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How the physical similarity of avatars can influence the learning of emotion regulation strategies in teenagers

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ABSTRACT

The aim of this study is to evaluate the influence of the physical similarity of avatars with the user on emotion regulation strategy training. In this study twenty-four teenagers observed an avatar (either physically similar to the participant or neutral) that gets frustrated with his/her computer, after which he/she applies an emotion regulation strategy (slow breathing). The intensity of the emotional induction and regulation processes was measured using questionnaires and electroencephalogram data. The results show that observing an avatar that is physically similar to the participant has a significantly greater impact on emotional valence and arousal in participants and also induces emotional states that are significantly more intense than when observing a neutral avatar. The results seem to indicate significantly greater activation of specific brain regions that are related to these processes and greater identification with the avatar in terms of both subjective and objective measures in participants that observed an avatar that was physically similar to them. However, there were no significant differences in the sense of presence or the appeal (i.e., satisfaction) to participants regarding the virtual environment. The use of avatars in mental health applications is relatively new and its specific influence is still unknown. We consider this study to be a first step forward in better understanding the use of avatars in mental health applications for youth. This research brings new guidelines to the design of different types of applications in this field in order to achieve greater behavioral changes in youth.

1. Introduction

The ability to regulate one's emotions corresponds to a critical aspect of socioemotional competence and provides an important foundation for inter- and intra-personal functioning. Recent studies in clinical psychology have demonstrated that people with emotional disorders frequently use maladaptive emotion regulation strategies (Barlow et al., 2011), and these studies have also shown a significant relationship between depression, stress, and coping strategies (Botella, Moragrega, Baños, & García-Palacios, 2011). Moreover, youth with different psychological disorders exhibit a wide range of difficulties related to expression, understanding, and/or regulation of emotions that may contribute to the onset or maintenance of their symptoms (e.g., Suveg, Southam-Gerow, Goodman, & Kendall, 2007). Research from the affective neuroscience field has also demonstrated the importance of emotion regulation processes in brain development. Numerous studies in the field of neuropsychology (see Davidson, 2000 for a brief review) have identified brain structures that underlie emotional responding (e.g., Phillips, Ladouceur, & Drevets, 2008) that make up a complex network that is responsible for processing responses to emotional events (Ochsner & Gross, 2005). These involve brain structures such as the ventromedial prefrontal cortex, the dorsolateral prefrontal cortex, the orbitofrontal cortex, amygdala, insula, hippocampus, cingulate cortex (Davidson, 2000; Ertl, Hildebrandt, Ourina, Leicht, & Mulert, 2013; Ochsner, Beer, Robertson, et al., 2005; Phillips et al., 2008; Suveg et al., 2007). These neuronal networks, which mature throughout childhood and adolescence, play an important role during emotion regulation processes and support the brain regions that are involved in reward processing, cognitive processes (e.g. attention), response inhibition to emotional stimuli, and risk taking (Marsh et al., 2006;

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Phillips et al., 2008; Rubia et al., 2000). Studies from both affective neuroscience and clinical psychology have demonstrated the importance of emotion regulation programs in child development (Suveg et al., 2007) and its crucial importance for socioemotional competence as well as for the prevention and treatment of mental health issues (Southam-Gerow & Kendall, 2002). Therefore, the application of emotion regulation programs seems to be crucial in order to help train and improve executive function networks that are related to attention, which in turn involve emotional changes and more favorable life outcomes (Posner, Rothbart, & Tang, 2013). Since teenagers have been identified as a population that is particularly vulnerable to mental disorders (Patel, Fisher, Hetrick, & McGorry, 2007), and the increase in indiscipline and physical and psychological violence has been specifically noted for this age group (Serrano & Iborra, 2005), our study focuses on this particular demographic.

