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A game for emotional regulation in adolescents: The (body) interface device matters

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ABSTRACT

The aim of this study is to evaluate the role of the type of interface device in the efficacy of a serious game that teaches emotional regulation (ER) strategies in a non-clinical sample of adolescents. We conducted a between-participants experiment in which participants ($N = 61$) played a frustration induction game, and then an ER game (a breathing strategy game), using one of three types of devices (computer, smartphone, and RGB-D camera). Frustration mood and perceived arousal were the main variables measured. Results revealed a significant interaction between moment (pre-induction phase, post-induction phase, and regulation phase) and the type of interface device used in the frustration mood scores. In participants who used the computer and smartphone, frustration increased after the induction phase and decreased after the regulation phase. However, for participants who used the RGB-D camera, frustration decreased significantly after the induction phase, and this change was maintained after the regulation phase. Changes in arousal were similar with the three devices. This study highlights that the type of interface device (and specifically, the participation of the body) is a crucial variable in the efficacy of serious games affecting users' emotional experience.

1. Introduction

Emotional Regulation (ER) has been defined as "the process by which individuals influence which emotions they have, when they have them, and how they experience and express them" (Gross, 1998, p. 275), whereas emotional dysregulation has been defined as "the difficulties in the intensity, frequency, and duration of emotional responses, as well as difficulties modulating emotional experiences in effective and adaptive ways" (Bloch, Moran, & Kring, 2010, p. 177). ER strategies have been researched mainly in adults, although recent studies have shown their relevance in childhood and adolescence (Betts, Gullone, & Allen, 2009; Gullone, Hughes, King, & Tonge, 2010; Gullone & Taffe, 2012; Larsen et al., 2013), and they have been related to psychological disorders in this population, such as anxiety, depression (i.e., Garber, Braafladt, & Weiss, 1995; Mathews, Kerns, & Ciesla, 2014; Silk, Steinberg, & Morris, 2003; Southam-Gerow & Kendall, 2002; Suveg & Zeman, 2004), aggressiveness (i.e., Bohnert, Crnic, & Lim, 2003; Dearing, Relyea, & Simons, 2002; Muñoz, Kimonis, Frick, & Aucoin, 2013; Sullivan, Helms, Kliewer, & Goodman, 2010) or eating disorders (i.e., Sim & Zeman, 2005, 2006), among others.

Several interventions have been developed to teach adaptive ER strategies to adolescents with psychopathology (i.e., Antshel & Olszewski, 2014; Mehlum et al., 2014; Simkin & Black, 2014). However, it is still a challenge to make these interventions attractive and get the users to be committed to their practice. Serious games may be useful tools for these objectives. This term refers to the use of videogames for purposes other than entertainment, for example, to provide training in several skills (i.e., strategic thinking, decision making, negotiation techniques) (Kirriemuir & McFarlane, 2004; Squire & Jenkins, 2003) or promote healthy lifestyles (DeSmet et al., 2014). Moreover, they allow learners to experience

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situations that are not possible in the real world for reasons of safety, cost, time or logistics (Corti, 2006).

In recent years, some games have been developed with the aim of teaching ER strategies to adolescents. For instance, *RAGE-control* "Regulate and Gain Emotional Control") (Kahn, Ducharme, Travers, & Gonzalez-Heydrich, 2009) is designed to teach adolescents (9–17 years old) to focus their attention, control their physiological arousal, and maintain their heart rate, through the application of relaxation techniques in the context of a traditional computer battle game. In a pilot study, Ducharme, Wharff, Kahn, Hutchinson, and Logan (2012) found that this application, along with anger control therapy, regulated physiological anger arousal in children receiving psychiatric treatment, compared to the usual treatment. Another computer game is *ROC* ("Reach Out Central") (Shandley, Austin, Klein, & Kyrios, 2010), which is based on the principles of cognitive behavior theory and teaches skills such as communication, problem solving and optimistic thinking. *ROC* has been shown to be effective in reducing psychological distress and improving life satisfaction, problem solving and help seeking in young women (16–25 years old). Finally, *SPARX* ("Smart, Positive, Active, Realistic, X-factor thoughts") (Merry et al., 2012) is a computerized fantasy role-playing game based on cognitive behavioral therapy. It was designed for young people (12–19 years old) with mild to moderate depression, in order to teach them to be better problem solvers, reinterpret the events around them in a more helpful and positive way, use relaxation skills, and perform pleasant activities (Griffiths, 2012). This therapy game was as effective as the usual care in reducing symptoms of depression in primary care settings, and it improved access to treatment for rural youth (Cheek et al., 2014).

Most of the serious games that teach ER strategies have been applied in therapies for children or adolescents with different psychopathological problems. So far, few studies have used this tool to prevent ER difficulties in a non-clinical population. For this reason, the *GameTeen System* (GT-System; Rodríguez et al., 2015) was designed to teach adolescents skills to tolerate and cope with unwanted emotions through the use of ER strategies. GT-system is a serious game that consists of two phases: a *frustration induction game,* which induces an emotion of frustration in the user, and a *training phase*, which allows users to practice two ER strategies through two games: the *breathing strategy game* and the *attention strategy game.* In a previous study (Rodríguez et al., 2015), results showed that the *frustration induction game* was able to significantly increase participants' frustration, and the *training phase* was able to reduce it.

The effect of user interface embodiment on the efficacy of games for inducing emotions and teaching ER strategies has not yet been analyzed. User interface embodiment has been defined as "the degree to which the user's body is coupled to the interface" (Kim, Prestopnik, & Biocca, 2014, p. 377). This concept has been receiving special interest since the emergence of digital technologies that allow new forms of play and interaction with the environment, as in the case of virtual reality (VR). VR involves a real-time simulation of an environment that allows user interaction via multiple sensory channels that elicit emotional responses and a sense of presence (i.e., Adamovich, Fluet, Tunik, & Merians, 2009; Baños et al., 2012; Felnhofera et al., 2015; Mantovani & Riva, 1999; Riva, Castelnuovo, & Mantovani, 2006). It can be provided through different devices, varying the degree of sensorial channels (i.e., vision, auditory, touch), the degree of sensory richness (i.e., from larger to smaller screens), or the involvement of the body (motor system) in interacting with the interface (i.e., from moving the mouse to interacting with the whole body). All these variables can influence the user's experience in virtual worlds. Regarding interaction interfaces, the new generation of games uses devices that provide opportunities for more intuitive interactions, such as the RGB-D camera, allowing users to be physically active and control video games through body movements. These devices make the interaction more realistic and enjoyable, and they increase the sense of presence, engagement, and emotional responses (i.e., Bianchi-Berthouze, 2013). For instance, Slater, Steed, McCarthy, and Maringelli (1998) found that when participants were asked to move within the virtual environment in a way that was related to the task they had to accomplish, their sense of presence was enhanced. Bianchi-Berthouze, Kim, and Patel (2007) found that body movements as an input device not only increased the gamer's level of engagement, but they also had an influence on the way the gamer became engaged in a virtual music game. Their results demonstrated that the body movement itself facilitated users' sense of presence and ER. Recently, Lisón et al. (2015) showed that a competitive active video game through an RGB-D camera increased the values of perceived arousal and affect in children during an opponent-based condition. Finally, Kim et al. (2014) examined how the level of user interface embodiment, that is, the degree to which the user's body interacted with the game, affected the user's experience, game behavior, and intention to change his/her behavior in exergaming, and they concluded that the type of interface is an important factor that affects user experience.

All these results are in line with the theory of embodied cognition, which indicates that sensory disposition, movement, and extension of the body can affect the user's cognitive and emotional experiences (i.e., Bohil, Alicea, & Biocca, 2011; Klemmer, Hartmann, & Takayama, 2006). From this perspective, evidence shows that bodily states (i.e., facial expression, posture, movements) are relevant in the expression and recognition of emotions, playing an important role in the emotional experience and vice versa (i.e., Duclos et al., 1989; James, 1932; Michalak et al., 2009; Michalak, Rohde, & Troje, 2015; Niedenthal, 2007; Rahona, Ruiz Fernández, Rolke, Vázquez, & Hervás, 2014).

Recently, user interface embodiment has also been studied in the smartphones field. Some studies have analyzed how finger movements can influence the user's emotional response. For example, Gao, Bianchi-Berthouze, and Meng (2012) examined the possibility of recognizing the player's emotional state by measuring the pressure, speed, direction and length of the finger strokes during a game. Their results showed that pressure discriminated a frustrated state from the other three states (excited, relaxed and bored). Specifically, the stroke speed and directness discriminated between different levels of arousal while the stroke length mainly discriminated boredom from a relaxed state. These results highlight that touch behavior could be an important measure of user experience when evaluating interactive technologies.

So far, serious games designed to teach ER strategies have mostly used laptop computers, and no studies have explored the role of different interface devices in the ER field. This study explores how the type of user interface embodiment can affect the way users perceive the gaming environment, and it is specifically designed to test the following hypotheses:

H1. The mood induction procedure (MIP) ("*frustration induction game*") will be effective in inducing frustration and perceived arousal on all devices (computer, smartphone, and RGB-D camera).

H2. The ER procedure ("*breathing strategy game*") will be effective in regulating frustration and perceived arousal on all devices (computer, smartphone, and RGB-D camera).

H3. Regarding user interface embodiment, more intense frustration and perceived arousal will be reported in the RGB-D camera condition than in the other two conditions (computer and smartphone).