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# Is There a Downside to Anticipating the Upside? Children's and Adults' Reasoning about How Prior Expectations Shape Future Emotions

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## Abstract

Four- to 10-year-olds and adults (*N*=205) responded to vignettes involving three individuals with different expectations (high, low, no) for a future event. Participants judged characters' pre-outcome emotions, as well as predicted and explained their feelings following three events (positive, attenuated, negative). Whereas adults rated high-expectation characters more negatively than low-expectation characters after all outcomes, children shared this intuition starting at 6 to 7 years for negative outcomes, 8 to 10 years for attenuated, and never for positive. Comparison to baseline (no-expectation) indicated that understanding the costs of high expectations emerges first and remains more robust across age than recognition that low expectations carry benefits. Explanation analyses further clarified this developing awareness about the relation between thoughts and emotions over time.

### Keywords

expectations; emotion understanding; social cognition

Imagine that two children—Susan and Mia—enter a school raffle. The teacher will announce the winners later that day. Although both girls really want to win the grand prize (a big teddy bear) and know that sometimes people win raffles and sometimes they lose, the girls formulate different expectations about the future. Whereas Susan anticipates winning (high expectation), a more pessimistic future plays out in Mia's mind. Mia is certain that she will not win (low expectation). Later that day, each girl receives a small teddy bear as a consolation prize: A shared outcome preceded by diverging expectations. How will each girl feel? What if instead they both won the big teddy bear, or alternatively, they both received nothing at all?

The current research investigates 4- to 10-year-olds' and adults' intuitions about whether, how, and why people's prior expectations push forward in time to shape their future emotional reactions. The utility of recognizing such thought-emotion relations not only

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applies to unique events such as raffles, but also to everyday musings about what will happen next. Whether one is disappointed or delighted by an outcome often derives from a prior *thought* about what would occur. In exploring this topic, we build on a rich literature examining children's knowledge about mental states, what is termed theory of mind (ToM; Wellman, 2014). Although typically examined in children 6 years and younger, there is rising interest in assessing ToM in older age groups, including advances in beliefs about how mental states and experiences connect across time (Hughes, 2016; Lagattuta, 2014; Lagattuta et al., 2015; Lagattuta, Tashjian, & Kramer, in press; Miller, 2012).

Numerous studies indicate that in the here-and-now, positive thinking feels better than negative thinking (Carver, Scheier, & Segerstrom, 2010; Nolen-Hoeksema, 2001). Indeed, a common technique for improving mood involves focusing attention and thoughts on positive stimuli or reframing negative thoughts and events more positively (Beck, Rush, Shaw, & Emery, 1979; Brenner, 2000; Gross, 1999; Westermann, Spies, Stahl, & Hesse, 1996). When outcomes occur, however, there is an intriguing twist. According to *decision affect theory* (DAT) once an event happens—which either confirms or refutes the prior expectation—the canonical direct relation between thoughts and emotions inverses (Mellers, Schwartz, Ho, & Ritov, 1997). Post-outcome, adults who previously thought positively (high expectations) feel worse than those who had thought negatively (low expectations): Unexpected losses feel worse than expected losses and unexpected gains feel better than expected gains (Bossuyt, Moors, & De Houwer, 2014; Carroll, Sweeny, & Shepperd, 2006; Mellers et al., 1997; Sweeny, Reynolds, Falkenstein, Andrews, & Dooley, 2016; Sweeny & Shepperd, 2010). Neurobiological research further reveals different dopaminergic responses to unexpected versus expected outcomes in several animal species, including humans (Glimcher, 2011; Schultz, 1998).

With this evidence in mind, we return to considering Susan's and Mia's emotions from the opening anecdote. Prior to learning the raffle results, Susan (high expectation) will feel happier than Mia (low expectation) as positive thinking feels better than negative thinking. Once outcomes occur, however, this hierarchy flips. For Mia, getting either a big or a small teddy bear would be an emotionally rewarding surprise; she mentally prepared for getting nothing at all. In contrast, for Susan, winning anything less than the big teddy bear would be disappointing. At what age, if ever, do folk intuitions align with DAT? That is, do children and adults believe that the impact of thoughts on emotions reverses from the time point of forming an expectation (direct relation) to the time point of learning the outcome (inverse relation)? What emerges first—awareness that high expectations carry a future emotional cost or that low expectations ultimately yield a benefit? The answers to these questions not only elucidate novel advances in ToM during middle childhood and adulthood, but they also reveal insight into developing knowledge of how to manage present thoughts while keeping the emotions of the future self in mind. Thus, this research further informs studies on awareness of *mental time travel*, or understanding of mental states through time (Lagattuta, 2014; Suddendorf & Corballis, 2007).

To test these concepts, we showed 4- to 10-year-olds and adults scenarios, each featuring three characters who share the same desire and knowledge, but differ in their expectations (high, low, no). For example, three children want to win a big teddy bear in a raffle and

know that sometimes children win raffles and sometimes they lose them. One character thinks that she will win, another thinks that she will lose, and the third decides to think about something neutral in the present scene. The no-expectation character serves as a baseline to test whether having high or low expectations carries an emotional cost or benefit relative to having held no expectations. Participants rated all three characters' emotions (from very bad to very good) pre-outcome, as well as judged and explained their feelings after three outcomes: positive (e.g., win), attenuated (e.g., get a consolation prize), and negative (e.g., lose). We included attenuated outcomes because they are unexpected for all characters, but are more negative than foreseen by the high-expectation character and more positive than predicted by the low-expectation character.

Prior developmental research indicates improvements from 3 to 10 years as well as between childhood and adulthood in recognizing that individuals experiencing the same objective event can vary in their interpretations and emotions (Carpendale & Chandler, 1996; Eisbach, 2004; Gnepp, McKee, & Domanic, 1987; Lagattuta, Sayfan, & Blattman, 2010; Lagattuta, Sayfan, & Harvey, 2014; Lalonde & Chandler, 2002; Osterhaus, Koerber, & Sodian, 2016; Sayfan & Lagattuta, 2008, 2009). Moreover, starting around 3 to 4 years, and increasing into adulthood, children appreciate the impact of thoughts on emotions: Thinking positively about a past, present, or future event feels better than thinking negatively (Bamford & Lagattuta, 2012; Flavell, Flavell, & Green, 2001; Lagattuta, 2014; Lagattuta, Elrod, & Kramer, 2016; Lagattuta & Sayfan, 2013; Lagattuta, Wellman, & Flavell, 1997; Lagattuta & Wellman, 2001; Sayfan & Lagattuta, 2008, 2009). Based on this evidence, we predicted that children as young as 4 to 5 years would recognize the direct relation between thoughts and emotions when expectations are first formed: High expectations (positive thoughts) feel better than low expectations (negative thoughts). Before outcomes, all age groups should also rate high expectations as beneficial and low expectations as costly compared to a no-expectation baseline.

Knowing that and how past thoughts have the potential to alter *future* emotions, however, constitutes a much more complex cognitive task. This requires awareness that fleeting thoughts—not just actual lived past experiences (as in Lagattuta, 2007, 2014; Lagattuta & Sayfan, 2013)—can shape how one reacts in the future. Amplifying this challenge, to align with DAT, the child or adult must further recognize that the correspondence between thoughts and emotions inverses over time: Those who previously envisioned a positive future later feel worse than those who had negative expectations.

Previous work indicates that adult reasoning follows DAT. Adults report lowering their expectations so that they can be pleasantly surprised by good outcomes and less upset when things go wrong (Martin, Marsh, Williamson, & Debus, 2003; Norem & Chang, 2002). Restaurant hosts believe that customers who get seated earlier than expected feel happier and tip more (Shepperd et al., 2007). Undergraduates judge that others feel better after earning an unexpected versus expected high exam grade and worse after obtaining an unexpected versus expected low score (Shepperd & McNulty, 2002). Based on these findings, we predicted that adults would rate low-expectation characters more positively than high-expectations characters after outcomes. We further investigated whether adults infer an emotional cost for high expectations and an emotional benefit for low expectations

compared to having no expectations. Because previous research has excluded this baseline, it is unknown which offset (i.e., cost, benefit, or both) drives the post-outcome difference between high and low expectations.

Although not tested in the extant literature, prior research provides a foundation for forming hypotheses regarding the development of children's reasoning about post-outcome emotions. Four- to 5-year-olds tend to focus on the objective features of a situation (e.g., Piaget, 1932/1965; Sayfan & Lagattuta, 2008; Schult, 2002), especially when such details provide an immediate, logical cause for an emotion (Gnepp, 1989; Gnepp, Klayman, & Trabasso, 1982; Harris, 2010; Lagattuta & Wellman, 2001; Miller & Aloise-Young, 2017). Given that all vignette outcomes included salient events (e.g., winning a big teddy bear), we anticipated that children younger than 6 to 7 years would be unlikely to consider additional emotion elicitors, especially differences among characters' past thoughts. This would be evidenced both in their judgments (providing similar post-outcome emotions to all three characters) and in their explanations (most often referencing the situation as the cause of characters' emotions).

Between 5 and 10 years, children not only demonstrate gains in appreciating the causal impact of the mind and past experience on emotions (Lagattuta, 2014; Lagattuta et al., 2015), but they also develop increasing awareness that relations between mental states and emotions can violate prototypical valence pairings (i.e., people can feel good inhibiting desires and bad fulfilling them; Lagattuta, 2005; Weller & Lagattuta, 2013, 2014). Nevertheless, some unevenness occurs in this developmental course: Children exhibit earlier and more sophisticated causal reasoning about negative versus positive emotions (Flavell, Green, & Flavell, 1995; Lagattuta et al., 1997; Lagattuta & Wellman, 2001, 2002). Thus, we hypothesized that by 6 to 7, children would align with DAT for negative events, but not until 8 to 10 years for attenuated and positive outcomes. As well, we predicted that awareness of the costs of high expectations would developmentally precede endorsing benefits of low expectations. We further anticipated a significant age-related increase in explaining current emotions in relation to past expectations.

Of course, it is possible that 6- to 10-year-olds have different ideas about the emotional impact of prior expectations than patterns predicted by DAT. The design of the current study enables the exploration of these alternatives as well. For example, 6- to 10-year-olds could *valence-match* past thoughts with current emotions (i.e., the positive thinking, high-expectation character continues to feel better than the negative thinking, low-expectation character), or they could view *expectedness* or *correctness* as emotionally beneficial (the character who accurately predicted the outcome feels better than the one who expected the opposite event). The latter way of reasoning would fit with *consistency theory*—people prefer outcomes that they predicted over those that are surprising (Carlsmith & Aronson, 1963). Here, the attenuated outcome provides a critical test case since none of the characters were correct in their forecasts.

# Method

## Participants

Four- to 10-year-olds and adults ($N$ = 205) were divided into four age groups based on previous research on children's understanding of connections between mind and emotion (e.g., Lagattuta & Sayfan, 2013; Lagattuta et al., 2015): 49 4.5- to 5-year-olds ($M$ = 5.28 years, $SD$ = .41 years, 25 females), 56 6- to 7-year-olds ($M$ = 7.02 years, $SD$ = .60 years, 27 females), 52 8- to 10-year-olds ($M$ = 9.47 years, $SD$ = .80 years, 25 females), and 48 undergraduates ($M$ = 21.16, $SD$ = 1.95 years, 24 females). Participants were recruited from within a 20-mile radius of a college town in Northern California from September 2015 to September 2016. Children were 2% Asian, 64% Caucasian, 11% Hispanic or Latino, 21% Multiracial, and 3% some other race or ethnicity. Adults were 6% African American, 21% Asian, 33% Caucasian, 2% Hawaiian or Pacific Islander, 19% Hispanic or Latino, 2% Native American, 6% multiracial, and 10% other groups. Most participants (89% children, 56% adults) had at least one parent with a college degree, with 62% of children's parents and 36% of undergraduates reporting a family income of more than $100,000 per year (range: < $10,000 to > $250,000). We recruited child participants from a list of previous participants, farmers markets, and participant referrals. Adults were drawn from a university subject pool. Included participants were fluent in English and did not have a diagnosed affective or cognitive disorder (via self- or parent-report).

