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Affective forecasting bias in preschool children

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ABSTRACT

Adults are capable of predicting their emotional reactions to possible future events. Nevertheless, they systematically overestimate the intensity of their future emotional reactions relative to how they feel when these events actually occur. The developmental origin of this "intensity bias" has not yet been examined. Two studies were conducted to test the intensity bias in preschool children. In the first study, 5-year-olds ($N = 30$) predicted how they would feel if they won or lost various games. Comparisons with subsequent self-reported feelings indicated that participants overestimated how sad they would feel to lose the games but did not overestimate their happiness from winning. The second study replicated this effect in another sample of 5-year-olds ($n = 34$) and also found evidence of an intensity bias in 4-year-olds ($n = 30$). These findings provide the first evidence of a negative intensity bias in affective forecasting among young children.

Introduction

The ability to mentally travel through time and imagine possible future events allows people to anticipate the future hedonic consequences of decisions made in the here and now (Gilbert & Wilson, 2007; Suddendorf & Busby, 2005). A large body of research on *affective forecasting* has found that healthy adults tend to overestimate the intensity of their future emotional reactions (Buehler & McFarland, 2001; Wilson & Gilbert, 2005, 2013). For example, when predicting emotional distress at ending a relationship, people accurately predict that they will feel sad; however, they also tend to pre-

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dict that they will feel much worse than they actually report feeling (Eastwick, Finkel, Krishnamurti, & Loewenstein, 2008; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998).

This so-called *intensity bias* has been implicated in a wide range of psychological processes, including decision making, psychopathology, and motivation (Halpern & Arnold, 2008; Hoerger, Quirk, Chapman, & Duberstein, 2012; Hoerger, Scherer, & Fagerlin, 2016; Levine, Lench, Kaplan, & Safer, 2013; Marroquín, Boyle, Nolen-Hoeksema, & Stanton, 2016; Morewedge & Buechel, 2013). To date, the development of this important cognitive bias during childhood remains unexamined, and therefore it remains unclear when foresight becomes biased in human development (Miloyan & Suddendorf, 2015).

Forecasting an emotional reaction to a future possibility presupposes a capacity to mentally simulate situations. Young children gradually acquire a capacity to imagine future events approximately between the ages of 3 and 5 years (Atance & Jackson, 2009; Atance & Meltzoff, 2005; McCormack & Atance, 2011; Redshaw & Suddendorf, 2013; Suddendorf & Moore, 2011). Although the capacity continues to mature over subsequent years, it is at the end of the preschool years that children undergo important developments in a range of domains, such as self-awareness and reasoning about mental states, which assist future-oriented thinking (Payne, Taylor, Hayne, & Scarf, 2015; Suddendorf & Redshaw, 2013). For affective forecasting, a general understanding of emotions is particularly important, and again significant developments occur at around age 5 years such as an appreciation that one's current emotions can be shaped by recollection of the past or anticipation of the future (Lagattuta, 2014; Lagattuta, Wellman, & Flavell, 1997). Although we do not directly measure foresight in the current studies, we chose to examine the presence of an intensity bias in 4- and 5-year-olds because of these developments in foresight and emotional understanding.

Although the intensity bias has yet to be examined in children, other foresight biases have been studied in adults and children (Atance & Meltzoff, 2006; Mahy, 2016; Mahy, Grass, Wagner, & Kliegel, 2014; Wilson & Gilbert, 2005). For example, both have been found to be influenced by their current physiological state, such as hunger, when predicting future physiological needs (Mahy, 2016; Wilson & Gilbert, 2005). One such study showed that children who had just eaten pretzels were more likely to predict that they would choose water over pretzels the next day (Mahy et al., 2014). However, when the same children quenched their thirst with water, they were more likely to predict that they would prefer pretzels the next day. Although predictions regarding physiological needs may differ from predictions regarding emotional states, this research shows that there are foresight biases that are shared between children and adults.

We were also interested in examining one common explanation of the intensity bias in preschool children. One theory in the adult literature is that when making predictions about future emotion, we neglect to take into account our future coping abilities or "psychological immune system" (Gilbert et al., 1998; Hoerger, 2012; Hoerger, Quirk, Lucas, & Carr, 2009; Pauketat, Moons, Chen, Mackie, & Sherman, 2016). In other words, we overestimate the intensity of future negative emotions because we underestimate how effective our future coping mechanisms are. The current research included measures of coping and effortful control (an ability to inhibit behavior) (Study 1) and emotion regulation (Study 2) to assess whether coping and coping-related abilities would be linked to the intensity bias in children. Children with superior emotion regulation abilities might be more able to regulate both excitement and disappointment when reacting to an event. However, they might not realize that they have these emotional regulation abilities and, therefore, might still make both exaggerated negative and positive predictions.

We adapted a design that is common in the adult affective forecasting literature (Gilbert et al., 1998; Van Dijk, 2009). Children were asked to predict their emotional reactions to winning and losing simple games and then reported their actual experienced emotions after the games were completed. In the first study we assessed whether an intensity bias was evident in 5-year-olds, and in the second study we attempted to replicate the findings of Study 1 and examine responses of younger children as well. There were two competing predictions. First, young children may exhibit an intensity bias for reasons similar to those of adults, particularly if this bias functions to motivate goal-directed behavior (Miloyan & Suddendorf, 2015; Morewedge & Buechel, 2013); such a functional component of foresight would likely be present as soon as children begin exhibiting foresight capacities. Alternatively, young children might not exhibit an intensity bias if foresight capacities only become biased later in development, for instance, as the result of a learning process. For example, parents might be modeling this "bias" by exaggerating outcomes themselves. The following studies aimed to explore the presence or absence of an intensity bias in children.

Study 1

Method

Participants

A total of 30 5-year-old children (18 boys; M_{age} = 66.07 months, range = 60–72) were recruited from the Early Cognitive Development Centre database at the University of Queensland.

Materials

Child response scale. Children predicted their emotional reactions and reported their actual emotions on a 7-point face scale, developed for this study, from 1 (*extremely happy*) to 7 (*extremely sad*). Faces were described ranging on a dimension from happy to sad: "This face is *extremely* happy; this face is *very* happy; this face is *a little bit* happy; this face is neither happy nor sad; this face is *a little bit* sad; this face is *very* sad; this face is *extremely* sad" (Fig. 1).

The development of this scale was inspired by face scales for pain reporting in children that are easily interpretable by children as young as 4 years (Chang, Versloot, Fashler, McCrystal, & Craig, 2015; Hicks, von Baeyer, Spafford, van Korlaar, & Goodenough, 2001; McGrath et al., 1996). These face-rating scales exhibit high construct validity and high test–retest reliability (Huguet, Stinson, & McGrath, 2010). A 10-point scale developed for use by young children by McGrath et al. (1996) was modified because the emotion depicted in this pain scale might not be appropriate for measuring *happy* or *sad* affective responses, which are distinct from feelings of pain (de Knegt, Schuengel, Evenhuis, Lobbezoo, & Scherder, 2013; Huguet et al., 2010; Trapanotto et al., 2009). We elected to shorten the scale to 7 points and displayed it as one line from happy to sad. Having one scale with happy and sad faces—as opposed to separate scales for happy and sad—prevented children from reporting that they felt both happy and sad and instead constrained them to pick only one face. Furthermore, a scale including both happy and sad faces, as opposed to two separate scales, halved the number of ratings children needed to make. Finally, various Likert scales have been used in the adult literature, ranging from a single 7-point Likert scale to measure happy and sad to two separate 9-point Likert scales for happy and sad, respectively (Gilbert et al., 1998; Meyvis, Ratner, & Levav, 2010; Morewedge & Buechel, 2013; Van Dijk, 2009). Consequently, we designed a new scale that we thought best suited this young age group.

Tasks. Children completed four games in a counterbalanced order. The games comprised two iPad games and two versions of a fishing game. In the first iPad game, called *Dog Bowling* (tengryprod., 2013), children positioned a bowling ball and then pressed a button to attempt to knock over all the pins. Children were told that they had two attempts to knock over all the pins; if they did not manage to do so they would lose, and if they did do so they would win. The second iPad game was called *Stick Archery* (Webb, 2014) and involved shooting an arrow at a target. Children were given three attempts and told that if they could hit the target with at least one arrow they would win, but otherwise they would lose. In the fishing game, children fished out a sticker (win) as opposed to a blank white label (loss) from a translucent square box using a "fishing rod" composed of double-sided tape at the end of some string. The second fishing game was identical to the first except that an opaque

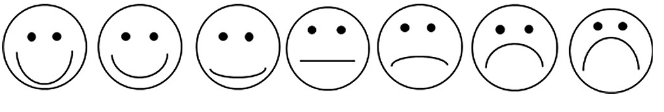

Fig. 1. Scale of faces devised for the current studies.

container instead of a clear container was used, such that differences in the controllability of the outcome could be examined (see Morewedge & Buechel, 2013). These games all had clear win/lose outcomes and were chosen so that preschool children would clearly understand each game and the emotion prediction task. We decided against using games of chance where the outcome could be surreptitiously controlled because we were unsure whether children of this age would understand their likelihood of winning or losing such games. In addition, if the intensity bias functions to motivate goal-directed behavior, this would be more likely to manifest in games where the outcome depended on effortful action rather than chance.

Filler task. The filler task was a measurement of effortful control adapted from Kieras, Tobin, Graziano, and Rothbart (2005) conducted immediately after an emotional prediction about each of the above tasks. The filler task was conducted to assess whether coping ability or effortful control might be related to the intensity bias, based on suggestions in the adult literature regarding psychological coping mechanisms (Gilbert et al., 1998). In addition, the filler task reduced the chance of children simply remembering their prediction and repeating it when asked for their actual emotion. Two tasks from Kieras et al. (2005) were used, the *circle task* and the *line task,* and both were completed twice and were counterbalanced. In the circle task, children drew three circles between inner and outer circles (18×18 cm), first at a normal pace and then twice as slowly as they could. The line task involved children walking along a 2.20-m line of masking tape, first at a normal pace and then twice as slowly as they could. These tasks were timed on a stopwatch and recorded. We could not include all tasks from the study by Kieras and colleagues for practical reasons. Parents were also given a coping competence questionnaire derived from Moreland and Dumas (2008). The questionnaire comprised three subsections that measured achievement coping, affect coping, and social coping. Social coping included challenges involving interpersonal skills and social situations, for example, "is kind to other children." Achievement coping included how well the children take responsibility for themselves, for example, "picks up or cleans up after self." Finally, affect coping included an understanding of emotions, for example, "talks about his/her feelings, beliefs, [and/or] experiences in an interesting way at the right time."

Procedure

Each child completed all four games described above in a counterbalanced order. The experimenter described the games and gave a demonstration. The scale of faces was then described, and children were asked to imagine winning and losing ("I want you to think about winning—how will you feel if you win?" and "I want you to think about losing—how will you feel if you lose?"). Children were asked to point to the face that best described how they thought they would feel about each outcome. After completing the affective forecast for a particular game, children completed one of the filler tasks (circle or line), the order of which was also counterbalanced. Children then completed the game for which they had predicted their emotion. At the immediate conclusion of the game, the experimenter asked, "How do you feel now that you have won/lost? Please point to the face." This procedure was repeated for all games.

Results and discussion

Means and standard deviations for predicted and actual feelings for each game and for wins and losses are displayed in Table 1. The predicted and actual feelings were averaged across games separately for wins and losses, creating four separate variables: predicted feelings for wins, predicted feelings for losses, actual feeling for wins, and actual feelings for losses.

Responses to the questions about actual and predicted emotions were significantly skewed, based on the limits provided by Tabachnick and Fidell (2014). This skew remained significant after log transformations. Therefore, we conducted nonparametric Wilcoxon signed-ranks analyses. These analyses indicated that participants predicted that they would feel sadder when they lost ($Mdn = 7$) than they actually felt after losing ($Mdn = 4$), $Z = -3.16$, $p = .002$, $r = -.63$. In contrast, there was no significant difference between predicted feelings toward wins ($Mdn = 1$) and actual feelings toward wins

Table 1
Means (and standard deviations) for predicted and actual feelings, separated by wins and losses.

Game (won/lost)	Win (n = 29)		Lose (n = 25)	
	Prediction	Actual	Prediction	Actual
iPad bowling (12/18)	1.33 (0.65)	1.17 (0.39)	5.61 (2.15)	3.89 (2.17)
iPad archery (18/12)	1.22 (0.55)	1.78 (1.35)	6.08 (2.15)	4.42 (2.57)
Fishing clear (26/4)	1.27 (0.60)	1.31 (0.55)	4.75 (2.87)	4.50 (3.00)
Fishing opaque (20/10)	1.25 (0.44)	1.35 (0.81)	5.10 (2.38)	4.50 (2.32)
Mean (all games)	1.27 (0.53)	1.40 (0.61)	5.39 (1.65)	4.33 (1.97)

Note. One participant lost all games, and five participants won all games.

(Mdn = 1), $Z = -1.20$, $p = .231$, $r = -.22$. Parametric tests (i.e., analyses of variance [ANOVAs]) also mirrored these findings (see online supplementary material).

To test whether the intensity bias was larger for losses than for wins, difference scores were created by subtracting predicted emotion ratings from actual ones. Post hoc analyses revealed that the intensity bias was larger for losses ($M = -1.38$, $SD = 1.71$) than for wins ($M = 0.01$, $SD = 0.66$), $t(23) = -3.53$, $p = .002$.

