Beauty is in the Eye of the Controller: Designing Avatars for the Actual and Ideal Self

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Short Paper

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Abstract

As metaverses are growing users need self-avatars to complete more and more tasks, such as virtual clothing-try-on or virtual work-meetings. To design these self-avatars the application of self-congruity theory suggests that avatars' appearance should either be congruent with users' actual view of themselves or ideal view of themselves. Past research has focused on comparing outcomes of using idealised avatars versus realistic avatars. Yet, it remains unclear what constitutes the ideal versus the actual self in avatar design. This short paper represents ongoing research to develop a theoretical avatar design framework to evoke either users' ideal or actual self. Building on evolutionary and computational approaches to facial beauty, we identify three groups of design factors that stimulate the ideal self: skin-homogeneity, face-symmetry, and balanced face-ratios. This work advances our understanding of the antecedents of the ideal versus actual self and makes self-congruity theory applicable to avatar design.

Keywords: metaverse, self-concept, self-congruity, avatar design, avatar identification, face beautification

Introduction

An increasing number of tasks has been and will be shifted from the physical universe to metaverse; leading business analysts expect that by 2026 25% of humans will spend considerable time in the metaverse on a daily basis (Rimol 2022). Metaverses are "immersive three-dimensional virtual worlds [...] in which people interact as avatars with each other and with software agents" (Davis et al. 2009, p. 91). Avatars are broadly defined as representations of the physical self of a user in a digital realm (Davis et al. 2009). Avatars can be used for leisure, such as gaming, or to fulfil specific tasks (Nowak and Fox 2018). Task-focused avatars can be used to complete tasks previously reserved for users' physical bodies, such as virtual clothing try-on, ergonomic and physical exercise, medical check-ups, immersive social media, and work-related telepresence (Pujades et al. 2019). In task-focused virtual contexts, the appearance and design of the avatar is a central factor in determining users' task performance and their continued use of the avatar (Suh et al. 2011). Yet, unlike in gaming, task-focused avatars are bound in physical reality (Pujades et al. 2019). The creation of such physically accurate task-focused self-avatars is tedious and users often struggle with the creation thereof (Pujades et al. 2019; Thaler et al. 2018). Thus, the creation of avatars *for* users is a focal problem in task-focused contexts (Pujades et al. 2019). However, it still remains unclear what these avatars should look like.

Self-congruity theory (Sirgy 1985) can be applied to guide the design of avatars. The theory describes the psychological process of users in perceiving products, i.e. technology, and the matching of these perceptions to their self-concept (Suh et al. 2011). Therefore, the theory is particularly suitable to explain how users form cognitive connections with their avatars. It explains that a match between a user's self-concept and product-concept leads to motivational outcomes, such as purchasing, customer loyalty or emotional attachment (Suh et al. 2011; Anand and Kaur 2018). A user's self-concept consists of the ideal self – how one would like to see oneself – and the actual self – how one actually sees oneself (Sirgy 1985). Thus, avatars can either be congruent with the ideal self or the actual self of users (Sirgy 1985). For example, older adults prefer avatars that display their unique aged features rather than generic features indicating a need for realistic avatars that reflect the actual self (Puri et al. 2017). In contrast such details could be considered imperfections that users might want to hide (Gunes 2011; Javornik et al. 2022). Research from adjacent fields has revealed that users like to optimise their virtual representations towards an ideal version of themselves. For example, on social media, users beautify their faces with filters to edit out their imperfections (Javornik et al. 2022). In gaming contexts, users tend to design their avatars according to societal beauty ideals (Dunn and Guadagno 2012; Vasalou and Joinson 2009). While Suh et al. (2011) have showed that self-congruity theory can be applied to avatars, they did not consider the ideal self. However, research applying self-congruity theory has shown that it is necessary to distinguish between ideal and actual self, as they can have different effects on behavioural outcomes such as purchasing (Sirgy 1985), and motivation in exercise mirroring (Kim and Sundar 2012). For instance Kim and Sundar (2012) have argued that activating user's ideal self with avatars can lead to an increase in motivation for users who want to live a more healthy lifestyle, by helping them view their ideal future self as more attainable. However, an avatar that represents user actual self makes users more accepting of the avatar experience in general, as an avatar that appears "similar to their self-body (i.e. body ownership) […] [helps users] align their virtual selves with their actual physical selves" (Huang and Liao 2017). Therefore, we argue that for designing avatars both the actual and ideal self have to be considered, as user preference depends on the context in which the avatars are used.