## Materials and Procedures

**Emotion-scale training—**Prior to responding to the expectation-emotion scenarios, children and adults were trained on a 7-point pictorial feeling scale adapted from Bamford and Lagattuta (2012; see Figure 1): *very bad, medium bad, little bad, okay–not good or bad, little good, medium good*, and *very good*. After learning about what each of the scale points signified, the experimenter tested participants on their comprehension of each face (e.g., "Can you tell me which one feels medium good?"). The experimenter did not move on to the expectation-emotion scenarios until participants answered correctly for every emotion face.

**Expectation-emotion scenarios (Figure 1)—**Children and adults responded to scenarios in which three characters had varying expectations about an upcoming uncontrollable event. We chose to make the outcomes uncontrollable because research with adults shows that lowering expectations is only beneficial when the event cannot be influenced by effort, skill, or persistence (Carroll et al., 2006). Children and adults responded to six scenarios that each featured three characters who all wanted to gain pleasurable treats (wanting to get a favorite dessert, wanting to win a big teddy bear), avoid unpleasant things (wanting to get no homework, wanting to leave a doctor's appointment), or maintain their creation's desirable state (wanting a snowman to stay just how it was made, wanting chalk drawings to stay just how they were made). Participants were told that all three characters knew that in general both negative and positive outcomes were possible for the event; this information was stated in a timeless, generic language (e.g., "All of them know that sometimes children win big prizes in raffles and sometimes they win nothing at all"). All characters also had the same starting-state desire (e.g., "They all want to win the big teddy bear"). A control question verified that participants understood that this desire was

mutually shared ("What do all of these kids really want?"). The trial did not progress until the control question was answered correctly.

Subsequent to learning about the characters' common knowledge and desire, participants learned about each of the three characters' individual *expectations*: One had a *high expectation* (desire will be met; e.g., "This one thinks, 'I'm sure I will win the big teddy bear'"); one had a *low expectation* (desire will not be met; e.g., "This one thinks, 'I am sure I will not win the big teddy bear'"); and one had *no expectation* (had an unrelated thought about an object depicted in the scene; e.g., "This one thinks, 'I will just think about those flowers'"). Thought bubbles containing pictorial representations of the characters' expectations were provided to aid in comprehension and to reduce memory demands; they remained visible for the duration of the trial. Children as young as 3 or 4 years of age comprehend thought bubbles as depicting thoughts, do not confuse thought bubbles with actual events, and understand that crossed-out thought bubbles indicate something that the person thinks will not occur (Lagattuta, 2008; Wellman, Hollander, & Schult, 1996). The characters' hands were depicted in a "thinking pose," effectively occluding their mouths, and thus, any facial cues to emotion.

After hearing (and seeing) each character's expectation, participants judged that protagonist's *pre-outcome* emotion using the 7-point feeling scale ("How does this one feel right now?"). If a participant stated that all three characters felt the same or if two of the characters felt the same "very" emotion (i.e., very good or very bad), he or she was asked the *best-worst prompt*: "Even though [they all *or* two of them] feel [answer choice], is there one kid that feels the [best *or* worst] here?" "Best" was used for positive emotions; "worst" was used for negative emotions; and "best or worst" was used for neutral emotions. We included this follow-up to allow participants flexibility to make further gradations of emotion intensity if needed.

Participants then heard three outcomes that occurred later that day in varying orders (sequencing described below): *positive outcome* (high expectation met), *attenuated outcome* (not as good as the positive outcome nor as bad as the negative outcome), and *negative outcome* (low expectation met). Characters were depicted profile, without any discernible facial expression. The experimenter introduced each alternative ending with, "Now imagine that instead…" Thus, each trial included two within-subjects factors: expectation (3: high, low, no expectation) and outcome (4: pre-outcome, post-positive, post-attenuated, and post-negative outcome).

After each outcome, participants predicted each character's *post-outcome emotion* using the 7-point scale ("How does this one feel right now?"). When prompting for each rating, the experimenter only pointed to characters in the present scene; she never directed participants' attention back towards the prior thoughts. Once participants finished making emotion judgments for all three characters, the experimenter asked the *emotion explanation question*: "Why are they feeling [those ways *or* that way]?" After providing explanations, the *best-worst prompt* was asked only if the participant judged that all three characters felt the same or that two of the characters felt the same "very" emotion. The experimenter also asked

whether any of the characters felt surprised ("Did any kids feel surprised when they heard [outcome]?" [If yes,] "Which ones?").

**General procedure—**Participants were tested individually at a university laboratory by a female experimenter. Story order, outcome order, and character questioning order (i.e., the character who was asked about first, second, and third) were counterbalanced across participants by age and participant gender. Within participants, outcome order and character questioning order were also counterbalanced. The first story featured characters matching the gender of the participant, and each subsequent trial alternated between having all male or all female characters. We made these ordering decisions to optimize interest, variety, and balance in presentation as well as to wash out unintended order effects that may have resulted from a fixed sequence.

Prior to these expectation-emotion scenarios, participants played chance games where they attempted to select a "winning" container. Of primary interest was how children and adults formed expectations based on mathematical probability (there were no prizes for winning or consequences for losing). These data will be presented elsewhere. The entire session lasted about one hour. For participating, children and adults received a pencil; children were also given $10.00 and adults earned research credit. All sessions were video- and audio-recorded, and subsequently transcribed verbatim.

## Scoring and Coding

**Emotion rating—**To assess predictions about how *individuals* will respond to different outcomes based on their prior expectations, we created *emotion-rating scores* (−3 [very bad] to +3 [very good]) by character (3: high, low, no expectation) and outcome (4: pre-outcome, post-positive, post-attenuated, post-negative outcome) for each trial. We averaged these ratings across the six trials to compute scores for the 12 expectation-by-outcome combinations.

**Explanations—**To analyze reasoning about why characters would feel these ways, we coded explanations for the cause(s) of characters' emotions for the presence or absence (0, 1) of three features (see Table 1 for examples): (1) explicit references to or descriptions of the key outcome in the present *situation*, (2) references to characters' *desires*, and (3) references to characters' prior *thoughts*. Participants were coded as referencing prior thoughts if they did so directly (e.g., "Because he thinks he'll get homework and he thinks he won't"), as well as if they did so more indirectly (e.g., "Because it surprised her"). The authors created the coding scheme informed by previous research on causal reasoning about emotions (e.g., Bamford & Lagattuta, 2012; Lagattuta & Wellman, 2001; Sayfan & Lagattuta, 2008). Two research assistants, blind to the study hypotheses, collaboratively coded 16% of the data with the first and third author. After reaching agreement on application of the coding scheme, the two research assistants independently coded the remaining data. All of the transcripts excluded identifying information.