The difference between predicted and actual feelings when losing the two fishing games (clear and opaque) was not analyzed because there were only four losses in the clear condition (see Table 1). The effect of winning on predicted and actual feelings was also not analyzed due to skew and kurtosis in the data and the fact that analysis of composite win variables revealed no differences between predicted and actual feelings.

Effortful control scores were obtained by finding the average of the two slow trials and then subtracting the baseline trial (Kieras et al., 2005). For each trial, the four effortful control tasks were averaged to create a mean effortful control score for each child. The coping competence scale contains three subsections: achievement, social, and affect. The mean score for each subsection was calculated for each child, and an overall mean coping score was also calculated. Difference scores were correlated with coping competence scores and effortful control scores. This analysis revealed that the social subsection correlated significantly with the difference score in the case of losses, whereas the achievement subsection correlated significantly with actual feelings toward losses ($r = .47$, $p = .018$ and $r = -.41$, $p = .043$, respectively). No other measures correlated significantly; however, we noted that the achievement subsection and the difference score in the case of losses had a correlation of $r = -.39$, $p = .052$. See supplementary material for all correlations.

To further investigate the relationships uncovered in the correlational analysis, a hierarchical multiple regression analysis was conducted with actual feelings toward losses as the criterion variable. Sex, age, and predicted feelings were entered at Step 1, and social and achievement scores were entered at Step 2. The direct effects of sex, age, and predicted feelings accounted for 42% of the variance in actual feelings, $F(3, 21) = 4.97$, $p = .009$, with predicted feelings accounting for 37% of the variance in actual feeling, $\beta = .62$, $p = .002$. Neither sex nor age significantly accounted for unique variance in actual feelings, $\beta = -.12$, $p = .532$ and $\beta = -.212$, $p = .255$, respectively. At Step 2, social and achievement scores were found to predict variance in actual feelings beyond that accounted for by predicted feelings, $Fch(2, 19) = 9.19$, $p = .002$. Social scores predicted 21% of the variance in actual feelings beyond predicted feelings, $\beta = .50$, $p = .002$. Achievement scores predicted 10% of the variance in actual feelings beyond that accounted for by predicted feelings, $\beta = -.35$, $p = .02$. The overall model predicted 70% of the variance in actual feelings, $F(5, 19) = 8.98$, $p < .001$.

In summary, children overestimated how sad they would feel when they lost, but they did not overestimate how happy they would feel when they won. Thus, they displayed an intensity bias with regard to losses but not with regard to wins. The presence of this one-sided intensity bias raised the question of whether it would emerge in an even younger age group, which we explored in Study 2.

Study 2

Study 2 aimed to replicate the results of Study 1 and investigate whether the same effect is evident in younger children. In service of these goals, we tested groups of 4- and 5-year-olds with the two iPad games used in Study 1.

Method

Participants

In total, 34 5-year-old children (22 girls; M_{age} = 67.9 months, range = 61–72) and 30 4-year-old children (13 girls; M_{age} = 52.8 months, range = 48–59) participated in Study 2. Of these children, 13 5-year-olds and 16 4-year-olds were tested at the Early Cognitive Development Centre; the remaining children were tested at the Queensland Museum and Sciencentre. Parents or guardians provided consent prior to testing, and children received a small wristband as a gift for participating.

Materials and procedure

The response scale using happy and sad faces and the iPad games from Study 1 were given to the children with the same instructions. The fishing games were excluded in Study 2 because they did not have an even spread of wins and losses in Study 1 and could not be analyzed (see Table 1). Because we did not find any meaningful results with the filler tasks and questionnaire used in Study 1, a different filler task and questionnaire was chosen for Study 2. Specifically, we included an emotional regulation questionnaire by Rydell, Berlin, and Bohlin (2003), which was completed by parents about their children, and an iPad game called *Zirkl* (Bernhard, 2015). Zirkl involves a watch hand that changes color and spins around a circle that has four exterior colors. The game requires children to tap the screen when the watch hand and exterior circle colors match; this becomes increasingly harder to do because the hand spins faster after each match. Zirkl was played after children predicted how they would feel toward either a win or a loss to distract children from their initial predictions.

Results and discussion

Table 2 displays means and standard deviations for predicted and actual feelings separately for each game and for wins and losses for 4-year-old participants, and below that it displays descriptive statistics for 5-year-old participants. There was no significant difference between the responses at the Sciencentre and those at the Early Cognitive Development Centre, with p values as follows for location differences between predicted and actual emotions: lose prediction, p = .581; lose actual, p = .605; win prediction, p = .557; win actual, p = .167. Therefore, we collapsed the data across locations in the subsequent analyses. As in Study 1, mean predicted and actual feelings were averaged across games separately for wins and losses, creating four separate variables: predicted feelings for wins, predicted feelings for losses, actual feelings for wins, and actual feelings for losses.

Table 2
Means (and standard deviations) for predicted and actual feelings, separated by wins and losses and by age group.

	Win (n = 47)		Lose (n = 80)	
Game (won/lost)	Prediction	Actual	Prediction	Actual
4-year-olds				
iPad bowling (5/24)	2.20 (2.68)	2.40 (2.61)	6.50 (1.02)	5.17 (2.28)
iPad archery (14/16)	1.14 (0.36)	1.14 (0.36)	5.31 (1.92)	4.69 (2.30)
Mean (all games)	1.67 (0.77)	1.77 (0.81)	5.91 (1.26)	4.93 (1.97)
5-year-olds				
iPad bowling (7/27)	1.43 (0.53)	1.14 (0.38)	5.85 (1.99)	4.56 (2.22)
iPad archery (21/13)	1.86 (1.31)	1.52 (0.68)	6.31 (1.03)	5.08 (1.93)
Mean (all games)	1.65 (1.11)	1.33 (0.66)	6.08 (1.71)	4.82 (2.07)

Responses to the questions about actual and predicted emotions were again skewed, even after applying log transformations, so the data were analyzed with Wilcoxon signed-ranks tests. These analyses indicated that participants predicted that they would feel sadder when they lost ($Mdn = 7$) than they actually felt after losing ($Mdn = 5.25$), $Z = -4.83$, $p < .001$, $r = -.65$. There was no significant difference between predicted feelings toward wins ($Mdn = 1$) and actual feelings toward wins ($Mdn = 1$), $Z = -0.57$, $p = .566$, $r = -.09$.

To test whether any signs of biases were different in magnitude for losses and wins, we again calculated difference scores by subtracting predicted emotion ratings from actual ones separately for wins and losses. Post hoc analyses revealed that the intensity bias was larger for losses ($M = -1.13$, $SD = 1.62$) than for wins ($M = -0.06$, $SD = 0.98$), $t(31) = -2.96$, $p = .006$.

Separate analyses of the two age groups were conducted. A Wilcoxon signed-ranks test revealed once again that 5-year-old participants predicted that they would feel sadder when they lost ($Mdn = 7$) than they actually felt after losing ($Mdn = 5$), $Z = -3.65$, $p < .001$, $r = -.67$. There was no significant difference between predicted feelings toward wins ($Mdn = 1$) and actual feelings toward wins ($Mdn = 1$), $Z = -1.04$, $p = .296$, $r = -.21$.

Similar to the 5-year-olds, the 4-year-old participants predicted that they would feel sadder when they lost ($Mdn = 7$) than they actually felt after losing ($Mdn = 6$), $Z = -3.50$, $p > .001$, $r = -.65$. There was no significant difference between predicted feelings toward wins ($Mdn = 1$) and actual feelings toward wins ($Mdn = 1$), $Z = -0.53$, $p = .595$, $r = -.11$. The results of ANOVAs again mirrored these findings (see supplementary material). There was no significant difference between the results of the 4- and 5-year-olds, with p values as follows for age differences between predicted and actual emotions: lose prediction, $p = .993$; lose actual, $p = .461$; win prediction, $p = .114$; win actual, $p = .450$.

The emotional regulation questionnaire was coded into two parts: questions that measured children's emotional reaction (e.g., "When my child wins a contest or a game, he/she reacts strongly and intensely") and questions that measured children's ability to regulate these emotions (e.g., "He/She has difficulties quieting down on his/her own"). Questions were answered on a 5-point Likert scale, and these responses have been averaged separately for reaction and regulation responses. The Zirkl score is an average of both Time 1 and Time 2 results. No notable correlations were revealed; see supplementary material for all correlations.

In summary, the results of Study 1 were replicated in Study 2 in that 5-year-olds again displayed an intensity bias with regard to losses but not with regard to wins. Furthermore, the same results emerged with 4-year-olds. Thus, we can conclude that an intensity bias with regard to losses is already present at the end of the preschool years.

General discussion

The current research provides the first evidence of an affective forecasting bias in young children. Across two studies, preschool children overestimated how sad they would feel to lose games relative to how sad they reported actually feeling after losing. These children showed a similar tendency to accurately predict the valance of future emotion but to overestimate the intensity of their emotional reactions to future negative events that has been documented repeatedly in adults (Elwakili, Ayton, & Pott, 2007; Gilbert et al., 1998; Levine et al., 2013; Wilson & Gilbert, 2005; Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000).

In contrast to the clear finding of a negative intensity bias, we did not find any evidence of such a bias for positive events. One possible reason for this is that children may have been influenced by their enjoyment of playing the games when reporting their actual emotions regarding wins and losses. This enjoyment may have contributed to children feeling just as happy as expected when they won but less sad than expected when they lost. When imagining future feelings, people tend to focus on the specifics of the event in question and neglect other factors that have an emotional impact (Wilson & Gilbert, 2005; Wilson et al., 2000). The lack of consideration of these other factors is termed "focalism" and is a potential mechanism underpinning the intensity bias in adults (Wilson & Gilbert, 2005; Wilson et al., 2000). Children in the current studies may have also shown focalism when they predicted that they would feel sad if they were to lose the game without taking into account their enjoyment of playing the game. In contrast, when they won the game, their enjoyment of their victory would influence their emotions in the same direction as their enjoyment of the game itself. Thus, focalism might have contributed to the one-sided intensity bias found in the current research. Future studies could address this by asking the children to provide an explanation for their emotional responses. Alternatively, it is worth noting that a number of studies with adults have found a stronger intensity bias for negative events than for positive events (Gilbert et al., 1998; Kermer, Driver-Linn, Wilson, & Gilbert, 2006; Van Dijk, 2009). Speculatively, children may exhibit an intensity bias for positive events if the task they predict emotion toward is not enjoyable, for example, completing a chore. This is because they may expect to feel extremely happy when finishing a chore, but in fact after completing such a dull task they might not feel as happy as predicted. This possibility could be addressed in future research.

It has been suggested that adults fail to take into account their "psychological immune system," or capacity for emotional regulation, when making predictions about negative future events, and this may explain why they overestimate the intensity of their negative emotional reactions (Gilbert et al., 1998; Hoerger, 2012; Pauketat et al., 2016). Young children are still in the process of developing emotion regulation in response to social rules, and they tend to rely heavily on help from parents (Cole, 2014; Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996); however, they too overestimated reactions to future negative events. The current studies included measures of coping, effortful control, and emotional regulation to investigate whether a similar mechanism might be present in children. Our results revealed a relationship between the intensity bias and two subsections of the coping competence scale: social coping and achievement coping. Specifically better social coping was found to be related to a *less* extreme intensity bias, whereas better achievement coping was found to be related to a *more* extreme intensity bias. These results are not consistent with the theory of *immune neglect* because these two subsections were related to the intensity bias in opposite directions. No relationship was found between the intensity bias and effortful control (Study 1) or emotional regulation (Study 2). Therefore, it is unclear from the current studies whether the intensity bias in children is also maintained by the neglect of future coping systems, as is proposed in adults.

The intensity bias may also play an important role in goal-directed cognition and behavior. For instance, overestimating the intensity of future sadness about an undesirable outcome may increase one's motivation to pursue other options to avoid the expected negative feelings (Morewedge & Buechel, 2013). From an evolutionary perspective, this may explain why people do not become more accurate over time in predicting their future emotions if being biased contributes to (or at least does not detract from) individual fitness (Hoerger, Quirk, Lucas, & Carr, 2010; Meyvis, Ratner, & Levav, 2010; Miloyan & Suddendorf, 2015). Given the possibility that the intensity bias may be functional in motivating goal-driven behavior (Miloyan & Suddendorf, 2015; Morewedge & Buechel, 2013), future studies might also want to examine the effect that differential anticipation of future emotions has on future-directed motivation in young children.

Although we did not measure other foresight capacities here, the current results suggest that the intensity bias is present at around the same time that children start to consider future events (Suddendorf & Redshaw, 2013). Thus, future research might examine the relationship between these capacities and biases directly. Is the intensity bias an inherent aspect of our emerging capacity to think about future events? In addition, future research could directly assess how the intensity bias differs with age by employing the same task with adults and children.

The current research provides the first evidence of an intensity bias regarding negative events in young children. Thus, this study can serve as a platform for future research on the development of emotion prediction, with implications for understanding the developmental trajectory underpinning goal-directed behavior. Both the existence of the intensity bias and the differential pattern in response to positive and negative events appear to emerge early in development.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jecp.2017.02.005.

References

Atance, C. M., & Jackson, L. K. (2009). The development and coherence of future-oriented behaviors during the preschool years. *Journal of Experimental Child Psychology, 102*, 379–391.

Atance, C. M., & Meltzoff, A. N. (2005). My future self: Young children's ability to anticipate and explain future states. *Cognitive Development, 20*, 341–361.

Atance, C. M., & Meltzoff, A. N. (2006). Preschoolers' current desires warp their choices for the future. *Psychological Science, 17*, 583–587.