Past research that investigated the difference between avatars that are either congruent with the ideal or the actual self focused on the outcomes of idealised versus realistic avatar use (Kim and Sundar 2012; Sylvia et al. 2014; Mancini et al. 2019; Javornik et al. 2021). However, it remains unclear which design features distinguish ideal form actual avatars. For instance, Kim and Sundar (2012) reported that users who were given the chance to create gaming avatars in Second Life, either created avatars that resembled their ideal or their actual self without describing what these avatars looked like. Similarly, other studies investigated the effects of idealised avatars in gaming (Mancini et al. 2019) and in augmented reality for virtual try-on (Javornik et al. 2021) without specifying the details of the idealized designs and without explaining why they chose specific enhancements. In sum, previous studies do not provide a sound and proven theoretical knowledge base on designing ideal and actual avatars.

In terms of appearance, the ideal self is largely influenced by societal standards of beauty (Kim and Damhorst 2010). Beauty is a physical characteristic of humans and closely related to attractiveness (Gunes 2011). While perceptions of beauty can be considered highly subjective, there is usually some degree of societal consensus within generations, ethnicities, and cultures on beauty standards. There are even certain aspects of human appearance that are deemed beautiful or attractive across genders, ethnicities, and cultures (Gunes 2011, Little et al. 2011). The evolutionary notion of attractiveness in the concept of beauty "suggests that there is a preference for various face and body traits due to the fact that they signal mate quality and imply success in reproduction and parasite resistance" (Gunes 2011, p.19). Accordingly, certain face and body traits transcend local or temporal influences on beauty. We argue that such beauty markers can be used to beautify self-avatars in order to evoke images of the ideal self (i.e., ideal self-congruity). This paper aims to explain how the facial appearance of self-avatars in task-focused contexts can be manipulated to reflect either users' ideal or actual self. We focus on the face and facial beauty as unique identifier of a user, which is especially relevant to the self-concept (Seymour et al. 2018). We draw on self-congruity theory to explain how the image of the avatar can be congruent to a user's self-concept. Our paper aims to answer the following research question:

RQ: Can facial beauty markers in avatar design be used to evoke ideal vs. actual self-congruity?

To address this research question, this paper develops a theoretical design framework which will be tested in an online experiment. It intends to contribute to Information Systems (IS) research in two key ways. First, the paper builds theoretical knowledge of avatar design. Prior research has focused primarily on the

outcomes of using ideal or actual avatars (e.g., Suh et al. 2011; Kim and Sundar 2012; Mancini et al. 2019), without systematically explaining how to stimulate the actual vs. the ideal self. We contribute to this literature by referring to self-congruity theory to extend the understanding of the antecedents of ideal and actual self-congruity. Second, the framework provides IS researchers and practitioners with the necessary guidance to strategically evoke users' ideal or actual self. We do so by translating sub-aspects of ideal appearance into tangible digital beautification techniques for avatars. Given that *"virtual worlds"* has been one of the top research themes in IS research since 2000 (Goyal et al. 2018), insights on how to construct digital selves will be relevant for broad streams of research. Furthermore, Big Tech companies, such as Meta (2021) and Microsoft (Roach 2021), recently announced their shifts to the metaverse and it is expected that many companies will follow suit until 2029 (Nguyen et al. 2022). Our design framework will help to plan and navigate the design of user representation in the metaverse.

Theoretical Background

This paper draws on two research streams. First, this paper relates to studies investigating design-related questions of avatar appearance, virtual appearance, and optimisation thereof. Second, this research is grounded in self-congruity theory to explain why users identify with avatars.