One of the possible pathways for learning appropriate emotion regulation strategies corresponds to Modeling Therapy (MT) (Bandura, 1977; Bandura, 2001). Bandura (1977), Bandura (2001) assumes that people can change their behavior by observing models of other people that successfully cope with the problems they face. Therefore, a teenager that has difficulties with the regulation of his/her emotions can observe someone dealing with the same issues in a more adaptive way and learn new coping strategies from this model. Even though MT has proven to be efficacious, it also has the following drawbacks: (1) the therapy and its preparation can be time-consuming; (2) there may be logistic difficulties (i.e., difficulty to get the room, the feared stimuli, actors); and (3) it is not easy to provide factors such as identification with the observed model (i.e., the actor should have the same gender and the same physical characteristics, etc.). Recently, innovative technologies such as VE and avatars have placed Bandura's MT in a new light by responding to these drawbacks (e.g. Bailenson, Blascovich, & Guadagno, 2008). An avatar that looks like the self, namely Virtual Representations of the Self (VRS), was recently created by Bailenson et al. (2008). The authors used photographs of individuals in order to create digital representations of humans that look like the self. According to Bailenson et al. (2008) VRSs can be used to create the ideal model by maximizing feelings of similarity in order to allow the demonstration of a wide range of rewards and punishments and to customize the VRS behavior to show an optimal performance that the physical self (e.g. an actor) cannot yet achieve. For instance, VRSs can represent the highest level of similarity to the observer (e.g. same age, gender, skill level, emotional state). Such similarities allow the individuals to develop feelings of identification with the VRSs and to develop empathy towards them (Gilliath, McCall, Shaver, & Blascovich, 2008). This feelings correspond to the identification factor that according to Bandura increases the effectiveness of VRSs as persuasive agents. Moreover, VRSs can also represent the effects of one's behavior in the short term (i.e., demonstrating the reward for one's behavior in an accelerated way). For instance, VRSs can demonstrate in a short time period different levels of attainable or ideal states (e.g. a physical states such as losing weight or an emotional state such as being proud of achieving a goal). By directly observing the results of their actions, individuals can be motivated to make a significant lifestyle change, showing that such changes are achievable (Fox & Bailenson, 2009). According to Bandura, this corresponds to the vicarious reinforcement factor, which increases the likelihood of the observer performing the modeled action. It also allows observers to believe in their self-efficacy regarding the observed behavior, which also has an impact on the observers' performance. Recent series of studies using VRSs have demonstrated the significant influence of these avatars on human behavior. Specifically, VRSs have been effectively used to do the following: promote physical exercise (Fox & Bailenson, 2009); modify eating habits (Fox & Bailenson, 2009); promote financial saving behavior (Ersner-Hershfield et al., 2011); modify product preferences (Ahn & Bailenson, 2011); induce greater embodiment (Fox, Bailenson, & Tricase, 2013) and greater physiological arousal (Fox, Bailenson, & Ricciardi, 2012). The similarity of avatars has also an impact on the social behavior in the Game-Based Virtual Community. According to Lortie and Guitton (2011), Lortie and Guitton (2012), human-like avatars display more homogeneity in their social groups than non-human avatars, and the visual similarity among group members provide high level of group stability over time. The authors suggest that the therapeutic potential of online support groups may be promoted through visual cohesion and a way to reinforce social bonds among participants. To the authors' knowledge, VRSs have not yet been applied to behavioral modification in the field of emotion regulation. Since new technologies have been identified as potential tools for increasing engagement in therapy and accessibility of treatment (Coyle, Doherty, Matthews, & Sharry, 2007), an interesting channel for providing an emotion regulation program to youth would be to use new technologies such as a Virtual Environments (VE) and VRS avatars.

VE and avatars resolve some of the problems associated with the traditional setting for delivering MT: (1) the time necessary for preparation corresponds only to the development and modeling of VE, which can be used for as many patients/participants as needed, at any time, and in any location; (2) all the necessary stimuli can be developed, modeled, and made available with a simple click of the computer button, which decreases the logistic issues; and (3) the avatars can be modeled in a way to perfectly respond to both identification and reinforcement factors that influence the change in behavior. Furthermore, individuals can interact in the VE spaces in a way that gives them the sensation of being present (Baños et al., 1999). In other words, they feel that the VE is real and that their sensations, feelings, and actions correspond to what can be perceived in VE as opposed to the real environment (Lee, 2004; Lombard & Ditton, 1997). Although numerous definitions and theoretical conceptualizations of presence exist, the authors of empirical studies and theoretical models agree on the fact that presence is a multi-dimensional concept (e.g. Lee, 2004. Lessiter, Freeman, Keogh, & Davidoff, 2000; Schubert, Friedmann, & Regenbrecht, 2001) that includes at least the following factors: (a) spatial presence (i.e., the feeling of physically being in the virtual space); (b) involvement (i.e., the attention to the virtual stimulus); and (c) realness (i.e., the feeling that the virtual stimulus coincides with the expectation of a real stimulus). In the context of virtual therapeutic environments, presence has been identified as a necessary construct for eliciting emotions (e.g. anxiety) during the exposure (Price & Anderson, 2007). However, the relationship between emotions and presence is still under investigation, and a bidirectional relationship is possible (Riva et al., 2007). The high level of presence in the VE also allows individuals to feel as if they were interacting with the VE rather than the real physical space, which in turn also has an impact on a greater sense of connection with the avatar (e.g. Behm-Morawitz, 2013), or what can be called self-presence (e.g. Biocca, 1997; Tamborini et al., 2004).

The aim of this study is to evaluate the influence of the physical aspects of the avatars on the learning of emotion regulation strategies in teenagers. Since the introduction of avatars in mental health applications is relatively new, a deeper understanding of their influence on the user's behavior is of great importance. Considering previous studies, VRSs applied to the MT framework can provide a useful tool for learning emotion regulation strategies in teenagers. More specifically, this study evaluates how the physical similarity of the avatar can influence the intensity of emotional induction and regulation of the emotion of frustration in teenagers. The following hypotheses were tested: