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Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full length article

Avatar-mediated creativity: When embodying inventors makes engineers more creative

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ARTICLE INFO

Article history:

Received 11 August 2015

Received in revised form

6 March 2016

Accepted 8 March 2016

Keywords:

Avatars

Virtual environment

Proteus effect

Creativity

Engineering

ABSTRACT

An important challenge today is to support creativity while enabling geographically distant people to work together. In line with the componential theory of creativity, self-perception theory and recent research on the Proteus Effect, we investigate how avatars, which are virtual representations of the self, may be a medium for stimulating creativity. For this purpose, we conducted two studies with a population of engineering students. In the first study, 114 participants responded to online surveys in order to identify what a creative avatar may look like. This enabled us to select avatars representing inventors, which were perceived as creative by engineering students, and neutral avatars. In the second study, 54 participants brainstormed in groups of 3, in 3 different conditions: in a control face-to-face situation, in a virtual environment while embodying neutral avatars and in a virtual environment with inventor avatars. The results show that inventor avatars led to higher performance in fluency and originality of ideas. Moreover, this benefit proved to endure over time since participants allocated to inventor avatars also performed better in a subsequent face-to-face brainstorming. The prospects of using avatars for enhancing creativity-relevant processes are discussed in terms of theoretical and applicative implications.

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1. Introduction

Creativity is the starting point to change the product range and offer new services in a context in which companies have to innovate and differentiate from their competitors. Therefore, finding relevant new methods to stimulate creativity and foster innovation becomes a key issue. Moreover, technological and organizational developments (collaborative design, distributed teams, etc.) create new challenges: creative methods must be consistent with this new reality of work. In this respect, virtual environments may help connect geographically distant people, but also support, or even

improve, creativity and innovation.

Much work has focused on the design of computational systems to support creativity (e.g. Afonso Jaco, Buisine, Barré, Aoussat, & Vernier, 2014; Lee, 2015). Classical platforms used for this purpose include, for example, electronic brainstorming systems, which have been the subject of research in Human-Computer Interaction and Psychology (e.g., DeRosa, Smith, & Hantula, 2007; Michinov & Primois, 2005; Michinov, 2012). However, in line with a *cybercreativity* analysis of virtual worlds (Nelson, Guegan, & Lubart, submitted), it seems possible to go a step further. In particular, the present paper focuses on the avatar (i.e., digital representation of the self) as a potential vector for stimulating creativity. The avatar is a character, often customizable, which represents user's identity in the virtual environment (Meadows, 2008). Avatars are interface items that are considered particularly attractive, hedonic and persuasive (Nemery & Brangier, 2014). They are a central component of many gamification systems (Hunicke, Leblanc, & Zubek, 2004;

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Singer & Schneider, 2012). Gamification, which refers to the use of game design elements in non-game contexts (Deterding, Khaled, Nacke, & Dixon, 2011), is generally used to increase user experience and engagement (Dominguez et al., 2013). For all these reasons the use of avatars in creativity sessions seems promising and timely.

Avatars are projections of users, a “tangible embodiment of their identity” (Ducheneaut, Wen, Yee, & Wadley, 2009). Users can create avatars looking like them, experience a multiplicity of identities or highlight certain aspects of their ideal self (Bessière, Seay, & Kiesler, 2007). Thereby, the configuration of avatars allows users to change their appearance, their social roles and their identity in the virtual world. The relationship between users and their avatars may even provide support to engage people with lifelong disability in activities and social interactions (Stendal, Molka-Danielsen, Munkvold, & Balandin, 2012). Furthermore, a growing body of research supports the idea that avatars' appearance influence users' behaviors in the virtual world (Yee & Bailenson, 2007). This kind of phenomenon leads us to investigate the potential impact of avatars on creativity-relevant processes, and the effects of embodying a creative avatar on users' creative performance. To substantiate this endeavor, Section 2 reviews the theoretical background and literature on avatar-modulated behaviors and Section 3 provides the theoretical articulation with the creativity framework.

2. The influence of avatars on behaviors and attitudes

The influence that the avatars may exert on users has been the subject of several experimental studies over the past decade. On a theoretical level, these studies are based on research on the effects of anonymity and identity cues.