Avatars

Avatars are typically defined as digital entities or digital representations of humans (Davis et al. 2009; Miao 2022). They differ from related concepts, such as conversational agents or chatbots, that do not necessarily have a visual representation (Seeger et al. 2021). Avatars can be classified based on their representation perspective, that is, they can represent the virtual self or virtual others (Miao et al. 2022). Virtual others include avatars as salespeople that users can interact with in e-commerce and customer service (Miao et al. 2022). Self-avatars are defined as digital representations of a user's self (Davis et al. 2009). They evoke presence and immersion into a virtual world (Davis et al. 2009). Self-avatars differ from static pictures and videos because self-avatars are controlled by the user in a virtual environment (Davis et al. 2009). Self-avatars can be further distinguished into leisure related avatars, such as gaming avatars, or avatars employed in task-focused contexts (Suh et al. 2011, p. 712). The latter contexts include virtual clothing try-on, ergonomics and workout modelling, medical check-ups, or professional telepresence (Pujades et al. 2019). Unlike in gaming, task-focused avatars are bound in physical reality. In this research, we focus on self-avatars that provide users with a digital representation of themselves.

Beauty and Virtual Beautification

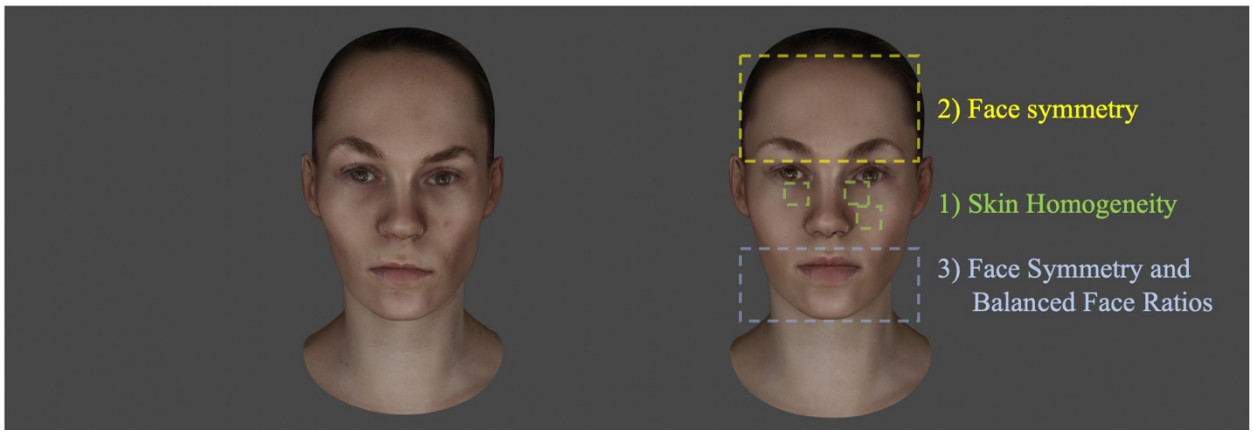

Figure 1: Realistic (Left) and Beautified (Right) Female Face Avatar

The term *beauty* refers to dominant physical characteristics of others and is mostly reserved to describe human appearance (Gunes 2011). Humans assess beauty implicitly, as humans' "preference for beauty is driven by an inherent natural tendency towards beauty in humans rather than explicit social cognitive processes" (Mo et al. 2016, p. 1). Thus, beauty refers to the outcome of a cognitive process all humans share. Even though perceptions of beauty can be considered highly subjective, certain aspects of beauty transcend

genders, ethnicities, and cultures (Gunes 2011). This is due to the fact that the implicit process by which we assess beauty is rooted in an assessment of mate quality and health to ensure reproductive success (Gunes 2011). Most research that investigated the computational assessment and/or improvement of human beauty focused on certain universal face traits, which are rooted in these evolutionary aspects of beauty (Eisenthal et al. 2006; Arakawa and Nomoto 2005; Liao et al. 2012; Zhang et al. 2018; Wei et al. 2021). This body of work agrees that universal facial traits associated with high ratings of beauty or attractiveness include skin texture/colour, face symmetry, and balanced face ratios based on gender (Little et al. 2011). The effect of beautyfing a face avatar based on these three universal beauty traits can be seen in Figure 1.

First, skin texture and skin colour homogeniety are deemed beautiful because they are associated with overall health (Little et al. 2011). Skin texture homogeniety refers to the absence of wrinkles, rhytids, and bumps, and a smooth skin topography (Gunes 2011). Skin color homogeniety refers to homogenous skin colour with overall warm undertones, especially red undertones in areas that are highly affected by blood flow, such as the lips and cheeks (Little et al. 2011). Red undertones suggest high oxygenation in the blood which is associated with high overall health, yellow undertones suggest high consumptions of vitamins which is also associated with high overall health (Little et al. 2011).

Second, face symmetry is deemed beautiful because it is related to reproductive success in terms of sperm production and fertility (Little et al. 2011). Face symmetry refers to the extent to which the right half of the face is a mirror image of the left half of the face (Little et al. 2011). Schmid et al. (2008) found that for computational approaches to beautification, symmetry of the nose and mouth are main drivers of face symmetry. Overall face symmetry is the most common aspect of virtual beautification approaches (Eisenthal et al. 2006; Liao, et al. 2012; Wei et al. 2021).

Third, balanced face ratios based on gender refer to sexually dimorphic face shapes (Little et al. 2011). Sexual dimorphism refers to different ideal distances between the facial landmarks for male and female faces, that emphasise feminity in women and masculinity in men (Little et al. 2011). Most ideal distances are based on golden ratio and/or on neoclassical canons (Schmid et al. 2008; Liao et al. 2012; Zhang, et al. 2018). Schmid et al (2008) showed that only some of these ratios are relevant in virtual beauty and that these differ largely based on gender. This gendered aspect is relevant because face shapes are associated with hormonal levels (Little et al. 2011). Highly feminine or masculine faces advertise mate quality based on hormonal levels: high levels of estrogen for women and high levels of testosterone for men (Little et al. 2011). Most studies show that women and men both prefer highly feminine faces out of all faces (Little et al. 2011). Thus, for feminine faces fuller lips, smaller chin/jaw, and larger distance between the eyes is preferred (Schmid et al. 2008). For male faces equal face proportions between hairline, eyebrows, nose and chin are especially beautiful (Schmid et al. 2008).

Self-Congruity Theory and Avatar Design

Self-congruity theory is based on self-concept and product-concept (Sirgy 1985). The theory explains how a match between these two concepts leads to behavioural outcomes, such as purchasing, customer loyalty or emotional attachment (Anand and Kaur 2018). *Product-concept* refers to characteristics of a product distinct from its functional attributes (Sirgy 1985); it is important in how users define themselves (Suh et al. 2011). *Self-concept* consists of actual self-concept and ideal self-concept (Sirgy 1985). The "actual self refers to the way one perceives oneself; the ideal self refers to the way one would like to perceive oneself" (Anand and Kaur 2018, p. 159). Self-congruity theory encompasses two processes that explain how very different products can both be congruent with users' self-concept. Two different cognitive processes are responsible for either ideal self-congruity or actual self-congruity. First, self-consistency motivation refers to users' need to act in ways that are consistent with their current view of themselves (Sirgy 1985). Second, self-esteem motivation refers to users' need to act in ways that improve their self-regard or bring them closer to a better version of themselves (Sirgy 1985). Therefore, products that are in line with their actual self satisfy user's self-consistency motivation (Sirgy 1985). In contrast, when users consume products that are in line with their ideal self it helps them to feel closer to their ideal self, which satisfies their self-esteem motivation (Sirgy 1985).

Suh et al. (2011) have demonstrated that self-congruity theory can be applied to avatars. They explained that avatars make bodily self-information salient and activate the evaluation of the self-concept. Therefore, avatars replace the products in the initial self-congruity proposed by Sirgy (1985). Accordingly, the avatar-concept, replacing the product-concept, can be defined as the "perception and symbolic meaning" (Suh et

al. 2011, p. 713) of the avatar. Users compare their self-concept with the avatar-concept and if users deem the avatar to be similar, the match between the two concepts leads to self-congruity with the avatar (Suh et al. 2011). Suh et al. (2011) argue that a match between the self-concept and the avatar-concept leads to a cognitive connection between the user and the avatar (Suh et al. 2011). In application to avatars, ideal self-congruity refers to a match between a user's ideal self-concept and avatar-concept and actual self-congruity refers to a match between a user's actual self-concept and avatar-concept. Avatars that match users' ideal self increase users' self-esteem by bringing a virtual substitute of the users' self closer to their ideal self (self-esteem motivation). Avatars that match users' actual self help them to maintain and safeguard their current image of themselves (self-consistency motivation).