Bernhard, J. (2015). *Zirkl* (Version 1.0.1) [mobile application software]. Retrieved from http://itunes.apple.com.au.

Buehler, R., & McFarland, C. (2001). Intensity bias in affective forecasting: The role of temporal focus. *Personality and Social Psychology Bulletin, 27*, 1480–1493.

Chang, J., Versloot, J., Fashler, S. R., McCrystal, K. N., & Craig, K. D. (2015). Pain assessment in children: Validity of facial expression items in observational pain scales. *Clinical Journal of Pain, 31*, 189–197.

Cole, P. M. (2014). Moving ahead in the study of the development of emotion regulation. *International Journal of Behavioral Development, 38*, 203–207.

Cole, P. M., Zahn-Waxler, C., Fox, N. A., Usher, B. A., & Welsh, J. D. (1996). Individual differences in emotion regulation and behavior problems in preschool children. *Journal of Abnormal Psychology, 105*, 518–529.

de Knegt, N. C., Schuengel, C., Evenhuis, H. M., Lobbezoo, F., & Scherder, E. J. A. (2013). Does format matter for comprehension of a facial affective scale and a numeric scale for pain by adults with Down syndrome? *Research in Developmental Disabilities, 34*, 3442–3448.

Eastwick, P. W., Finkel, E. J., Krishnamurti, T., & Loewenstein, G. (2008). Mispredicting distress following romantic breakup: Revealing the time course of the affective forecasting error. *Journal of Experimental Social Psychology, 44*, 800–807.

Elwakili, N., Ayton, P., & Pott, A. (2007). Affective forecasting: Why can't people predict their emotions? *Thinking & Reasoning, 13*, 62–80.

Gilbert, D. T., Pinel, E. C., Wilson, T. D., Blumberg, S. J., & Wheatley, T. P. (1998). Immune neglect: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology, 75*, 617–638.

Gilbert, D. T., & Wilson, T. D. (2007). Prospection: Experiencing the future. *Science, 317*, 1351–1354.

Halpern, J., & Arnold, R. M. (2008). Affective forecasting: An unrecognized challenge in making serious health decisions. *Journal of General Internal Medicine, 23*, 1708–1712.

Hicks, C. L., von Baeyer, C. L., Spafford, P. A., van Korlaar, I., & Goodenough, B. (2001). The Faces Pain Scale–Revised: Toward a common metric in pediatric pain measurement. *Pain, 93*, 173–183.

Hoerger, M. (2012). Coping strategies and immune neglect in affective forecasting: Direct evidence and key moderators. *Judgment and Decision Making, 7*, 86–96.

Hoerger, M., Quirk, S., Chapman, B., & Duberstein, P. (2012). Affective forecasting and self-rated symptoms of depression, anxiety, and hypomania: Evidence for a dysphoric forecasting bias. *Cognition & Emotion, 26*, 1098–1106.

Hoerger, M., Quirk, S. W., Lucas, R. E., & Carr, T. H. (2009). Immune neglect in affective forecasting. *Journal of Research in Personality, 43*, 91–94.

Hoerger, M., Quirk, S. W., Lucas, R. E., & Carr, T. H. (2010). Cognitive determinants of affective forecasting errors. *Judgment and Decision Making, 5*, 365–373.

Hoerger, M., Scherer, L. D., & Fagerlin, A. (2016). Affective forecasting and medication decision making in breast-cancer prevention. *Health Psychology, 35*, 594–603.

Huguet, A., Stinson, J. N., & McGrath, P. J. (2010). Measurement of self-reported pain intensity in children and adolescents. *Journal of Psychosomatic Research, 68*, 329–336.

Kermer, D. A., Driver-Linn, E., Wilson, T. D., & Gilbert, D. T. (2006). Loss aversion is an affective forecasting error. *Psychological Science, 17*, 649–653.

Kieras, J. E., Tobin, R. M., Graziano, W. G., & Rothbart, M. K. (2005). You can't always get what you want: Effortful control and children's responses to undesirable gifts. *Psychological Science, 16*, 391–396.

Lagattuta, K. H. (2014). Linking past, present, and future: Children's ability to connect mental states and emotions across time. *Child Development Perspectives, 8*, 90–95.

Lagattuta, K. H., Wellman, H. M., & Flavell, J. H. (1997). Preschoolers' understanding of the link between thinking and feeling: Cognitive cuing and emotional change. *Child Development, 68*, 1081–1104.

Levine, L. J., Lench, H. C., Kaplan, R. L., & Safer, M. A. (2013). Like Schrödinger's cat, the impact bias is both dead and alive: Reply to Wilson and Gilbert (2013). *Journal of Personality and Social Psychology, 105*, 749–756.