In line with the seminal proposals of *self-perception theory* (Bem, 1972), the individual explains his attitudes and internal states based on observation of external cues. Therefore, the individual would adopt the same point of view as an external observer “who must necessarily rely upon those same external cues to infer the individual's inner states” (Bem, 1972, p.3). For example, Frank and Gilovich (1988) showed that participants wearing black uniforms exhibit more aggressive behavior than participants wearing white uniforms. This phenomenon was observed both in laboratory and in natural environment. Moreover, this self-perception process can be linked to *deindividuation* (Diener, 1980; Festinger, Pepitone, & Newcomb, 1952), which refers to a behavioral modulation in situations of anonymity. Indeed, although deindividuation was initially seen as a negative phenomenon (i.e., which leads to aggressive and antisocial behaviors; see Postmes & Spears, 1998 for an overview), subsequent research has shown that deindividuation is quite neutral but may increase the sensitivity of individuals to environmental influences (e.g., Gergen, Gergen, & Barton, 1973; Spivey & Prentice-Dunn, 1990). For instance, it has been shown that participants exhibit more prosocial behavior when wearing a nurse costume rather than a Ku Klux Klan uniform (Johnson & Downing, 1979), which is consistent with expectations an external observer might have. However, this study also showed that the participants in nurse costume behaved in a more prosocial way when they were anonymous (i.e., deindividuated). Consequently, it can be considered that deindividuation does not necessarily lead to aggressive and antisocial behavior, but also (and perhaps most importantly) that “deindividuation increases the self-perception reliance on identity cues” (Yee, Bailenson, & Ducheneaut, 2009, p.292).

This reasoning can be transposed to avatars in virtual environments. As noted by Yee and Bailenson (2007), virtual environments are conducive to deindividuation because of the physical isolation and the anonymity of the users. Moreover, the avatar may greatly influence self-perception process as it is even more than a costume or a uniform that is worn: “the avatar is our entire self-representation” (Yee & Bailenson, 2007, p.274).

In situation of anonymity in virtual environment, the digital representation of the self may thus influence users and rationalize their behaviors to be consistent to the avatar's identity. This behavioral modulation related to the appearance of the avatar, known as *Proteus Effect* (from the Greek God Proteus who possessed the ability of metamorphosis), has been observed in several studies. Yee and Bailenson (2007) have shown that attractive avatars lead to behave in a more intimate way in terms of self-disclosure and interpersonal distance (see also Waddell & Ivory, 2015). It should be noted that this phenomenon results from the mere exposure to a virtual mirror allowing the participant to see his/her avatar for about 1 min. In this respect, it can be considered that the Proteus Effect is initiated almost instantly. In another study, Yee and Bailenson (2007; Yee et al., 2009) have shown that tall avatars lead to more confident behavior than short avatars in a negotiation task. Recent studies have also shown that the appearance of the avatar may affect subsequent behavior in the real world (Rosenberg, Baughman, & Bailenson, 2013; Yoon & Vargas, 2014). For example, the benefits of a tall avatar on negotiation endures in a subsequent negotiation task in face-to-face situation (Yee et al., 2009). Likewise, it was found that the weight of avatars influence real life physical activity during motion gaming sessions (Peña, Khan, & Alexopoulos, 2016; Peña & Kim, 2014).

Beyond behavior, it has also been shown that avatars could influence attitudes and productions of the users. For instance, the embodiment of female avatars, with an appearance more or less sexualized, can impact perceptions and judgments towards women (Fox, Bailenson, & Tricase, 2013), and the use of a doctor vs. a Ku Klux Klan avatar can influence the content of stories composed by the users (Peña, Hancock, & Merola, 2009). Since the latter study shows that avatars' appearance modify narrative productions, which somehow are related to a creative or imaginative process, we think that the influence of avatars on creative processes is worth investigating. In the following section, we elaborate on how this effect could occur and which component of creativity it may impact.

3. The use of avatars for creativity

Creativity can be defined as the capacity to produce novel, original work that fits with task constraints (Sternberg & Lubart, 1999). It is said to be a cornerstone of innovation and of the knowledge economy (Florida, 2002). The *Componential Theory of Creativity* (Amabile, 1983, 2013) posits that four components are essential to creativity: three intra-individual components—Domain-Relevant Skills, Creativity-Relevant Processes and Intrinsic Task Motivation—and an external component corresponding to the Social Environment. A considerable amount of research has been devoted to capturing the influence of the social environment and of the motivational component on creativity (Amabile, 2013). It has notably been shown that the imposition of salient extrinsic constraints undermines intrinsic motivation and subsequently decreases creative performance (Amabile, 1985). This effect can be explained by the self-perception theory (Bem, 1972), which predicts that the presence of extrinsic motivators

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