducted to examine possible difference in these appearance factors across the three virtual worlds. Our results show that users have distinct preferences. Specifically, compared to WoW and MS players, SL residents show a significant preference for creating avatars they describe as an *idealized self* (F (2, 171) = 18.06, $p < .001$, $\eta^2 = .174$). In addition, MS players apparently prefer to *follow a trend* when customizing their avatar, compared to the other worlds (F (2, 171) = 5.83, $p < .01$, $\eta^2 = .064$).

Since we collected data about our participant's physical appearance, we were also able to explore directly the relationship between these physical features and the choices participants made for their virtual self. In particular, using a combination of weight and height we computed our participant's Body Mass Index (BMI) and categorized them into four groups. The results of an ANOVA show significant differences between BMI groups regarding the *idealized self* factor (F (3, 160) = 6.06, $p < .005$, $\eta^2 = .102$). Post hoc results indicate that the mean score of the obese group (BMI > 30) is significantly higher than the underweight (BMI < 18.5), normal range (BMI = 18.5 to 25) and overweight (BMI = 26 to 30) groups. In other words, users with weight issues tend to create idealized avatars more than do other users.

Real bodies, virtual differences

We then tried to assess exactly which of their own physical features our participants tried to change or enhance in their avatar. To do so, we asked our participants to imagine themselves and their avatar standing side-by-side and to compare the differences in attributes between their physical and virtual bodies. A five-point scale (1: not different at all to 5:extremely different) was used to assess avatar features broken down into physical attributes (e.g. height, weight, physical fitness) and style (e.g. attractiveness, standing out from the crowd, fashionability).

Results show that the mean scores of these attributes ranged between 2.67 and 3.34, that is, from mildly different to somewhat different (the differences are statistically significant, $F(7, 1333) = 5.68$, $p < .001$, $\eta^2 = .029$). In particular, attractiveness (*mean* = 3.34, *Std.* = 1.18) was the attribute that differed most between users and their avatars, followed by physical fitness (*mean* = 3.19, *Std.* = 1.26) and "standing out from the crowd" (*mean* = 3.19, *Std.* = 1.29). Unsurprisingly perhaps, it looks as if users prefer avatars that look better, are fitter and stand out more than they do in real life – a form of identity exploration, to be sure, but a somewhat one-sided version of it as we discuss in more depth later in this paper.

We stated earlier that high-BMI users tended to create avatars that are idealized versions of themselves. Correlation analysis was conducted to explore the relationships between users' BMI and the degree of difference in appearance between users and their avatar. Results show that high BMI users tend to create avatars that differ significantly from themselves in terms of attractiveness ($r = .281$, $p < .001$), weight ($r = .408$, $p < .001$), and physical fitness ($r = .389$, $p < .001$). This aligns well with previous work [2] showing that virtual worlds users realize aspects of their ideal selves through their characters: here, it looks as if avatars can be used to transcend specific body proportions that Western culture often look at in negative terms.

Participants' attachment to their avatar

The data above shows that avatars can be used by users to "reinvent" their body online. However, it could be that this form of identity exploration is only superficial, and that the virtual bodies created have little impact on a user's life – they could be "throw-away" experiments with few consequences. We explored this issue in more depth by trying to evaluate a user's level of emotional attachment to their avatar.

To do so, we asked questions related to three aspects of attachment: 1) a participant's motivation to use their current avatar in other environments (e.g. "I would use this avatar in other places on the Internet if I could"), 2) a participant's desire to trade their real body for their virtual body (e.g. "I would trade my own body for this avatar body if I could"), and 3) a participant's level of sadness upon short/long term loss of ownership of their avatar (e.g. "I would let someone else play with my avatar for a few hours").

We found that participants who project an *idealized self* tend to have a higher attachment to their avatar. Results of correlation analysis show that participants' age and attachment to avatar are significantly positively correlated ($r = .337$, $p < .001$), with older participants having a higher attachment to their virtual body. Moreover, people with high BMI also have a high level of attachment to their avatar ($r = .199$, $p < .001$).

Overall, these results seem to indicate that the more an avatar allows a user to project an "enhanced" version of themselves, the more important the avatar becomes to the user. This adds weight to the argument offered in [2], namely, that VWs enable forms of identity exploration that have positive benefits to users with low self-esteem.