Mahy, C. E. (2016). Young children have difficulty predicting future preferences in the presence of a conflicting physiological state. *Infant and Child Development, 25*, 325–338.

Mahy, C. E., Grass, J., Wagner, S., & Kliegel, M. (2014). These pretzels are going to make me thirsty tomorrow: Differential development of hot and cool episodic foresight in early childhood? *British Journal of Developmental Psychology, 32*, 65–77.

Marroquín, B., Boyle, C. C., Nolen-Hoeksema, S., & Stanton, A. L. (2016). Using emotion as information in future-oriented cognition: Individual differences in the context of state negative affect. *Personality and Individual Differences, 95*, 121–126.

McCormack, T., & Atance, C. M. (2011). Planning in young children: A review and synthesis. *Developmental Review, 31*, 1–31.

McGrath, P. A., Seifert, C. E., Speechley, K. N., Booth, J. C., Stitt, L., & Gibson, M. C. (1996). A new analogue scale for assessing children's pain: An initial validation study. *Pain, 64*, 435–443.

Meyvis, T., Ratner, R. K., & Levav, J. (2010). Why don't we learn to accurately forecast feelings? How misremembering our predictions blinds us to past forecasting errors. *Journal of Experimental Psychology: General, 139*, 579–589.
Miloyan, B., & Suddendorf, T. (2015). Feelings of the future. *Trends in Cognitive Sciences, 19*, 196–200.
Moreland, A. D., & Dumas, J. E. (2008). Evaluating child coping competence: Theory and measurement. *Journal of Child and Family Studies, 17*, 437–454.
Morewedge, C. K., & Buechel, E. C. (2013). Motivated underpinnings of the impact bias in affective forecasts. *Emotion, 13*, 1023–1029.
Pauketat, J. V. T., Moons, W. G., Chen, J. M., Mackie, D. M., & Sherman, D. K. (2016). Self-affirmation and affective forecasting: Affirmation reduces the anticipated impact of negative events. *Motivation and Emotion, 40*, 750–759.
Payne, G., Taylor, R., Hayne, H., & Scarf, D. (2015). Mental time travel for self and other in three- and four-year-old children. *Memory, 23*, 675–682.
Redshaw, J., & Suddendorf, T. (2013). Foresight beyond the very next event: Four-year-olds can link past and deferred future episodes. *Frontiers in Psychology, 4*. http://dx.doi.org/10.3389/fpsyg.2013.00404.
Rydell, A.-M., Berlin, L., & Bohlin, G. (2003). Emotionality, emotion regulation, and adaptation among 5- to 8-year-old children. *Emotion, 3*, 30–47.
Suddendorf, T., & Busby, J. (2005). Making decisions with the future in mind: Developmental and comparative identification of mental time travel. *Learning and Motivation, 36*, 110–125.
Suddendorf, T., & Moore, C. (2011). Introduction to the special issue: The development of episodic foresight. *Cognitive Development, 26*, 295–298.
Suddendorf, T., & Redshaw, J. (2013). The development of mental scenario building and episodic foresight. *Annals of the New York Academy of Sciences, 1296*, 135–153.
Tabachnick, B. G., & Fidell, L. S. (2014). *Using multivariate statistics* (6th ed.). Harlow, UK: Pearson Education.
tengryprod. (2013). *Dog bowling for kids* (Version 3_6.1_pu_un) [mobile application software]. Retrieved from http://itunes.apple.com.au.
Trapanotto, M., Pozziani, G., Perissinotto, E., Barbieri, S., Zacchello, F., & Benini, F. (2009). The cold pressor test for the pediatric population: Refinement of procedures, development of norms, and study of psychological variables. *Journal of Pediatric Psychology, 34*, 749–759.
Van Dijk, W. (2009). How do you feel? Affective forecasting and the impact bias in track athletics. *Journal of Social Psychology, 149*, 343–348.
Webb, M. (2014). *Stick man archery* (Version 1.0) [mobile application software]. Retrieved from http://itunes.apple.com.au.
Wilson, T. D., & Gilbert, D. T. (2005). Affective forecasting: Knowing what to want. *Current Directions in Psychological Science, 14*, 131–134.
Wilson, T. D., & Gilbert, D. T. (2013). The impact bias is alive and well. *Journal of Personality and Social Psychology, 105*, 740–748.
Wilson, T. D., Wheatley, T., Meyers, J. M., Gilbert, D. T., & Axsom, D. (2000). Focalism: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology, 78*, 821–836.