

**Interpersonal Emotion Regulation in Children: Age, Gender and Cross-cultural
Differences using a Serious Game**

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Abstract

Interpersonal emotion regulation entails a wide array of strategies aimed at influencing others' emotions. Despite its importance for successful social interactions, only a few studies have evaluated interpersonal emotion regulation in children. In detail, the study of developmental changes in the use of emotion regulation strategies overlooked age, gender and cultural differences across different emotions. To address this gap, the present study used the serious game Emodiscovery, a simulation game targeted at 8-10 year-olds, which measures the strategies selected by children to improve the emotions of anger, sadness, and fear displayed by 3D virtual characters. One-hundred British ($M = 9.10$ years; 39% girls) and 108 Spanish ($M = 9.04$, 44% girls) 8-10 year-olds played three different levels or scenarios of the game. In each level, the character displayed a negative emotion (i.e., sadness, anger, and fear, respectively) and children were first asked to indicate what emotion the character was feeling and afterwards to interact three times with the character to improve his/her mood. In each interaction, four possible regulation strategies (two adaptive and two maladaptive) were displayed for children to select. Results showed that in the scenario where the character was displaying sadness, 8-year-olds chose significantly less adaptive strategies than 10-years-olds. In the scenario where the character was angry, boys who accurately recognized the emotion of anger chose more adaptive strategies than those who did not recognize the emotion. For the scenario depicting fear, boys chose less adaptive strategies than girls. The obtained results highlight the importance of looking at specific emotions when researching interpersonal emotion regulation.

Keywords: interpersonal emotion regulation; emotion recognition; serious game; children; culture; gender differences.

Interpersonal Emotion Regulation in Children: Age, Gender and Cross-cultural Differences using a Serious Game

Modifying and influencing others' emotional experiences is part of our daily interactions with people. This process, labelled *interpersonal emotion regulation* (Zaki & Williams, 2013), can have positive or detrimental effects in social relationships, depending on how successful the emotional exchange is (Niven, García, van der Löwe, Holman, & Mansell, 2015). Research on interpersonal emotion regulation has been conducted mainly with adults, showing the different motivation (López-Pérez, Howells, & Gummerum, 2017; Netzer, Van Kleef, & Tamir, 2016) and strategies people use to change others' emotions (Niven, Totterdell, & Holman, 2009).

Concerning the use of regulation strategies, different models have been proposed. On the one hand, the Interpersonal affect classification (Niven et al., 2009) has made a distinction between those strategies aiming at affect improvement (e.g., cognitive engagement, humour, attention) and those aiming at affect worsening (e.g., negative engagement or rejection). On the other hand, the Interpersonal emotion management model (Williams, 2007), based on the process model of emotion regulation (Gross, 2007), suggests that people change others' emotions by using a strategy that may target a particular stage of the emotion process (i.e., situation, attention, cognition, and physiological response).

Hence, taking into account the models presented before, adaptive interpersonal affect improvement strategies could include situation modification (i.e., deleting or changing a problem to lessen its emotional impact), attentional deployment (i.e., diverting the person's attention to a pleasant and different stimuli or situation) (Little, Kluemper, Nelson, & Gooty, 2012), affective engagement (i.e., targeting the person's

feelings by providing reassurance and listening and talking), cognitive engagement (i.e., modifying how the target perceives a situation by emphasizing others' care, etc.), humour (i.e., making the person feel better by telling jokes, acting the clown, etc.) and attention (i.e., any act that aims to make the target feel valued and special) (Niven et al., 2009); on the contrary, maladaptive interpersonal emotion regulation strategies can encompass co-rumination (i.e., expansively conversing others' concerns and negative feelings which may intensify distress; Parkinson & Simons, 2012), avoidance (i.e., eluding negative emotional states), or support of avoidance in others (i.e., encouraging others to elude their negative emotional states; Mazefsky, Borue, Day, & Minshew, 2014), and emotional suppression (i.e., stopping others' emotional responding; Little et al., 2012).

Interpersonal Emotion Regulation in Children: Age and Gender Differences

Despite the emergence of multiple studies and the advances in the field of interpersonal emotion regulation in adults, research with children has been scarce. Evidence from the few studies available documented the use of different strategies depending on age. For instance, while in early childhood (2-7 years of age) children use physical comforting to improve others' feelings (e.g., hugs) (Persson, 2005), from middle childhood to adolescence (8-14 year-olds) they seem to use more cognitive strategies such as giving advice or expressing reassurance (e.g., McCoy & Masters, 1985; Rose & Asher, 2004), as well as more expressive behaviours (e.g., smiling; Saarni, 1992). More recent research relying on the Interpersonal affect classification (Niven et al., 2009) has found that older children (7-8 year-olds) tend to use more cognitive strategies, whereas younger children (3-4-year-olds) report using more attention strategies (e.g., distraction) (López-Pérez, Wilson, Dellaria, & Gummerum, 2016). The differences found between distinct age groups have been explained by the

emotional development that takes place from childhood to adolescence. Changing someone's mood requires the ability not only to represent another's emotional experience but being able to discriminate that this emotional experience might be different from others (Dunfield, 2014). This ability to perceive emotions accurately has been labelled emotion recognition (Mayer, Caruso, & Salovey, 1999). Although children from the age of three show some of these skills, they only start mastering the difference between negative emotional states (e.g., sadness vs. anger) by the age of five (Widen & Russell, 2003). This improvement in emotion recognition is linked to children's development in emotion regulation. Some authors have argued that emotion regulation can only take place once emotion recognition has happened (Izard et al., 2001; Lane, 2000), as the person needs to understand how one is feeling before aiming to change such emotional response.

Concerning possible gender differences in emotion regulation, the results are mixed. Some studies that focused on intrapersonal emotion regulation abilities found that female participants use more regulation strategies compared to males (Garnefski et al., 2004; Nolen-Hoeksema & Aldao, 2011). Furthermore, girls score higher in seeking social support and problem-solving, whereas boys score higher in avoidance (Eschenbeck, Kohlmann & Lohaus, 2007). However, other studies did not find any gender differences (e.g., Barrett, Robin, Pietromonaco & Eysell, 1998; McRae, Ochsner, Mauss, Gabrieli & Gross, 2008). Looking at the available evidence on interpersonal emotion regulation in children, so far no gender differences have been observed (López-Pérez et al., 2016; McCoy & Masters, 1985).

Interpersonal Emotion Regulation: The Role of Culture

Besides age and gender differences, previous research has also emphasized the importance of culture when looking at emotion regulation. Culture provides meaning, as well as shaping a set of values (Kâğıtçibâsi, 1996) linked to how the individual needs relate to the group and how emotions should be expressed (Kitayama, Markus, & Kurokawa, 2000). Hence, cultures reinforce different emotional responding, which leads to differences in emotion regulation (Mesquita, 2001). Traditionally, research on cultural differences in emotion regulation has focused on the differences between individualistic vs., collectivistic societies, as these differ in whether the emphasis is placed in the personal or group goals and how these may impact on what strategies may be adaptive to change one's own emotions (e.g., Triandis, Bontempo, Villareal, Asai, & Lucca, 1988). For instance, while in collectivistic cultures the reduction of emotional expression is linked to social harmony and higher individual and social well-being (Matsumoto, 2006), in individualistic cultures higher suppression is linked to lower individual well-being (Soto, Perez, Kim, Lee, & Minnick, 2011). Furthermore, individualistic cultures are more likely to engage in hedonic emotion regulation (up-regulation or maintenance of positive affect) as compared to collectivistic cultures (Miyamoto, Ma, & Peterman, 2014). These differences do not only happen at the intrapersonal level, as there are also differences in the interpersonal domain, such that individualistic cultures tend to rely more on the family to change their emotions (Ryan, La Guardia, Solky-Butzel, Chirkov, & Kim, 2005).

The Present Research

Although the studies presented so far have provided some evidence on the different strategies that children may use to change others' emotions, they have exclusively looked at the emotion of sadness (López-Pérez et al., 2016; Saarni, 1992), overlooking other negative emotional states expressed by the target of the regulation

process. Furthermore, although the role of culture has been extensively documented for intrapersonal emotion regulation, there is limited evidence for interpersonal emotion regulation, with most studies looking at whether people seek for social support rather than which strategies are employed to change others' emotions (e.g., Ryan et al., 2005). Most studies conducted with children, additionally, are based on a single interaction or structured interviews, rather than an in-depth analysis of multiple interactions (López-Pérez et al., 2016; McCoy & Masters, 1985). Hence, these studies have not fully considered the role of context (Aldao, 2013), limiting the external validity of the obtained findings. Finally, although the use of technology-enhanced platforms, in particular, serious games and e-learning tools, was extensively adopted for the exploration of emotion recognition and/or social communication in adults (Golan & Baron-Cohen, 2006; LaCava et al., 2004) and children (e.g., Finkelstein et al., 2009; Schuller et al., 2013); interpersonal emotion regulation was not investigated so far using this methodology, and this novel approach could help overcome the aforementioned limitations.

The present research aims to address these gaps by evaluating whether children from the United Kingdom (UK) and Spain differ in the use of adaptive interpersonal emotion regulation strategies when engaging in hedonic emotion regulation (i.e., up-regulation of positive affect) of virtual targets expressing sadness, anger, and fear. To that aim, children were asked to complete the experimental version of Emodiscovery, an online serious game aimed at evaluating and training interpersonal emotion regulation in children with the use of virtual characters (name deleted for revision, 2018). In the game, children were exposed to three real-life scenarios in which an artificial character could display the emotions of sadness, anger, or fear. Children were asked to interact

with the character three times in each scenario to evaluate whether they tended to use adaptive or maladaptive strategies in their effort to improve the character's feelings.

The game focused on the emotions of sadness, anger, and fear, as previous research found different responding patterns associated with each of them; for instance, while sadness prompts social support (Balsters, Krahmer, Swerts, & Vingerhoets, 2013), fear may more likely elicit avoidance as it signals a potential danger (Keltner & Haidt, 1999). Furthermore, previous research on intrapersonal emotion regulation showed that both adolescents and adults tend to use more maladaptive strategies to regulate their own emotion of anger, as compared to sadness and fear (Zimmermann & Iwanski, 2014). Finally, the emotion of sadness has been linked to the use of more intrapersonal regulation strategies as compared to anger and anxiety (Dixon-Gordon, Aldao, & De Los Reyes, 2015).

Based on previous literature, we hypothesized that older children may use more adaptive strategies than younger children, as older children will be better at emotion recognition and understanding (López-Pérez et al., 2016). Given the mixed findings regarding gender differences in intrapersonal emotion regulation (Garnefski et al., 2004; McCoy & Masters, 1985), we explored whether boys and girls used adaptive strategies to a similar extent. Considering the use of adaptive strategies for each emotion context, we tested whether children tend to use more adaptive strategies for sadness and fear as compared to anger, as this was previously found in intrapersonal emotion regulation with adolescents and adults (Zimmermann & Iwanski, 2014). Given that no previous research so far had evaluated the role of culture on interpersonal emotion regulation we compared UK children and Spanish children in the number of adaptive strategies they chose for each scenario. We focused on these two countries given that previous research

described the UK as a more individualistic country compared to Spain (Godwin & Plaza, 2000; Gouveia, Clemente, & Espinosa, 2010; Hofstede, 1980; Minkov et al., 2017) and hence it could allow for possible cross-cultural comparisons. Finally, given that emotion recognition has been suggested by some authors as the necessary step for emotion regulation to happen (Izard et al., 2001; Lane, 2000) we also evaluated if emotion recognition influenced children's use of adaptive regulation strategies.

Method

Participants

A sample of 100 UK and 108 Spanish 8-10 year-olds children participated in this study. These two groups did not differ in age ($M_{UK} = 9.10$, $M_{Spain} = 9.04$, $t(206) = .55$, $p = .59$) or gender composition (39% female participants in the UK and 44% in Spain; $\chi^2 = .66$, $df = 1$, Cramer's $V = .06$). The sample size was determined with an a priori power analysis (targeting .80 power to detect an $f = .20$ effect, at $p < .05$) and then exceeding the target value of 199 for the total sample. In detail, in the UK sample there were 30 eight-year-olds, 30 nine-year-olds, and 40 ten-year-olds; in the Spanish sample there were 35 eight-year-olds, 34 nine-year-olds and 39 ten-year-olds. We focused on 8-10 year-olds for different reasons. First, due to the nature of the game (i.e., reading, understanding, and independent decision-making), children needed to have the necessary abilities (e.g., literacy) to answer the game independently and understand the content included in the different written sections (i.e., introduction of the scenario and the different interactions) which seems to be achieved by the age of eight (Horowitz-Kraus, Schmitz, Hutton, & Schumacher, 2017). Second, prior literature has identified that between the ages of 8 to 10 years, children experience significant socio-emotional improvements in abilities such as perspective-taking and executive control (e.g.,

Simonds, Kieras, Rueda, Rothbart, 2007), which are strongly linked to emotion regulation. Finally, we did not include older children as we wanted to keep the age groups in both countries as even as possible in terms of the school context. In this sense, it is important to note that secondary education starts at the age of 11 in the UK whereas in Spain starts at the age of 12. Hence, we thought the most optimal strategy for comparison was to set up 10 as the upper age limit to ensure children in both samples were still in primary school education.

Procedure

The study received ethical clearance at the authors' previous institution (FREC-PSY-021). Six schools in each country (considering different backgrounds) were invited to participate in the study. Out of the six, three schools in the UK and two schools in Spain accepted to take part, all of them with children from middle-socioeconomic backgrounds. Testing was conducted at the children's school. Only children whose parents gave consent took part in the study. Less than 5% of the parents opted out. Children played the experimental version of Emodiscovery (name deleted for revision, 2018)¹ individually, using a PC. Upon arrival to the testing session, children were briefed by a research assistant who explained they would play a new videogame whose purpose was to cheer up the different characters that appeared on the screen. First, children were asked to create a username and a password to access the game. After that,

¹ The game underwent many piloting phases before we applied the experimental version for the current and other studies. The first piloting phase involved asking children to read different scenarios and identify the emotion felt by the character in the game. Those scenarios in which the accuracy was too low or two emotions were equally identified were discarded. In a second phase, upon the elaboration of the strategies for each interaction, two independent experts on emotion regulation reviewed the different strategies to determine whether they were adaptive/maladaptive and check the level of agreement with the research team. In a third phase, upon revision of some of the strategies, the external experts reviewed again the strategies until all disagreements were resolved. In the final phase, the three scenarios along with the strategies were piloted with 60 children in the UK. Once a final version was reached, it was then adapted to Spanish and the data collection happened in the UK and Spain.

they indicated their date of birth and their gender. Importantly, the virtual targets belonged to the same gender of each child, to facilitate children's emotion recognition and understanding (Batson, 2011). Then, children were presented with three different scenarios/levels of the game in which the characters expressed the emotions of sadness, anger, and fear. The order of those scenarios was randomized. For each scenario, children were presented with an introduction to the character's situation (i.e., , character's pet is ill and not recovering for the sad scenario, the character has been punished unfairly by his/her parents for the anger scenario, and the character has to perform on stage in the school theatre for the fear scenario) and the character (represented by a 3D avatar) appeared displaying a coherent and appropriate facial expression of sadness, anger, or fear, depending on the scenario. After that, children were first asked to identify what emotion the character was feeling. Children were provided with five possible answers corresponding to the five basic emotions of happiness, sadness, fear, surprise and anger. Then, children were asked to interact with the virtual character three times in each scenario to try to improve the character's feelings. To that aim, the character expressed a comment about his or her situation and the child was prompted with four possible sentences depicting two adaptive (i.e., affective engagement) and two maladaptive regulation strategies (e.g., co-rumination with the character about his or her problem). The number of choices on each interaction was kept to four to prevent boredom or distraction, therefore not all possible maladaptive or adaptive strategies were displayed among the choices. The adaptiveness of the regulation strategies was determined in prior piloting phases in which two external experts on emotion regulation reviewed the different regulation strategies proposed. These strategies were refined until there was a 100% agreement between the research team and the experts. An example of an interaction between the child and the

virtual target is displayed in Figure 1. Once the child had completed the three interactions, to avoid children feeling distressed, the character appeared displaying a happy facial expression and expressed that he or she was feeling better. When all children finished playing the three scenarios, the research assistant provided a written debrief to the parents and explained to the children the purpose of the study.

Data Analysis Plan

First, we explored whether there were age, gender, and cultural differences in emotion recognition. Given the nominal nature of the data we used a hi-log-linear to evaluate the possible interaction between the variables and find the most parsimonious model in which the expected and observed frequencies were not different (i.e., likelihood ratio with $p > .05$; Wickens, 1989). Then, to estimate the main or interaction effects we computed a log-linear and interpreted through the Z and partial χ^2 . Second, we evaluated whether the use of adaptive strategies (within-subject factor) could differ by emotional scenario (sadness, anger, and fear) with a repeated measure ANOVA. Finally, we assessed the role of age, gender, culture and emotion recognition (fixed factors) in children's use of adaptive strategies (dependent variable) through a set of ANOVAs for each scenario. Results

Age, Culture, and Gender Differences in Emotion Recognition

In regards to emotion recognition accuracy, for the scenario which depicted a character feeling sad, 86% of children identified correctly the emotion felt by the character. For the scenario in which the character was feeling anger, 72% of children were accurate. Finally, for the scenario in which the character was feeling fear, 66% of children did answer correctly. To evaluate if emotion recognition was different across the three scenarios we computed a log-linear analysis considering a possible interaction

between the three emotion recognition scores; a Z score higher than 1.96 indicates that there are significant differences. Results showed that the accuracy levels for fear were significantly lower compared to sadness ($\chi^2 = 6.17$, $df = 1$, $p = .01$; $Z = 2.51$) and anger ($\chi^2 = 15.01$, $df = 1$, $p = .001$; $Z = 3.58$). However, there were no significant differences in the level of accuracy between the scenarios in which the character was feeling sadness and anger ($\chi^2 = 1.47$, $df = 1$, $p = .23$; $Z = .54$).

To evaluate whether there were possible cultural, age and gender differences in emotion recognition we performed a hi-log-linear (hierarchical) and log-linear analyses (Wickens, 1989). The hi-log-linear was conducted to find the most parsimonious model from a backward elimination procedure in which the final model was not significantly different from the saturated model, which included all the variables and interactions. Hence, a final model having a likelihood ratio value (χ^2) greater than $p = .05$ is considered to be fitting, as the observed frequencies are close to the expected frequencies (Wickens, 1989). To estimate the significance of main or interaction effects a log-linear was computed (Z value, partial χ^2). For each scenario, we included Emotion recognition [not correct (r), correct], Culture [UK (r), Spain], Age [8-year-olds (r), 9-year-olds, 10-year-olds], Gender [male (r), female] with r indicating the reference category for each factor for the Z value.

For the scenario depicting the character feeling sad, the hi-log-linear analyses showed a significant Culture \times Emotion Recognition interaction ($\chi^2 = 4.09$, $df = 1$, $p = .04$). Overall, UK children were less accurate than Spanish children in the recognition of sadness ($Z = -7.52$). For the scenario with the character feeling anger, the hi-log-linear analyses showed a significant Age group \times Emotion Recognition interaction ($\chi^2 = 11.67$, $df = 2$, $p = .003$). Namely, 8-year-olds were significantly less accurate in the

recognition of anger than 9-year olds ($Z = 2.94$) and 10-year-olds ($Z = 3.03$). Finally, for the scenario showing a character feeling fear there was a Culture \times Gender \times Emotion recognition ($\chi^2 = 5.65$, $df = 1$, $p = .02$) and Gender \times Emotion recognition ($\chi^2 = 5.54$, $df = 1$, $p = .02$) interactions. Although overall boys were less accurate than girls in the recognition of fear ($Z = 2.27$), this difference was only significant for the UK sample ($\chi^2 = 8.99$, $df = 1$, $p = .003$) but not for the Spanish sample ($\chi^2 = .10$, $df = 1$, $p = .76$).

Age, Culture, and Gender Differences in the Use of Adaptive Regulation Strategies

Given that the repertoire of adaptive and maladaptive strategies presented to children differed across interactions, as explained in the method, we ran the analyses considering whether children from different cultures, age or gender groups differed in the selection of adaptive strategies. The different strategies available for the different scenarios can be found in the paper by [name deleted for revision] (2018). However, the frequency of choice of regulation strategies in each interaction for each scenario by culture, age groups, and gender can be found in Appendices A, B, and C. The consistency of children's responses across scenarios was evaluated with Cronbach's alpha (1951) and it was $\alpha = .69$ for the overall sample, and $\alpha = .65$ and $\alpha = .75$ for the UK and Spanish samples, respectively. As can be seen in Figure 2, most of the children selected adaptive strategies to improve others' feelings.

First, we conducted a repeated measures ANOVA to evaluate if there were differences in the use of adaptive strategies across scenarios. Results showed a significant main effect ($F(1, 207) = 37.18$, $p = .001$, $\eta^2_p = .15$) and pairwise comparisons showed that for the scenario in which the character is experiencing fear children used significantly less adaptive strategies than for the scenarios in which the

character is feeling sadness ($d = -.43$, S.E. = .06, $p = .001$) or anger ($d = -.39$, S.E. = .06, $p = .001$). There were no differences in the number of adaptive strategies used between these two ($d = .04$, S.E. = .05, $p = .99$).

Given that we found that the number of adaptive strategies differed across scenarios and that emotion recognition was dichotomous and could not be included as a within-subject factor in an ANOVA analysis (Field, 2013), we decided to run separate ANOVAs² for each scenario. This decision was also driven for theoretical reasons based on prior findings with adults which found significant differences between emotions when analysed separately (Dixon-Gordon et al., 2015; Zimmermann & Iwanski, 2014). Namely, we considered the choice of Adaptive regulation strategies for each scenario as a dependent variable and Culture, Gender, Age group, and Emotion recognition as between-subject factors. For the scenario in which the character was feeling sadness, the results showed a significant main effect for Age group; $F(2, 208) = 4.07$, $p = .02$, $\eta^2_p = .04$. There were no other significant main effects (Culture, $F(1, 208) = 2.78$, $p = .10$, $\eta^2_p = .01$; Gender, $F(1, 208) = 1.01$, $p = .32$, $\eta^2_p = .005$; Emotion recognition, $F(1, 208) = 1.75$, $p = .19$, $\eta^2_p = .009$) or interactions (Culture \times Gender, $F(1, 208) = 1.01$, $p = .32$, $\eta^2_p = .005$; Culture \times Age group, $F(2, 208) = 1.50$, $p = .22$, $\eta^2_p = .008$; Gender \times Age group, $F(2, 208) = .17$, $p = .84$, $\eta^2_p = .002$; Culture \times Emotion recognition, $F(1, 208) = .48$, $p = .49$, $\eta^2_p = .003$; Gender \times Emotion recognition, $F(1, 208) = 1.88$, $p = .17$, $\eta^2_p = .01$; Age group \times Emotion recognition, $F(2, 208) = .15$, $p = .86$, $\eta^2_p = .002$). Pairwise comparisons showed that 8-year-olds selected less adaptive strategies than 10-year-olds ($d = -.26$, S.E. = .09, $p = .02$). However, 8-year-olds did not differ from 9-year-olds ($d = -.22$, S.E. = .10, $p = .11$) and neither did 9-year-olds from 10-year-olds ($d = -.05$, S.E. = .10, $p = .90$) (see Figure 2).

² The results were identical after being analysed with an ordinal regression.

For the scenario in which the character was feeling anger the results showed a main effect of Gender ($F(1, 208) = 12.75, p = .001, \eta^2_p = .07$) and Emotion recognition ($F(1, 208) = 18.49, p = .001, \eta^2_p = .09$) and a significant Gender \times Emotion recognition ($F(1, 208) = 7.63, p = .006, \eta^2_p = .04$) interaction. There were no other significant main effects (Culture, $F(1, 208) = .57, p = .50, \eta^2_p = .003$; Age group, $F(2, 208) = 1.26, p = .29, \eta^2_p = .013$) or interactions (Culture \times Gender, $F(1, 208) = .01, p = .91, \eta^2_p = .001$; Culture \times Age group, $F(2, 208) = .004, p = .99, \eta^2_p = .001$; Gender \times Age groups, $F(2, 208) = .121, p = .30, \eta^2_p = .013$; Culture \times Emotion recognition, $F(1, 208) = 2.41, p = .12, \eta^2_p = .013$; Age group \times Emotion recognition, $F(2, 208) = .91, p = .40, \eta^2_p = .010$). Pairwise comparisons showed that whereas for boys there was a significant difference in the number of chosen adaptive strategies between those who accurately identified the emotion of anger compared to those who did not ($d = .73, S.E. = .13, p = .001$), for girls there was not a significant difference ($d = .16, S.E. = .16, p = .32$) (see Figure 2).

Finally, for the scenario in which the virtual character was feeling fear, the results showed only a main effect of Gender ($F(1, 208) = 9.24, p = .003, \eta^2_p = .05$). There were no other significant main (Culture, $F(1, 208) = .77, p = .38, \eta^2_p = .004$; Age groups, $F(2, 208) = .62, p = .54, \eta^2_p = .007$; Emotion recognition, $F(1, 208) = 3.70, p = .06, \eta^2_p = .02$) or interaction effects (Gender \times Culture, $F(1, 208) = .28, p = .60, \eta^2_p = .002$; Gender \times Age group, $F(2, 208) = 2.74, p = .07, \eta^2_p = .03$; Gender \times Emotion recognition, $F(1, 208) = .01, p = .91, \eta^2_p = .001$; Age group \times Culture, $F(2, 208) = 2.74, p = .07, \eta^2_p = .03$; Age group \times Emotion recognition, $F(2, 208) = .18, p = .84, \eta^2_p = .002$; Emotion recognition \times Culture, $F(1, 208) = 1.09, p = .30, \eta^2_p = .006$). Pairwise comparison showed that boys selected less adaptive strategies than girls ($d = -.43, S.E. = .14, p = .003$) (see Figure 2).

Discussion

Previous research looking at interpersonal emotion regulation in childhood had overlooked some factors (e.g., culture) and the role different emotions might have in the use of regulation strategies, as suggested by previous research on intrapersonal emotion regulation (Aldao, 2013). This project aimed to overcome those limitations by using a serious game and evaluating the strategies selected by 8-, 9-, and 10-year-olds when interacting with virtual characters.

Interpersonal Emotion Recognition

Interpersonal emotion regulation is a key process that can be best interpreted when the strategy selected is in line with the emotion expressed by the target of the regulation process (Dunfield, 2014). For this reason, we analysed both the emotion recognition aspect and the emotion regulation strategy chosen. The findings that emerged during the analyses evidenced some cultural, gender and age differences. Importantly, these differences were emotion-specific and they were not related to emotion recognition, as previously found with previous research (name deleted for revision, 2018). Concerning emotion recognition, results showed that children (regardless of their age) were less accurate in the recognition of the emotion of fear. This is in line with previous findings that suggest a different developmental pattern across emotions and, in particular, that fear tends to be correctly categorized later than sadness (Boyatzis et al., 1993; Gosselin & Larocque, 2000). However, a cultural difference emerged showing male children from the UK to be less accurate in recognizing fear than females from the same country; while Spanish children did not display such gender difference. One tentative explanation of this difference includes the fact that recent results showed that men from individualistic cultures display the typical phenomenon of restrictive emotionality about the so-called “powerless emotions” of fear and sadness (Fischer et al., 2004). While this phenomenon seemed to only affect

how adults feel and report their own emotions, it could be a transversal process that can also affect emotion recognition in others (Fischer & Good, 1994). This interpretation can be further supported by the fact that, concerning the recognition of the emotion of sadness, UK children were less accurate than Spanish children. Finally, regarding the recognition of anger, no cultural differences were found. However, older children were more accurate than younger children. This is in line with previous findings that showed a consistent significant difference between anger recognition in children among several age groups and adults, with older children and adults exhibiting the higher levels of recognition accuracy (Durand et al., 2007). Overall, the percentages obtained in emotion recognition for the different emotions in this study are in line with the previous research which used photographs (Boyatzis et al., 1993; Gosselin & Larocque, 2000). This concordance further validates the serious game as a robust methodology for the investigation of emotion recognition and regulation and adds value to the preliminary results about the platform presented in [name deleted for revision] (2018).