In/out world personality

Having explored the relationship between a user's virtual and physical bodies, we then examined the psychological relationship between users and their character. An adapted version of the Big Five Personality test [2] was used to measure the personalities of participants "in avatar" and outside their VW of choice. Participants rated how similar a series of personality characteristics were to their actual self, and then used the same rating scale to evaluate their primary avatar. When the participants rated their actual self, questions started with "I see myself as someone who…." - for example, "I see myself as someone who is full of ideas" or "I see myself as someone who has a soft heart." For questions about their avatar, questions began with "I see my main character as someone who…", for example, "I see my main character as someone who is always prepared," or "I see my main character as someone who makes people feel at ease."

Remember that we ascertained earlier on that users play mostly one main avatar (see "demographics"), which makes the above comparison meaningful. The link between online and offline personas would be much harder to analyze if users fragmented their time across a multitude of widely different virtual characters.

Since we used the same methods as [2], we started by directly comparing our data to theirs. We found significant differences between in- and out-world personalities along the following dimensions: Conscientiousness ($t[338] = 4.29$, $p < .001$), Openness ($t[336] = -3.33$, $p < .001$), Neuroticism ($t[338] = 3.34$, $p < .001$) and Extraversion ($t[337] = 5.53$, $p < .001$). Agreeableness was not significantly different ($t[340] = -.51$, $p > .005$). The means for each dimension in each condition are summarized in Figure 5.

We note that our results match [2] point for point: as they proposed, on average, participants rated their virtual character as being more conscientious, extraverted, and less neurotic than they themselves were. We found an additional significant difference for openness, with participants being slightly less open in their virtual character than out. But overall this clearly reinforces the notion that VWs offer players the opportunity to create idealized characters as virtual, alternative selves, as [2] concluded.

To push this analysis further, we decided to explore how these differences relate to some of the factors we had identified earlier. In particular, we wanted to see whether or not users with very different online selves were more satisfied with their avatar. To do so, we computed the mean

difference between the Big Five scores for all participants and their avatars. We then looked for correlations between these values and previous data.

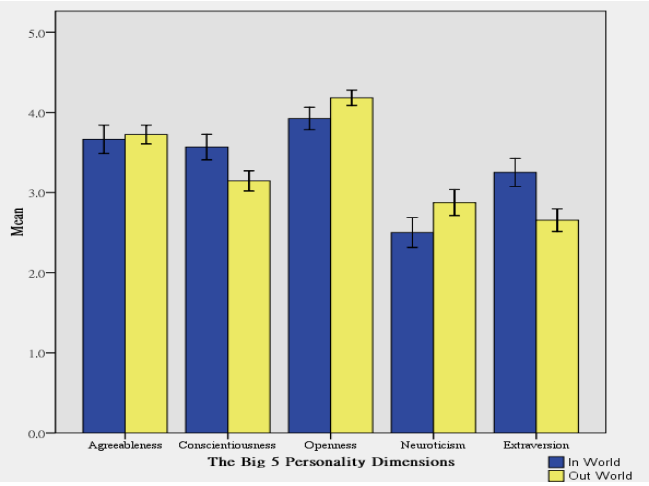

Figure 5 - Mean Big Five scores in- and out-world

We found that participants with the smallest psychological difference between their online and offline selves were, on average, more satisfied with their avatar (r = -.201, $p < .005$) and more attached to it (r = -.415, $p < .001$). This is an interesting contrast to the data reported in previous sections: while users apparently grow more attached to their avatar if its body differs significantly (in an idealized way) from theirs, it looks as if great differences in personality between the two actually reduce satisfaction. In other words, trying to behave in a very different way from one's offline self in VWs is not particularly satisfying. This is reinforced by another correlation, namely, the one between personality difference and play time (r = -.168, $p < .001$): the more users play, the less their online and offline personalities diverge. This suggests that, as one's tenure in a given VW increases, their offline and online personalities become more congruent, perhaps to the point of becoming identical.

The above refines our understanding of the role of avatars in identity exploration. While users do experiment with different bodies, most often to enhance their appearance in some way, it seems that users do not enjoy changing their personality "in-avatar" too much. We know from [2] and Figure 5 that these changes do exist and that, on average, they are also idealized versions of a user's personality. But our data shows that these differences will probably remain small and even possibly disappear over time. Therefore, the transformative potential of VWs seems to reside more in the power they give users to transform their bodies rather than their minds – we return to this important difference in our discussion section.

We also note an interesting parallel between our data and recent research on deception in online dating sites: there as in VWs, many users "lied" and projected an enhanced view of themselves, but the actual differences between their real and virtual selves remained small [5]. Extreme differences between physical and virtual selves appear to be rare in a variety of online spaces.

DISCUSSION

Hair matters

During our presentation of avatar customization practices, we showed that hair style and color were consistently ranked among the most important features. They were also the ones users spent the most time customizing. We would like to explore a few reasons why this might be the case and what the implications for future avatar creation and customization systems might be.

First, it is worth noting that hair being a "malleable" part of the human body, it is often used in real life to control and build an individual's appearance. Hair styles like dreadlocks, for instance, can be used as identity markers signaling membership in a particular group [15]; hair length and color can be manipulated to dramatically affect someone's look, sometimes even to the point of making them hard to recognize (note how changes in hair style are often the first consideration of someone attempting to disguise themselves). It is therefore perhaps unsurprising that players would use them in similar ways to reflect their desired age, fashion/style, personality and ethnicity. Interestingly, we note from our survey data that 82.8% of our participants chose not to copy their natural hair color to be their virtual hair color. Quite a few chose colors that require hair dyes in real life: there were 15 users who chose blue hair, 10 who chose purple and four who chose green hair for their avatar.

A second reason why hair may be the most important feature for avatar customization is its visibility. In a game-based world like WoW or MS, a character's virtual body can be covered by equipment such as armor, robes or gloves. Also, this equipment often has the same color and form across users: in WoW sets of armors look identical, for instance, and they cover most of a player's body. Therefore, having a unique hair color or style for an avatar will help players be more easily recognizable by other users. Note also that a large majority of users navigate their virtual world of choice using a "zoomed out", third person perspective (by choice, but also because this tends to be the default setting in most worlds). This makes distinguishing small visual features like the details on someone's face quite difficult, while hair offers a larger surface prominently displayed at the top of a user's avatar, where it is most visible using a third-person perspective.

Although users rate customizing their avatars' hair as quite important, most still feel that the design options provided by current customization systems for character hair design are relatively weak in the three VWs we studied. Our survey asked participants to assess the richness of each avatar customization feature using a five-point scale (from 1: way too few options to 5: way too many options). Hair consistently received low scores compared to other features.

The mean score in WoW was 1.97, SL was 1.72 and MS was 2.02.

We believe our data points at two possible directions for improving current and future avatar systems in virtual worlds. One would be to take the importance of hair as indicative of a more general deficiency in avatar interaction systems. To address it, a virtual world's interface could be redesigned to make an avatar's facial features much more visible, either by using "cartoonish" and exaggerated faces visible at a distance (in a fashion similar to Manga characters, for instance) or by changing a user's viewpoint automatically when interacting with another user and zooming in on their avatar, in order for them to see the finer details of their appearance more easily[1]. Virtual worlds designers could also simply provide more options to customize other parts of a user's avatar, but the fact that hair style and color remain important in SL's rich customization interface tends to indicate that the problem lies elsewhere.

Another option would be to accept that hair is central to a user's identity and greatly refine the way it can be customized. Indeed, our participants were quite explicit about the limitation of current systems in their comments:

> *The hairstyle options were all pretty heinous [Female, 30, WoW]*

> *(3 face * 3 hair style) = 9 choices to change your character's basic appearance is not enough to feel as if your character is your own [Male, 14, Maple Story]*

> *It is impossible to make the hair look good. [Female, 52, Second Life]*

Simply providing more choices would therefore seem to be a good starting point. But our participants also suggested possible augmentations:

> *As a female I change my hair style daily, it would be nice to see something similar reflected in game. [Female, 21, WoW]*

> *In the real world, hairdoes can change frequently. Why not in-game. [Male, 65, WoW]*

> *The three free hairstyles are disappointing. Although, there is that quest where you get a random haircut, it most likely ruins your hair even further. [Female, 15, Maple Story]*

Overall, it is clear that hair matters a great deal to people using virtual worlds, just like it does in the physical world. Beyond the range of options offered to customize it, the ability to change styles and color over time is apparently important to users (SL, with its emphasis on fashion, probably satisfies this need the best). The importance of digital hair indicates that, despite the plasticity of virtual bodies and the possibilities they offer for unusual appearances, users tend to favor a single, highly-visible and malleable feature that is immediately recognizable by others – the same one they shape every day in front of their mirror.

Reinforcing this point, it is interesting to note that a lot of "avatar space," in highly-customizable systems like SL, isn't used. As we saw earlier few people make very short, very tall, or very fat avatars - they do not want those features (perhaps because they do not match their vision of an idealized self), or they simply do not care about them. Therefore, it seems important to give users more control over the parts of the body that matter because they signal something about their identity, and more control within reasonable parts of these features' range. Indeed, it looks as if some of the currently available customizations are like a knob that goes all the way to 10, when users really want to fine-tune the range between 2 and 3.

Different worlds, different requirements

Our section on user demographics illustrated how gender and age distribution can vary greatly across virtual worlds. Later on we also saw that age and gender significantly impact the way users create and customize their avatars: males want to stand out, females idealize more, older users create younger-looking avatars, etc. Therefore, it is interesting to ask whether or not each world offers an avatar design system that reflects the needs of its unique population.

MS can appear simplistic at first (of the three worlds, it is the one with the smallest number of customizable features, and the smallest number of options within these features). But, as we saw earlier, younger users prefer creating avatars that follow a trend. Taking this into account, a system that offers a limited number of popular "templates" probably makes sense when serving a user population composed mostly of teenagers (see "demographics"). Seen in this light, it looks as if a simple avatar system such as the one in MS can make sense for a certain user population. While there is certainly room for improvement (see the user comments presented earlier), it is important to remember that an avatar system does not have to be highly customizable to serve its users well.

Similarly, WoW's population is overwhelmingly male, a demographic segment that cares about avatars "standing out." The fantasy races offered to the players, with their selection of extreme physical attributes (horns, partially decomposed faces, etc.) probably satisfy some of this need. For WoW's demographic segment, it might be more important to offer a wide range of outlandish body modifications than full control over the entire avatar's body.

[1] It is interesting to note that one of the characters in *Snow Crash* [14], the famous novel widely considered to have foreseen the emergence of virtual reality, makes her fortune improving the capability of the Metaverse to render avatar faces.

Finally, we saw how SL's population is on average older and more gender-balanced than the other two worlds. This demographic segment cares about projecting an "idealized self" that differs from their own physical appearance but not necessarily in a highly exaggerated manner. A system offering subtle control over fine-grained aspects of an avatar's appearance is therefore probably well suited to this population.

Overall, it is interesting to note how each world's avatar creation system broadly matches the customization needs of its population. A self-selection process might be at work, whereby users gravitate towards the platform that lets them express their identity online in the way they are most comfortable with. Additionally, this suggests the possibility of offering different "customization modes" in each world in order to appeal to a broader population: for instance, the same VW could offer the option to switch from a "template mode" to "full control" to satisfy the needs of two different demographic segments.

The cult of perfection

Our study differs from previous avatar research [2] in part because we were able to directly compare a user's physical attributes to their avatar's, and the resulting data illustrates how avatars can be used as vehicles to escape the constraints of our physical bodies. Interestingly, this form of "avatar escapism" is not always conscious: for instance, many users say their avatar is not much different from themselves in age whereas in fact, the older they are the more different it is. Clearly here the avatar is a vehicle for escaping one of the most visible and unavoidable aspects of our physical bodies: its decay over time. Another physical aspect that has direct bearing on the eventual look of an avatar is the user's weight: significantly overweight users tend to project a more idealized version of themselves than others.

But while most users create avatars that look different from their physical bodies, it is worth noting that almost all of these changes are in directions that Western popular culture would consider "improvements" - that is, users tend to create thinner, younger, more fashionable versions of themselves. So while avatars are indeed a vehicle for identity exploration, they seem to be used mostly to experience physical appearances that match or exceed a society's norms about attractiveness. Only one subject in our survey consciously decided to create a fatter version of himself, for instance, and he explicitly mentioned that this was to rebel against the "Barbie doll" look that is prevalent in SL. This is interesting when considering research that shows that "putting yourself in someone else's shoes" helps reduce negative stereotyping and increases empathy [20]. It looks as if current virtual world users only put on one kind of shoe, so to speak, which doesn't necessarily position virtual worlds as the best environment for building understanding between people of varying body types.