We assessed reliability on 100% of the non-collaboratively coded data (84% total), and agreement was excellent (Cohen's kappa for situation explanations = .85; for desire explanations = .96; for thought explanations = .96). Discrepancies were resolved by group

discussion. We then used SPSS syntax to recode the data to determine the proportion of trials (out of six) for each expectation-by-outcome combination where participants: (1) referenced only the present situation (but not desires or thoughts); (2) referenced desires but not prior thoughts; and (3) referenced prior thoughts.

## Results

We investigated developmental changes in children's and adults' emotion ratings, supplemented by an analysis of their explanations for why characters would experience those feelings. Preliminary analyses revealed no main effects or interactions for gender on emotion ratings ($F$s < 1.10, $p$s > .360, $\eta_p^2$ < .02); thus, we removed gender from primary analyses. Initial analyses further showed redundant findings whether or not we allowed for the inclusion of responses to the best-worst prompt. Therefore, we only present data on initial emotion judgments. Responses to the surprise question will be examined in a separate manuscript.

### Emotion Ratings

A 4 (age: 4- to 5-year-olds, 6- to 7-year-olds, 8- to 10-year-olds, adults) × 3 (character: high-, low-, no-expectation) repeated-measures multivariate analysis of variance (MANOVA) on emotion ratings for each of the four outcomes (pre-outcome, post-positive, post-attenuated, post-negative) resulted in main effects for age, $F(12, 600) = 4.43$, $p < .001$, $\eta_p^2 = .08$, and character, $F(8, 800) = 123.25$, $p < .001$, $\eta_p^2 = .55$, qualified by an Age × Character interaction, $F(24, 1608) = 9.80$, $p < .001$, $\eta_p^2 = .13$. Univariate tests confirmed these effects for all four outcomes ($2.73 < F\text{s} < 849.92$, $p$s < .045, $.04 < \eta_p^2\text{s} < .81$). The following sections describe the four Age × Character interactions (Table 2 and Figure 2), focusing on age-related changes in (1) the contrast between high and low expectations and (2) whether high and low expectations carried a cost or benefit relative to a no-expectation baseline.

**Pre-outcome (Figure 2a)—**Children and adults judged that forecasting positively (high expectations) felt better than forecasting negatively (low expectations; $p$s < .001), with 8- to 10-year-olds and adults endorsing more extreme views about the power of positive ($p$s < .054) and negative ($p$s < .009) thinking compared to 4- to 5-year-olds. All age groups viewed high expectations as emotionally beneficial and low expectations as detrimental compared to a baseline of no expectations ($p$s < .001). Four- to 5-year-olds anticipated no-expectation characters to feel better than older participants ($p$s < .003), with 6- to 7-year-olds also rating the decision to form no expectations more positively than did adults ($p = .035$).

**Positive outcome (Figure 2b)—**After positive outcomes, only adults believed that low-expectation characters now felt better than high-expectation characters ($p = .007$). Four- to 10-year-olds followed the opposite pattern (rated those who expected desire fulfillment to feel more intensely "good" than those who expected the negative outcome; $p$s < .039). This was primarily driven by two age-related changes: Adults rated low-expectation characters more positively than did 4- to 7-year-olds ($p$s < .028), and there was a drop in emotion ratings for high-expectation characters between 8 to 10 years and adulthood ($p = .045$).

Adding the comparison to the no-expectation baseline, however, revealed hints of convergence in children's and adults' beliefs. Eight- to 10-year-olds, like adults, judged that low (versus no) expectations carry an emotional boost following positive events ($p$s < .023). Adults, similar to 6- to 10-year-olds, viewed high (versus no) expectations as emotionally beneficial ($p$s < .004). Four- to 5-year-olds were the only age group to rate low (versus no) expectations as costly ($p$ = .002). Similar to pre-outcome, children (6- to 10-year-olds) rated no-expectation characters more positively than did adults ($p$s < .016).

**Attenuated outcome (Figure 2c)—**When outcomes fell between those envisioned by the high- and low-expectation characters, adults and 8- to 10-year-olds decided that those who had previously thought positively now feel worse than those who had anticipated the negative outcome ($p$s < .001). Indeed, adults rated high-expectation characters more negatively than did children ($p$s < .001), and 8- to 10-year-olds did so more than 4- to 5-year-olds ($p$ = .014). Adults also evaluated low-expectation characters more positively than 6- to 7-year-olds ($p$ = .018).

The comparison to baseline, however, indicated closer parallels in reasoning between children and adults not evident in the high- versus low-expectation contrast. All age groups endorsed that high expectations are detrimental in contrast to no expectations ($p$s < .013), but only adults anticipated an emotional boost from low expectations ($p$ = .003; 4- to 5-year-olds actually viewed a cost, $p$ = .001). Identical to pre-outcome, 4- to 5-year-olds gave more positive emotion ratings for no-expectation characters than did older children and adults ($p$s < .042).

**Negative outcome (Figure 2d)—**Following negative outcomes, participants as young as 6 to 7 years judged that individuals who had high expectations now felt worse than those with low expectations ($p$s < .008). Still, adults were the most negative and 4- to 5-year-olds the most positive about high expectations ($p$s < .028). Moreover, a transition occurred after 6 to 7 years towards endorsing more positive emotions for low expectations ($p$s < .001).

When contrasted to baseline, all age groups attributed a cost to high expectations ($p$s < .006). Although 4- to 7-year-olds also viewed low expectations as disadvantageous ($p$s < .018), older children and adults did not differentiate between low expectations and baseline ($p$s > .356). Six- to 7-year-olds were the least positive age group about no expectations ($p$s < .024).