Research Model and Hypotheses

In our study, we explain how face beauty markers of users' self-avatars can be manipulated to evoke either actual or ideal self-congruity. The research model is depicted in Figure 2. We argue that when being provided with self-avatars in task-focused contexts users' physical self-concept will be made salient. Physical self-concept is a highly relevant aspect of self-concept (Epstein 1973) and if made salient by an avatar, users are forced to reflect on their self-concept. Consequently, one of the two cognitive self-congruity processes described by self-congruity theory is activated: self-consistency or self-esteem motivation (Sirgy 1985).

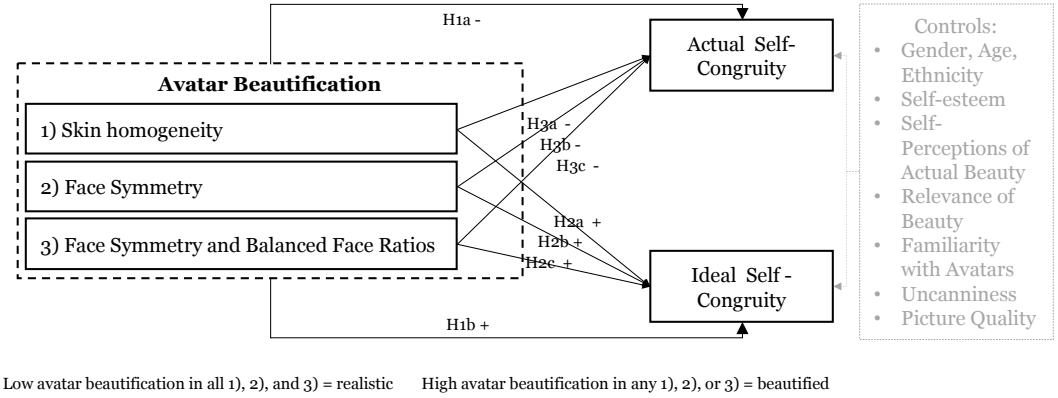

Figure 2: Research Model

First, we argue that a realistic self-avatar activates users' actual self-concept in an implicit act of comparison with the avatar, which leads to actual self-congruity (Suh et al. 2011). Highly realistic avatars are similar to the way users look when they see themselves in the mirror. Due to self-consistency motivation – the notion to protect and maintain the actual self – users evaluate the avatar as highly similar to the actual self, which leads to a match between the actual self-concept and the avatar-concept, referred to as actual self-congruity (Suh et al. 2011). Past research has shown that highly realistic full body avatars lead to actual self-congruity and identification with the avatar (Suh et al. 2011). In contrast, a recent study revealed that virtual face representations that are altered do not activate the actual self (Javornik et al. 2021). Users recognise altered representations of themselves as themselves, but they are aware of the manipulations (Javornik et al. 2021). We argue that highly realistic face avatars will activate the actual self. Therefore, we hypothesize:
H1a: Beautified self-avatars-evoke lower actual self-congruity than realistic avatars.
H3a-c: Avatars with any type of beautification evoke lower actual self-congruity than realistic avatars.