Use of Interpersonal Regulation Strategies

Overall, children selected most of the time adaptive strategies to improve the character's feelings. This is in line with previous literature with typically developing children in which high adaptive emotion regulation rates have been found (Cole, Dennis, Smith-Simon, & Cohen, 2009). In fact, although emotion dysregulation is more prevalent in groups with neurodevelopmental conditions this is still not extremely high (e.g., 35% in children with attention-deficit and hyperactivity disorder; Shaw, Stringaris, Nigg, & Leibenluft, 2014), which may explain why a high proportion of children selected adaptive regulation strategies in this study.

Considering the use of adaptive strategies across scenarios, results showed that children used less adaptive strategies for fear than sadness and anger. This partially

supports previous research, which showed that participants tended to use more adaptive strategies for sadness; however, the current findings did not support previous results in which fear prompted to use more adaptive strategies than anger (Zimmermann & Iwanski, 2014). It is important to acknowledge that previous research has been conducted with adolescents and adults, which may explain the obtained differences, as the ability to recognize fear increases from childhood to adolescence (Lawrence, Campbell, & Skuse, 2015).

Looking at the choices of regulation strategies for each emotional context, in the scenario depicting sadness, there were significant age differences, such that 8-year-olds chose significantly less adaptive strategies than 10-year-olds. This finding supports previous research conducted with a different methodology (López-Pérez et al., 2016). In the scenario depicting anger, instead, boys who accurately recognized the emotion in the first step of the scenario, chose adaptive strategies significantly more; while for girls, emotion recognition did not play a role in the number of adaptive strategies. This finding provides further support to the studies that showed anger was more often regulated using maladaptive strategies (Zimmermann & Iwanski, 2014) and highlight the need to measure jointly emotion recognition and regulation in a real-life context, as it may help to identify also gender differences as the ones found in this study. For the scenario depicting fear, boys belonging to any age group and country, regardless of their ability to recognize the emotion, chose significantly less adaptive strategies than girls. This gender difference is partly in agreement with published findings on intrapersonal emotion regulation (Garnefski et al., 2004), according to which women were generally better at using regulation strategies than men. Finally, the fact that emotion recognition only played a role in the selection of adaptive strategies for anger but not for the other emotions indicates the need to further investigate the links between the two emotion

processes. Prior research on intrapersonal emotion regulation showed how emotion recognition was the necessary step for emotion regulation to happen (e.g., Izard et al., 2011). Given that interpersonal emotion regulation relies on other mechanisms (as compared to intrapersonal emotion regulation) such as perspective-taking (Zaki & Williams, 2013), it is possible that the role of emotion recognition may not be so important for this regulation process.

Limitations and Future Research

This study aimed to consider multiple factors (i.e., culture, age, gender, and different emotions) when analyzing children's interpersonal emotion regulation, however, it presents some limitations. Although the methodology used allows capturing children's use of regulation strategies for different emotions, its cross-sectional nature limits the ability to capture what happens across situations and more importantly across different regulation targets. Research with adults has shown that the interpersonal regulation strategies used may change depending on the target (i.e., family member or work colleague; Francis, Monahan, & Berger, 1999). Given that the target of the game was a virtual character of similar age of the participating children, future research should explore if the use of strategies changes depending on whether the target is an adult or a child. Future research should also consider controlling for variables that may affect children's performance on the game. For example, low inhibitory control is linked to impulsivity and poor emotion regulation and could be an important variable to control (e.g., Carlson & Wang, 2007).

Although the use of a serious game can be perceived as artificial and not being able to capture how children may behave in real-life, there is evidence that the use of computer-based interaction tasks has been linked with the activation of expected brain areas for such behaviors in real life (Guyer, Silk, & Nelson, 2016; Jarcho et al., 2016).

Furthermore, the use of serious games has been linked to improved social skills in real contexts in children with Attention Deficit and Hyperactivity disorder (Bul et al., 2016), more engagement in health promotion behaviors (Baranowski, Buday, Thompson, & Baranowski, 2008), and reduction of anxiety and pain in children (Verschuere et al., 2019). Despite this, future research could look at the link between the interactions children made in the game and their real-life efforts to change others' emotions. Finally, one could argue that the lower emotion recognition and use of fewer adaptive regulation strategies could be due to the features of the scenario itself rather than the emotion of fear. We find this explanation unlikely given that the scenario of fear depicted a situation of fear of public speaking which has been used previously to evaluate fear in children (Field, Hamilton, Knowles, & Plews, 2003). Despite this, future research may consider developing more fear-related scenarios to evaluate whether the results are similar to the ones obtained in this study.

In this research, only cultural differences emerged in regards to emotion recognition but not in the selection of regulation strategies. Although cultural differences were observed at an intrapersonal level, it is important to acknowledge that this research was conducted mainly with adolescents and adults (Miyamoto et al., 2014), which may explain the obtained results. However, the obtained results can also be explained by the fact that the differences between UK and Spain may not be so large, given that recent research showed that Spain is closer to the individualism part of the continuum (Minkov et al., 2017). Therefore, future research should be conducted with children from highly collectivistic countries (e.g., China) to determine whether cultural differences can also be found in the interpersonal domain of emotion regulation.