## Emotion Explanations

To gain insight into children's and adults' reasoning about the causes of characters' post-outcome emotions, we then analyzed how often they explained emotions as caused by situations, desires, or thoughts. Because participants did not explain pre-outcome emotions, this analysis included three levels of the "outcome" variable. A 4 (age) × 3 (outcome) repeated-measures MANOVA on the proportion of trials that participants used each explanation type yielded main effects for age, $F(9, 603) = 12.80$, $p < .001$, $\eta_p^2 = .16$, and outcome, $F(6, 802) = 9.51$, $p < .001$, $\eta_p^2 = .07$, qualified by an Age × Outcome interaction, $F(18, 1206) = 2.32$, $p = .001$, $\eta_p^2 = .03$. The univariate tests confirmed the main effects of age and outcome for all explanation types ($3.60 < F\text{s} < 49.49$, $p$s < .015, $.05 < \eta_p^2\text{s} < .43$) as

well as the Age × Outcome interaction for desire and thought explanations ($2.31 < F$s $< 5.86$, $p$s $< .033$, $.03 < \eta_p^2$s $< .08$; see Figure 3).

Whereas situation and desire explanations decreased with age, thought explanations increased. Four- to 7-year-olds referenced the situation more often than 8- to 10-year-olds (Tukey's HSD $p$s $< .001$) who did so more frequently than adults (Tukey's HSD $p = .022$), with participants providing situation explanations least often for negative outcomes ($p$s $< .001$). Although desire explanations remained stable across age after positive outcomes ($p$s $> .137$), adults generally referenced desires less often than children for negative ($p$s $< .068$) and attenuated outcomes ($p$s $< .006$). Regardless of outcome, adults more frequently referred to prior thoughts than 8- to 10-year-olds ($p$s $< .001$), who did so more often than 4- to 7-year-olds ($p$s $< .004$). Attenuated and negative outcomes elicited more references to prior thoughts than positive outcomes for 8- to 10-year-olds ($p$s $< .053$) and adults ($p$s $< .001$). Eight- to 10-year-olds also discussed thoughts more after negative than attenuated outcomes ($p = .041$).

## Discussion

The current study extends theory and research on advanced theory of mind (ToM) by documenting developmental changes and continuities in beliefs about connections between people's mental states and emotions over time; in other words, their explicit awareness of and intuitions about mental time travel (see Lagattuta, 2014 for a review). As young as 4 to 5 years, children appreciate that when forming expectations, thoughts directly shape feelings (i.e., thinking positively feels better than thinking negatively). After time passes and the outcome occurs, however, adults intuit inverse thought-emotion relations. Consistent with decision affect theory (DAT; Mellers et al., 1997), adults predict that individuals with prior high expectations later feel worse than those who previously held low expectations. Children's responses reflect this pattern by 6 to 7 years for negative outcomes and 8 to 10 years for attenuated outcomes. Following positive events, however, 4- to 10-year-olds persist in assuming a direct relation between thinking and feeling (i.e., the positive thinker feels better than the one who anticipated a negative future). Analyses of emotion explanations helped clarify these results. Comparing high and low expectations to a no-expectation baseline revealed an earlier developing and more robust folk theory that high expectations carry a future emotional cost as opposed to low expectations being emotionally beneficial. Below, we elucidate these findings, connect them to broader literatures, and provide suggestions for further exploration.

### Understanding Thought-Emotion Connections Across Time

Four- to 10-year-olds and adults had no trouble linking thoughts and emotions when expectations were formed (i.e., thinking positively feels good, thinking negatively feels bad), with age-related increases in judging that thoughts have greater influence over emotional wellbeing (Bamford & Lagattuta, 2012; Carver et al., 2010; Lagattuta et al., 2016; Nolen-Hoeksema, 2001). More striking developmental changes appeared in knowledge that expectations also exert power later in time. Despite lowering the cognitive demands that reasoning about expectation-emotion relations likely require in "real life" (i.e., we

represented characters' thoughts pictorially; these visible reminders of prior expectations remained in view throughout questioning), even the oldest children did not consistently reason like adults.

Confirming our predictions, adults rated high expectations as less emotionally positive than low expectations following all outcomes; the previous positive thinker later feels worse than the prior negative thinker (Shepperd et al., 2007; Shepperd & McNulty, 2002). Moreover, adults referenced prior thoughts substantially more than situations or desires alone when explaining emotion causes. In contrast, 4- to 5-year-olds equated the high- and low-expectation characters' emotions after the negative and attenuated outcomes. As well, this age group most often referenced current situations as the cause of the characters' emotions (Lagattuta et al., 1997; Lagattuta & Wellman, 2001; Sayfan & Lagattuta, 2008, 2009). Thus, the youngest children's responses reflected a largely outcome-driven perspective—they most often aligned emotion ratings with the valence of salient features of the current event (Gnepp et al., 1982; Gnepp, 1989; Harris, 2010; Lagattuta & Wellman, 2001; Miller & Aloise-Young, 2017; Piaget, 1932/1965).

Post-outcome emotion ratings by 6- to 10-year-olds revealed growing awareness that past expectations matter for future emotions, with a pattern that diverged from adult intuitions. For positive outcomes, 6- to 10-year-olds (as well as 4- to 5-year-olds) appeared to prioritize expectedness: People who accurately predicted the future feel better than those who forecasted incorrectly. This intuition that "being right feels better than being wrong" fits with *consistency theory* (i.e., people prefer outcomes that fit with their prior hypotheses; Carlsmith & Aronson, 1963). Six- to 10-year-olds also judged high expectations to feel worse than low expectations for negative outcomes; predictions that equally align with DAT and consistency theory (i.e., unexpected losses feel worse than expected losses). The critical test case, then, for disentangling whether intuitive theories change between 6 and 10 years of age comes from the attenuated outcomes. Here, 6- to 7-year-olds aligned with consistency theory (i.e., high- and low-expectation characters feel the same since neither expected the outcome), whereas 8- to 10-year-olds adhered to DAT (i.e., the same event feels worse to the person who expected more than to the person who anticipated less). That 8- to 10-year-olds provide thought explanations more than twice as often as younger age groups further signals a transition to adult-like intuitions.

Why would consistency theory developmentally precede DAT, despite both requiring attention to prior thoughts? Arguably, consistency theory adheres to a simpler rule which sidesteps children's need to attend to inverse relations between thoughts and emotions over time (i.e., the person whose prior thought matches the outcome feels better than the one whose thought mismatches). To follow DAT, inverse relations must be acknowledged: Expected feels better than unexpected for negative outcomes, unexpected feels better than expected for positive outcomes. Unlike consistency theory, DAT also likely requires counterfactual thinking—comparing outcomes to what could have been (German, 1999; Roese, 1997) or what had been anticipated (Shepperd & McNulty, 2002). Skills in counterfactual reasoning undergo significant improvements during middle childhood (Beck & Riggs, 2014; O'Connor, McCormack, & Feeney, 2014; Payir, & Guttentag, 2016). More generally, children's ability to attend to and integrate multiple variables in problem-solving

contexts show rapid development between 4 and 10 years of age (Halford, Andrews, Dalton, Boag, & Zielinkski, 2002; Lagattuta, 2005; Marini & Case, 1989; Weller & Lagattuta, 2013, 2014).