Second, we argue that users' implicit comparison with a beautified avatar of themselves will lead to an activation of the ideal self due to the self-esteem motivation as explained by self-congruity theory (Sirgy 1985). Past research has demonstrated that augmented-reality representations of users' self (augmented with makeup) evoked congruity with the ideal self rather than with the actual self (Javornik et al. 2021). We propose that this is also the case for face avatars. Users recognise the beautified avatar as a virtual aspect of their self-concept (Javornik et al. 2021). Thus, the avatar can satisfy the user's self-esteem motivation – the notion to self-improve – which leads to ideal self-congruity (Sirgy 1985). We also argue that universal beautification mechanisms can be applied to all face avatars equally without having to consider individual insecurities. We are proposing this because the ideal physical self-concept is largely rooted in societal standards of beauty (Ahadzadeh et al. 2017). Personal deviations from one's ideal appearance are usually the product

of a deviation of the beauty standard (Ahadzadeh et al. 2017). Thus, beautification mechanisms for avatars based on universal beauty standards should address users' unique insecurities. We hypothesize:
H1b: Beautified avatars evoke higher ideal self-congruity than realistic avatars.

Because the physical ideal self is rooted in beauty standards (Ahadzadeh et al. 2017), avatars that adhere to the beauty standards are deemed closer to the ideal version of ourselves. These beauty standards are identified by evolutionary concepts of beauty as a function of expected reproductive success in mate selection (Little et al. 2011). The evolutionary notion lists *skin homogeneity*, *face symmetry*, and *balanced face ratios* as the universal beauty standard across genders, ages, cultures, and ethnicities (Little et al. 2011). Past research based on this evolutionary perspective has revealed that virtual beautification can be achieved by beautifying either the skin (e.g., Arakawa and Nomoto 2005), the face shape (symmetry and ratios) (e.g., Liao et al. 2012; Wei et al. 2021), or both (e.g., Eisenthal et al. 2006; Zhang et al. 2018). This suggests that the individual virtual beautification techniques are additive. Thus, we argue that avatars with all three beautification techniques (skin homogeneity, face symmetry, and balanced face ratios) will be closest to the universal beauty standards. As the user's ideal self is largely rooted in the universal beauty standard (Ahadzadeh et al. 2017), beautified avatars that are closer to this standard will be closer to user's ideal self, which in turn results in the highest level of ideal self-congruity. Research on virtual beautification that employed multiple mechanisms either used face shape beautification mechanisms (ratio/ symmetry) (Liao et al. 2012) or skin beautification mechanisms (skin colour and texture beautification) (Arakawa and Nomoto 2005). This suggests that skin beautification can be performed independently of face shape beautification (ratios/ symmetry). A study on augmented reality has shown that improving skin in augmented reality mirrors evokes the ideal self (Javornik et al. 2021). In line with these findings, we hypothesize:
H2a: Avatars with beautified skin texture and colour evoke higher ideal self-congruity than avatars with realistic skin texture and colour.

Past research has also shown that users consider their face shape very important to their ideal self-concept, and even undergo surgical procedures to come closer to their ideal self-concept (Askegaard et al. 2002). Thus, we propose that avatar face shapes that are beautified evoke higher ideal congruity than avatars that are not. Furthermore, in past virtual beautification research only face symmetry has been applied on its' own (Wei et al. 2021). Beautification of balanced face ratios was only applied after symmetry (Liao et al. 2012) or at least simultaneously (Wei et al. 2021). In addition, research on evolutionary perspectives of beauty has demonstrated that preferences for face symmetry and balanced face ratios are highly correlated (Little A. et al. 2008). This suggests that balanced face ratios cannot be applied without face symmetry; but face symmetry can be applied without balanced face ratios. This also makes sense intuitively, as for faces with asymmetries it would be difficult to decide on which side of the face to apply the ideal face ratios, and applying face ratios regardless would make the asymmetries more noticeable. Therefore, we hypothesize:
H2b: Avatars with beautified face symmetry evoke higher levels of ideal self-congruity than avatars with realistic face symmetry.
H2c: Avatars with beautified face symmetry and beautified face ratios evoke higher levels of ideal self-congruity than avatars with beautified face symmetry and with realistic face ratios.

Study Design

	Realistic archetype	Beautified archetype
1) Skin Homogeneity	• Realistic texture • Realistic colour	• Smooth texture correction, minimise bumps and folds • Overall colour homogenisation, warm undertone correction, and increased redness of lips and cheeks
2) Face Symmetry	• Realistic face and shape ratios	• Symmetry correction of face shape (especially nose and lips)
3) Balanced Face Ratios		• Face shape correction - Women: fuller lips, smaller chin/jaw, and larger distance between the eyes • Face shape correction - Men: equal distances between hairline, eyebrows, base of nose, and edge of chin; balanced eye to mouth width

Table 1: Summary of Avatar Design Characteristics in Study Design

We plan to conduct an online experiment to test our research model. The research model includes ideal self-congruity and actual self-congruity as dependent variables to differentiate the causal effects between avatar beautification, avatar realism, and self-congruity. We will employ a between-subject full factorial design and participants will be randomly assigned to either one of six treatment conditions along the two factors (skin beautification and shape beautification) or a control condition. The treatment conditions are organized along the two variables skin beautification (two levels of skin beautification: none, homogenised skin) and shape beautification (three levels of shape beautification: none, symmetry, symmetry plus balanced ratios). Table 1 offers an overview of our treatments. In the control condition users will be presented with a photograph of themselves instead of an avatar to render physical self-concept salient.

For the experiment we adopt a two-session design based on the experimental design of Suh et al. (2001). In the first session, participants will be asked to take seven high resolution pictures of their bare face from different angles to allow a sufficient coverage of the face. They are then asked to upload their unmodified images to the study's web interface. Based on the experimental group participants' pictures are manipulated in an algorithm-supported process. Afterwards, the avatars will be created from the pictures in an algorithm-supported process, where the final approval of the avatar is conducted by a human to ensure similarity with the participant. Participants can access the second session after one to three days as the "process for creating digital face representations modelled after the actual face of a human [...] is, at present, highly time-consuming" (Seymour et al. 2018, p. 959). To ensure participant persistence between sessions we will remunerate participants if they complete both sessions as proposed by Suh et al (2011). In the second session, participants will be provided with their self-avatars which will be presented invertedly to mimic looking in the mirror. We will then ask all participants "to zoom their avatar in/out at different angles" (Suh et al. 2011, p. 718) to ensure that they evaluate the avatar and have control over it. Afterwards they answer a questionnaire to measure their perception of ideal self-congruity with the avatar and actual self-congruity with the avatar. These measures are adapted from Sirgy et al. (1997) for ideal and actual self-congruity. The questionnaire will also include control measures including gender, age, ethnicity, self-esteem, perceptions of participants' actual beauty, and familiarity with self-avatars as proposed by Javornik (2021). We will also include measures of eeriness and uncanniness as proposed by Seymour et al. (2021). This is important to ensure that possible uncanny perceptions of the avatar do not distort our results. We will first conduct elaborated and thorough pre-tests to then collect data in the proposed main experiment.

Expected Contributions

We expect this study to offer two major contributions. First, we combine self-congruity theory with evolutionary perspectives on beauty to identify antecedents of physical self-concept. "Only a few studies have examined what characteristics constitute self-concept" (Suh et al. 2011, p. 715). Our study aims at identifying universal characteristics that influence ideal self-concept to fill this gap. This knowledge offers researchers and practitioners in IS and human-computer-interaction with the necessary guidance to strategically evoke users' ideal or actual self when providing avatars. Future research could deploy the design characteristics to synthesise and reconcile the inconclusive findings on the outcomes of using avatars that represent the ideal self. For example, some studies found that avatars that represent users' ideal self have positive, energising effects (Kim and Sundar 2012) while others showed negative, health-detrimental effects (Sylvia et al. 2014; Mancini et al. 2019). Our study extends the applicability of self-congruity theory to technology beyond products and brands. Suh et al. (2011) were the first to showcase that self-congruity theory can be used to explain congruity between a user's actual self-concept and a technology-concept. Our work demonstrates that self-congruity theory can also be applied when investigating the relationship between a user's ideal self-concept and technology. Second, the study contributes to the small body of literature on metaverses in IS. Large multinational conglomerates such as LVMH (2022), Meta (2021) and Microsoft (Roach 2021) have already begun shifting resources to the metaverses. It is crucial to lay the theoretical foundation now to understand how avatar design influences how we will complete tasks in the metaverse in the future.

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