Conclusion

The study of interpersonal emotion regulation in childhood had previously overlooked the role of different emotions or culture. In this project, we aimed to address those gaps by relying on the serious game Emodiscovery to assess children's use of regulation strategies across three different emotion scenarios (sadness, anger, and fear). Overall, the results highlight the need to look at both emotion recognition and use of regulation strategies jointly and, importantly, evaluating the role of age, gender, and culture for different emotions, as the regulation patterns may be different depending on the emotion felt by the regulation target. Although future research should be conducted to test whether the obtained findings are confirmed, the role of emotional contexts should become a priority for future research on the field.

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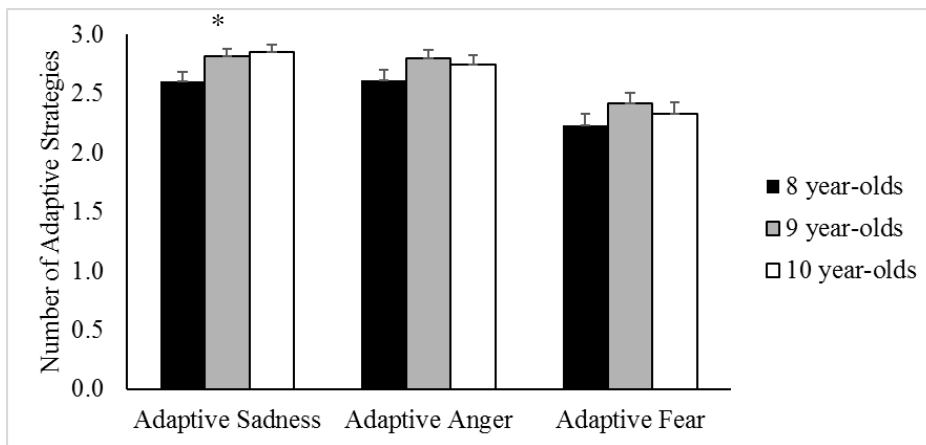
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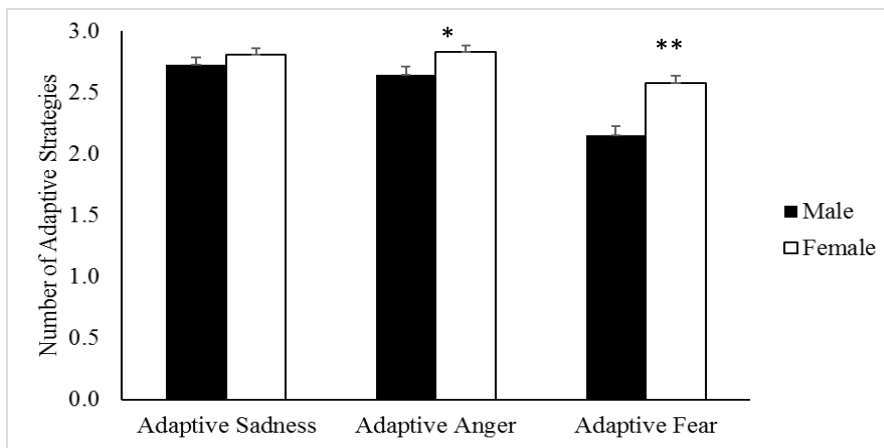


Figure 1. Example of the Regulation Strategies Choices Presented to each Child in a Scenario Depicting a Situation of Sadness.

(a)



(b)



(c)

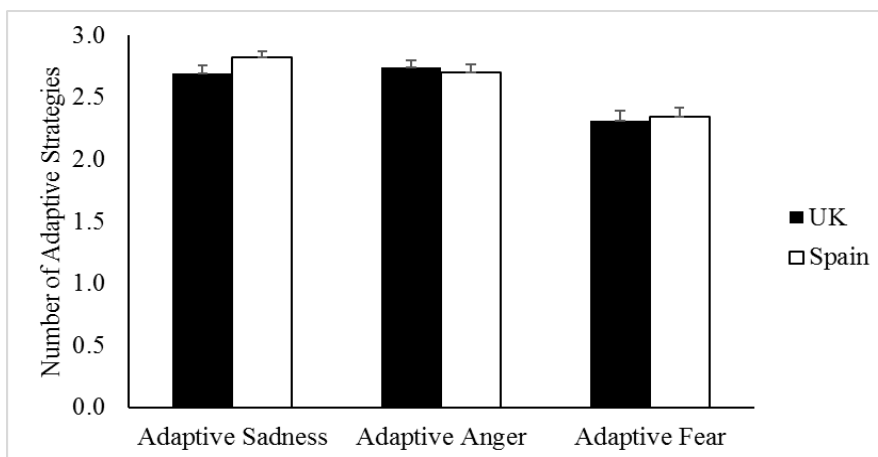


Figure 2. Children's Use of Adaptive Interpersonal Regulation Strategies by (a) Age,

(b) Gender, and (c) Culture. Note. * $p < .05$; ** $p < .01$.

Appendix A

*Frequency of Regulation Strategies by Age, Gender, and Culture for the Three**Interactions in the Sadness Scenario*

	8-year-olds	9-year-olds	10-year-olds	Male	Female	UK	Spain
Interaction 1							
Cognitive engagement	44 (21%)	57 (27%)	65 (32%)	91 (44%)	75 (36%)	79 (38%)	87 (42%)
Affective engagement	13 (6.5%)	6 (3%)	11 (5%)	21 (10%)	9 (4.5%)	12 (5.5%)	18 (9%)
Suppression	1 (0.5%)	0 (0%)	3 (1.5%)	2 (1%)	2 (1%)	2 (1%)	2 (1%)
Avoidance	7 (3%)	1 (0.5%)	0 (0%)	7 (3%)	1 (0.5%)	7 (3%)	1 (0.5%)
Interaction 2							
Affective engagement	40 (18%)	42 (20%)	46 (22%)	77 (37%)	51 (25%)	56 (27%)	72 (34%)
Cognitive engagement	20 (10%)	20 (10%)	28 (14%)	38 (18%)	30 (14%)	35 (17%)	33 (16%)
Co-rumination	2 (1%)	1 (0.5%)	2 (1%)	3 (1.5%)	2 (1%)	4 (2%)	1 (0.5%)
Avoidance	3 (1.5%)	1 (0.5%)	3 (1.5%)	3 (1.5%)	4 (2%)	5 (2.5%)	2 (1%)
Interaction 3							
Affective engagement	14 (7%)	19 (9%)	30 (14%)	38 (18%)	25 (12%)	36 (17%)	27 (13%)
Cognitive engagement	38 (18.5%)	36 (17%)	45 (22%)	65 (31%)	54 (26%)	51 (25%)	68 (33%)
Co-rumination	9 (4%)	5 (2.5%)	4 (2%)	12 (6%)	6 (3%)	7 (3%)	11 (5%)
Negative affect engagement	4 (2%)	4 (2%)	0 (0%)	6 (3%)	2 (1%)	6 (3%)	2 (1%)

Note. Percentages should be read for each category (age, gender, culture) for each interaction.

Appendix B

*Frequency of Regulation Strategies by Age, Gender, and Culture for the Three**Interactions in the Anger Scenario*

	8-year- olds	9-year- olds	10-year- olds	Male	Female	UK	Spain
Interaction 1							
Cognitive engagement	10 (5%)	18 (9%)	36 (17%)	34 (16%)	30 (14%)	35 (17%)	29 (14%)
Affective engagement	48 (23%)	40 (19%)	38 (18%)	73 (35.5%)	53 (26%)	58 (28%)	68 (32%)
Negative affective engagement	6 (3%)	3 (1.5%)	3 (1.5%)	9 (4%)	3 (1.5%)	5 (2.5%)	7 (3.5%)
Diminishing comparisons	1 (0.5%)	3 (1.5%)	2 (1%)	5 (2.5%)	1 (0.5%)	2 (1%)	4 (2%)
Interaction 2							
Cognitive engagement	16 (8%)	11 (5%)	14 (7%)	27 (13%)	14 (7%)	21 (10%)	20 (9%)
Affective engagement	40 (19%)	50 (24%)	57 (27%)	79 (38%)	68 (32%)	68 (33%)	79 (38%)
Negative behavioural engagement	3 (1.5%)	2 (1%)	4 (2%)	8 (4%)	1 (0.5%)	5 (2.5%)	4 (2%)
Negative affective engagement	6 (3%)	1 (0.5%)	4 (2%)	7 (3.5%)	4 (2%)	6 (3%)	5 (2.5%)
Interaction 3							
Cognitive engagement	36 (18%)	45 (22%)	41 (20%)	69 (33%)	53 (26%)	64 (31%)	58 (27%)
Affective engagement	20 (10%)	15 (7%)	31 (14.5%)	38 (18%)	28 (13.5%)	28 (14%)	38 (17%)
Negative affective engagement	6 (2.5%)	4 (1%)	7 (3.5%)	11 (5%)	6 (3%)	7 (3.5%)	10 (5%)
Co-rumination	3 (1.5%)	0 (0%)	0 (0%)	3 (1.5%)	0 (0%)	1 (0.5%)	2 (1%)

Appendix C

*Frequency of Regulation Strategies by Age, Gender, and Culture for the Three**Interactions in the Fear Scenario*

	8-year- olds	9-year- olds	10-year- olds	Male	Female	UK	Spain
Interaction 1							
Cognitive engagement	15 (7%)	14 (6%)	10 (5.5%)	24 (12%)	15 (6.5%)	19 (9%)	20 (10%)
Affective engagement	36 (17%)	41 (20%)	51 (25%)	63 (30%)	65 (31%)	59 (28%)	69 (33%)
Avoidance	5 (2.5%)	2 (1%)	1 (0.5%)	8 (4%)	0 (0%)	6 (3%)	2 (1%)
Co-rumination	9 (4%)	7 (3.5%)	17 (8%)	26 (13%)	7 (3.5%)	16 (8%)	17 (8%)
Interaction 2							
Affective engagement	30 (14%)	33 (16%)	48 (23%)	55 (26%)	56 (27%)	55 (26%)	56 (27%)
Humour	12 (6%)	10 (5%)	4 (2%)	19 (10%)	7 (3.5%)	23 (11%)	25 (12%)
Co-rumination	13 (6%)	19 (9%)	16 (8%)	28 (13%)	20 (9.5%)	12 (6%)	14 (7%)
Negative affective engagement	10 (5%)	2 (1%)	11 (5%)	19 (9%)	4 (2%)	10 (5%)	13 (6%)
Interaction 3							
Cognitive engagement	25 (12%)	36 (17%)	51 (25%)	58 (28%)	54 (26%)	58 (28%)	54 (26%)
Affective engagement	27 (13%)	21 (10%)	20 (9%)	41 (20%)	27 (12%)	28 (13%)	40 (19%)
Negative affective engagement	5 (2.5%)	2 (1%)	1 (0.5%)	6 (3%)	2 (1%)	5 (2.5%)	3 (1.5%)
Diminishing comparisons	8 (4%)	5 (2.5%)	7 (3.5%)	16 (8%)	4 (2%)	9 (4.5%)	11 (5.5%)

Note. Percentages should be read for each category (age, gender, culture) for each interaction.