### Is it a Cost to High or a Benefit to Low?

Research on expectation-emotion connections has framed the difference between high and low expectations as a cost to high and a benefit to low (Bossuyt et al., 2014; Carroll et al., 2006; Mellers et al., 1997; Sweeny et al., 2016; Sweeny & Shepperd, 2010). This assumption, however, has gone untested. By including a no-expectation baseline, the current study both extends DAT and provides further insight into parallels between children's and adults' reasoning. After attenuated and negative outcomes, individuals as young as 4 to 5 years judged high expectations as emotionally costly. Following positive outcomes, 8- to 10-year-olds and adults anticipated a benefit from low expectations (further evidence that the oldest children were nearing DAT). Only adults reported a boost from low expectations after attenuated outcomes.

Thus, children show earlier and more consistent knowledge of the future costs of positive thinking than the future benefits of negative thinking. Notably, adults rated the emotion decrement from high expectations in negative outcomes as 70% more potent than the emotional boost from low expectations in positive outcomes. The costly nature of high expectations may appear more salient to children and adults because negative events and emotions elicit more counterfactual thinking than positive events and emotions (e.g., people are more apt to think "How could this have gone better?" than "How could this have gone worse?"; German, 1999; Roese, 1997). People also prefer to avoid prospective losses than to obtain future gains (Kahneman & Tversky, 1979). That understanding emotional costs precedes knowledge about emotional benefits further fits with children's more sophisticated causal knowledge about negative versus positive emotions (Lagattuta, 2014; Lagattuta et al., 2015). Not surprisingly then, children's earliest breakthrough in explaining emotions as caused by past thoughts as opposed to just situations or desires occurred in negative outcomes.

### Implications for Regulating Emotions

Three techniques frequently suggested to aid emotion regulation are thinking about the positive aspects of situations (Gross, 1999), mindfulness (attending to sensory features of present events in a non-elaborative way; Chambers, Gullone, & Allen, 2009), and managing expectations (Sweeny et al., 2006, 2016). We contribute to this literature by documenting young children's emerging knowledge about the mechanisms underlying these strategies. Consistent with prior work, we show that by 4 to 5 years children know that current thoughts shape current emotions (Bamford & Lagattuta, 2012; Davis, Levine, Lench, & Quas, 2010; Lagattuta et al., 2015, 2016; Sayfan & Lagattuta, 2009). We further reveal that all age groups, even the 4- to 5-year-olds, may appreciate the emotional benefits of mindfulness: Participants rated no-expectation characters (those who only focused on aspects of a present event, such as a flower) as feeling better than high-expectation characters following negative or attenuated outcomes. Indeed, the youngest age group exhibited the most positive evaluation of this no-expectation approach. Finally, these data show that even 8- to 10-year-

olds do not recognize the negative downstream effects of positive thinking on par with adults. This protracted development is likely protective; optimistic views can motivate children to persist despite past failures and attempt new challenges without fear (Bjorklund, 1997; Seligman, 2007). Thus, we would not endorse teaching young children to think negatively about the future. Given that high expectations can be costly, however, a more developmentally appropriate approach may be to guide children in how to think flexibly about the future, to help them gauge the likelihood that different outcomes could occur, and to prepare mentally (if needed) for how they can effectively cope with whatever happens.

## Limitations and Future Directions

We tested beliefs about expectation-emotion connections in a state-like manner (i.e., each character had one expectation for a single event) and only for uncontrollable outcomes. Expectations can also take a trait-like form (i.e., level of optimism versus pessimism; Nes & Segerstrom, 2006; Norem & Chang, 2002; Sweeny & Falkenstein, 2016). Thus, researchers should examine developmental changes in beliefs about expectation-emotion connections when there are multiple instances of a person having the same type of expectation (e.g., a person who always thinks the worst or always thinks the best). For example, adults, and perhaps children may recognize that a person who continually expects the worst may always find flaws even in objectively positive circumstances (e.g., despite winning a big teddy bear could decide that it is not good enough). Moreover, it is likely that children's and adults' beliefs about relations between expectations and emotions over time differ for controllable versus uncontrollable outcomes. Thus, we would encourage expanding this paradigm to a wider variety of events where high expectations may or may not be costly (e.g., expectations for performance).

Adults' reasoning about expectation-emotion connections followed directional effects found in their "real life" (Carroll et al., 2006; Sweeny et al., 2016; Sweeny & Shepperd, 2010). We argued that individuals increasingly move towards the adult pattern because of age-related improvements in complex cognitive abilities (e.g., counterfactual reasoning, recognition that thought-emotion relations can inverse over time). Alternatively, children may experience these relations differently than adults, thus leading to variance in beliefs. For example, children may endorse the maxim that "expected or correct feels better than unexpected or incorrect" more than adults because children have fewer opportunities to control their environment (e.g., adults make the rules) and they know less than adults. Thus, any sense of controllability or being "right" may feel particularly good to them. Moreover, children's books and movies often focus on "wishes coming true" as the cause of extreme happiness; perhaps boosting children's own positive affect when a high expectation is realized. At the same time, it is worth questioning whether adults hold exaggerated or biased intuitions, in line with prior work showing an augmenting bias in affective forecasting (Golub, Gilbert, & Wilson, 2009). Research systematically comparing children's and adults' *predictions* with their *experiences* of expectation-emotion connections is needed.

## Conclusion

By at least 4 to 5 years, children know that people's current thoughts influence their emotional wellbeing. With increasing age, children more closely align to adult intuitions

about mental time travel: Thoughts not only cause here-and-now emotions but also push forward in time to shape later affective responses. Understanding these connections requires sophisticated social-cognitive insights. Starting from an emotion judgment aligned with outcome valence, the child has to learn how to layer several additional considerations—situations can elicit diverse emotions in different people; emotions can have both proximal and distal causes; thoughts carry causal weight in the present and in the future; and prototypical thought-emotion relations inverse over time (negative thinking can augment positive future emotions and positive thinking can magnify negative future emotions). These findings highlight multiple opportunities for broadening investigations of ToM across the lifespan to test children's and adults' beliefs about interconnections among experience, mind, and emotion across time.

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## References

Bamford C, Lagattuta KH. 2012; Looking on the bright side: Children's knowledge about the benefits of positive versus negative thinking. Child Development. 83:667–682. DOI: 10.1111/j.1467-8624.2011.0176.x [PubMed: 22187976]

Beck, AT, Rush, AJ, Shaw, BF, Emery, G. Cognitive therapy of depression. New York, NY: The Guilford Press; 1979.

Beck SR, Riggs KJ. 2014; Developing thoughts about what might have been. Child Development Perspectives. 8:175–179. DOI: 10.1111/cdep.12082

Bjorklund DF. 1997; The role of immaturity in human development. Psychological Bulletin. 122:153–169. DOI: 10.1037/0033-2909.122.2.153 [PubMed: 9283298]

Bossuyt E, Moors M, De Houwer J. 2014; Unexpected and just missed: The separate influence of appraisals of expectancy and proximity on negative emotions. Emotion. 14:284–300. DOI: 10.1037/a0034675 [PubMed: 24364851]

Brenner E. 2000; Mood induction in children: Methodological issues and clinical implications. Review of General Psychology. 4:264–283. DOI: 10.1037/1089-2680.4.3.264

Carlsmith JM, Aronson E. 1963; Some hedonic consequences of the confirmation and disconfirmation of expectancies. Journal of Abnormal and Social Psychology. 66:151–156. DOI: 10.1037/h0042692 [PubMed: 14018688]

Carpendale JI, Chandler MJ. 1996; On the distinction between false belief understanding and subscribing to an interpretive theory of mind. Child Development. 67:1686–1706. DOI: 10.1111/j.1467-8624.1996.tb01821.x

Carroll P, Sweeny K, Shepperd JA. 2006; Forsaking optimism. Review of General Psychology. 10:56–73. DOI: 10.1037/1089-2680.10.1.56

Carver CS, Scheier MF, Segerstrom SC. 2010Optimism. Clinical Psychology.

Chambers R, Gullone E, Allen NB. 2009; Mindful emotion regulation: An integrative review. Clinical Psychology Review. 29:560–572. DOI: 10.1016/j.cpr.2009.06.005 [PubMed: 19632752]

Davis EL, Levine LJ, Lench HC, Quas JA. 2010; Metacognitive emotion regulation: Children's awareness that changing thoughts and goals can alleviate negative emotions. Emotion. 10:498–510. DOI: 10.1037/a0018428 [PubMed: 20677867]

Eisbach AO. 2004; Children's developing awareness of diversity in people's trains of thought. Child Development. 75:1694–1707. DOI: 10.1111/j.1467-8624.2004.00810.x [PubMed: 15566373]

Flavell JH, Flavell ER, Green FL. 2001; Development of children's understanding of connections between thinking and feeling. Psychological Science. 12:430–432. DOI: 10.1111/1467-9280.00379 [PubMed: 11554679]

Flavell JH, Green FL, Flavell ER. 1995; Young children's knowledge about thinking. Monographs of the Society for Research in Child Development. 60:v-96.doi: 10.2307/1166124

German TP. 1999; Children's causal reasoning: Counterfactual thinking occurs for 'negative' outcomes only. Developmental Science. 2:442–457. DOI: 10.1111/1467-7687.00088

Glimcher PW. 2011; Understanding dopamine and reinforcement learning: The dopamine reward prediction error hypothesis. Proceeds of the National Academy of Sciences of the United States of America. 108:15647–15654. DOI: 10.1073/pnas.1014269108

Gnepp J. 1989; Personalized inferences of emotions and appraisals: Component processes and correlates. Developmental Psychology. 25:277–288. DOI: 10.1037/0012-149.25.2.277

Gnepp J, Klayman J, Trabasso T. 1982; A hierarchy of information sources for inferring emotional reactions. Journal of Experimental Child Psychology. 33:111–123. DOI: 10.1016/0022-0965(82)90009-1

Gnepp J, McKee E, Domanic JA. 1987; Children's use of situational information to infer emotion: Understanding emotionally equivocal situations. Developmental Psychology. 23:114–123. DOI: 10.1037/0012-1649.23.1.114

Golub SA, Gilbert DT, Wilson TD. 2009; Anticipating one's troubles: The costs and benefits of negative expectations. Emotion. 9:277–281. DOI: 10.1037/a0014716 [PubMed: 19348540]

Gross JJ. 1999; Emotion regulation: Past, present, future. Cognition and Emotion. 13:551–573. DOI: 10.1080/026999399379186

Halford GS, Andrews G, Dalton C, Boag C, Zielinski T. 2002; Young children's performance on the balance scale: The influence of relational complexity. Journal of Experimental Child Psychology. 81:417–445. DOI: 10.1006/jecp.2002.2665 [PubMed: 11890729]

Harris, PL, de Rosnay, M, Pons, F. Understanding emotion. In: Feldman Barret, L, Lewis, M, Haviland-Jones, J, editors. Handbook of emotions. 4. New York, NY: Guilford Press; 2010. 293–306.