Bodies and minds

While we have discussed how and possibly why users enjoy creating different bodies online, it is also important to note that our data indicates a user's personality remains fairly congruent across online and offline environments. In other words, it looks as if the main contribution of VWs for identity exploration lies in transcending physical, not psychological limitations, which refines the argument presented in earlier work such as [2]. We also note that past research was most often based on a limited sample of users (for instance, male college and graduate students in [2]), while our demographics are much broader. This leads us to believe that our results are reflective of broader trends than were previously reported.

Early computer-mediated communication research emphasized the psychological dimensions of online life [16]. And indeed, at the time graphical worlds were practically inexistent (or at the very least not widely used), which focused attention away from the issue of digital bodies. But now that such 3D environments have become the norm, our study suggests that the kinds of physical transformations they allow play a very important role. While users apparently find it difficult to vary their personality between online and offline contexts a great deal, they clearly have much more freedom to experiment with their physical appearance, with positive impacts on their overall satisfaction. This reinforces the need for VW creators to offer the best possible avatar creation and modification tool they can: physical appearance is essential to a user's projected identity, whatever they choose it to be. And considering that this appearance will, in turn, directly affect their relationships with other users [1], only reinforces this point even more.

Methodological limitations

Before concluding our analyses, we believe it is important to mention a few limitations of our study. First, online surveys can suffer from selection bias: the people who chose to fill out our survey may not necessarily be the "average player." The fact that our participants' demographics broadly match previously reported data leads us to think we have avoided most of this risk, but we also note that the mean age (41 years) of our SL participants looks high and might not reflect the entire player population.

Second, choosing a particular method always involves some trade-offs. In our case, while surveys excel at characterizing broad trends in a population, they are more limited when it comes to understanding the reasons behind these trends. This can be mitigated by using complementary, in-depth interviews, which we plan to conduct at a later date.

Finally, the issue of how to appropriately measure personality traits is still debated. We note however that the field of personality psychology has been "approaching consensus on a general taxonomy of personality traits, the

Big Five personality dimensions" [13, p.103]. We adopted the latter in our study.

CONCLUSION

The increased popularity of VWs has led more and more users to create and use a digital body on a regular basis. While the tools used to create these virtual personas differ widely from one world to the next, our data shows that users still tend to focus their attention on common avatar features. In particular, the importance (in perceived value and time) attributed to hair illustrates the need for avatar creation systems that give users a lot of creative freedom but only in selective areas, namely, those parts of their virtual bodies that will be most immediately visible and recognizable by others, and which are easily adaptable and commonly modified in real life. We also saw how different demographic segments approach avatar creation differently, and how their diverse needs can be satisfied by different types of interfaces.

Our data also show that VWs are used to experiment with digital bodies that are often very different from a user's. In a large majority of cases, VWs users create a digital identity that looks close to Western ideals: leaner, younger, more fashionable versions of themselves. This trend is particularly prevalent for older users and those with weight issues, but it also benefits these users more – they are more satisfied and more attached to their enhanced online selves than average. While such "perfect bodies" therefore appear to have clear benefits to some, it is also worth mentioning that it may cause VWs to become much less diverse than physical environments in the long run, which may in turn lead users to a fairly stereotyped vision of what a human body should be.

Finally, we were able to confirm and refine some earlier research on psychological differences between users and their in-world character. Like previous work, we saw that users tend to see their avatar as having an idealized version of their own personality. Going beyond this however, we also showed that these differences are fairly small and may even disappear over time. Moreover, users with large personality discrepancies appear to be less satisfied with their avatar than those with smaller differences. This stands in contrast to the large differences we observed between physical and digital bodies, and the mostly positive impact these differences have. Overall, our data suggests that avatars might be a better vehicle to explore new forms of physical embodiment rather than for exploring new facets of one's personality. For designers of future VWs, this only reinforces the need to consider their avatar creation and customization system very seriously, since a user's online appearance will be key to their overall satisfaction.

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