Hughes C. 2016; Theory of mind grows up: Reflections on new research on theory of mind in middle childhood and adolescence. Journal of Experimental Child Psychology. 149:1–5. DOI: 10.1016/j.jecp.2016.01.017 [PubMed: 27255715]

Kahneman D, Tversky A. 1979; Prospect theory: An analysis of decision under risk. Econometrica. 47:263–292. DOI: 10.2307/1914185

Lagattuta KH. 2005; When you shouldn't do what you want to do: Young children's understanding of desires, rules, and emotions. Child Development. 76:713–733. DOI: 10.1111/j.1467-8624.2005.00873.x [PubMed: 15892788]

Lagattuta KH. 2007; Thinking about the future because of the past: Young children's knowledge about the causes of worry and preventative decisions. Child Development. 78:1492–1509. DOI: 10.1111/j.1467-8624.2007.01079.x [PubMed: 17883444]

Lagattuta KH. 2008; Young children's knowledge about the influences of thoughts on emotions in rule situations. Developmental Science. 11:809–818. DOI: 10.1111/j.1467-7687.2008.00727.x [PubMed: 19046149]

Lagattuta KH. 2014; Linking past, present, and future: Children's ability to connect mental states and emotions across time. Child Development Perspectives. 8:90–95. DOI: 10.1111/cdep.12065

Lagattuta KH, Elrod N, Kramer HJ. 2016; How do thoughts, emotions, and decisions align? A new way to examine theory of mind in middle childhood and beyond. Journal of Experimental Child Psychology. 149:116–133. DOI: 10.1016/j.jecp.2016.01.013 [PubMed: 27017060]

Lagattuta KH, Kramer HJ, Kennedy K, Hjortsvang K, Goldfarb D, Tashjian S. 2015; Beyond Sally's missing marble: Further development in children's understanding of mind and emotion in middle childhood. Advances in Child Development and Behavior. 48:1885–217. DOI: 10.1016/bs.acdb.2014.11.005

Lagattuta KH, Sayfan L. 2013; Not all past events are equal: Biased attention and emerging heuristics in children's past-to-future forecasting. Child Development. 84:2094–2111. DOI: 10.1111/cdev.12082 [PubMed: 23480128]

Lagattuta KH, Sayfan L, Blattman A. 2010; Forgetting common ground: Six- to seven-year-olds have an overinterpretive theory of mind. Developmental Psychology. 46:14717–1432. DOI: 10.1037/a0021062

Lagattuta KH, Sayfan L, Harvey C. 2014; Beliefs about thought probability: Evidence for persistent mindreading and links to executive control. Child Development. 85:659–674. DOI: 10.1111/cdev.12154 [PubMed: 24033285]

Lagattuta KH, Tashjian SM, Kramer HJ. Does the past shape anticipation for the future? Contributions of age and executive function to advanced theory of mind. To appear in Zeitschrift f€ur Psychologie: Special Issue on Theory of Mind Across the Lifespan.

Lagattuta KH, Wellman HM. 2001; Thinking about the past: Early knowledge about links between prior experience, thinking and emotion. Child Development. 72:82–102. DOI: 10.1111/1467-8624.00267 [PubMed: 11280491]

Lagattuta KH, Wellman HM. 2002; Differences in early parent-child conversations about negative versus positive emotions: Implications for the development of psychological understanding. Developmental Psychology. 38:564–580. DOI: 10.1037/0012-1649.38.4.564 [PubMed: 12090486]

Lagattuta KH, Wellman HM, Flavell JH. 1997; Preschoolers' understanding of the connections between thinking and feeling: Cognitive cuing and emotional change. Child Development. 68:1081–1104. DOI: 10.2307/1132293 [PubMed: 9418227]

Lalonde CE, Chandler MJ. 2002; Children's understanding of interpretation. New Ideas in Psychology. 20:163–198. DOI: 10.1016/S0732-118X(02)00007-7

Lockhart KL, Chang B, Story B. 2002; Young children's beliefs about stability of traits: Protective optimism? Child Development. 73:1408–1430. DOI: 10.1111/1467-8624.00480 [PubMed: 12361309]

Marini Z, Case R. 1989; Parallels in development of preschoolers' knowledge about their physical and social worlds. Merrill-Palmer Quarterly. 35:63–87.

Martin AJ, Marsh HW, Williamson A, Debus RL. 2003; Self-handicapping, defensive pessimism, and goal orientation: A qualitative study of university students. Journal of Educational Psychology. 95:617–628. DOI: 10.1037/0022-0663.95.3.617

Mellers BA, Schwartz A, Ho K, Ritov I. 1997; Decision affect theory: Emotional reactions to the outcomes of risky options. Psychological Science. 8:423–429. DOI: 10.1111/j.1467-9280.1997.tb00455.x

Miller PH, Aloise-Young PA. 2017; Revisiting young children's understanding of the psychological causes of behavior. Child Development. doi: 10.1111/cdev.12891

Miller, SA. Theory of mind: Beyond the preschool years. New York, NY: Psychology Press; 2012.

Nes LS, Segerstrom SC. 2006; Dispositional optimism and coping: A meta-analytic review. Personality and Social Personality Review. 10:235–251. DOI: 10.1207/s15327957pspr1003_3

Nolen-Hoeksema S. 2001; Gender differences in depression. Current Directions in Psychological Science. 10:173–176. DOI: 10.1111/1467-8721.00142

Norem JK, Chang EC. 2002; The positive psychology of negative thinking. Journal of Clinical Psychology. 58:993–1001. DOI: 10.1002/jclp.10094 [PubMed: 12209860]

O'Connor E, McCormack T, Feeney A. 2014; Do children who experience regret make better decisions? A developmental study of the behavioral consequences of regret. Child Development. 85:1995–2010. DOI: 10.1111/cdev.12253 [PubMed: 24773388]

Osterhaus C, Koerber S, Sodian B. 2016; Scaling of advanced theory-of-mind tasks. Child Development. 87:1971–1991. DOI: 10.1111/cdev.12566 [PubMed: 27338116]

Payir A, Guttentag R. 2016; "It could have been worse": Developmental change in the use of counterfactual consoling strategy. Journal of Experimental Child Psychology. 148:119–130. DOI: 10.1016/j.jecp.2016.04.001 [PubMed: 27156177]

Piaget, J. The moral judgment of the child. Vol. 30. London: Free Press; 1932/1965. 879–889. Review

Roese NJ. 1997; Counterfactual thinking. Psychological Bulletin. 121:133–148. DOI: 10.1037/0033-2909.121.1.133 [PubMed: 9000895]

Sayfan L, Lagattuta KH. 2008; Grownups are not afraid of the scary stuff, but kids are: Young children's and adults' reasoning about children's, infants, and Adults' Fears. Child Development. 79:821–835. DOI: 10.1111/j.1467-8624.2008.01161.x [PubMed: 18717892]

Sayfan L, Lagattuta KH. 2009; Scaring the monster away: What children know about managing fears of real and imaginary creatures. Child Development. 80:1756–1774. DOI: 10.1111/j.1467-8624.2009.01366.x [PubMed: 19930350]

Schult CA. 2002; Children's understanding of the distinction between intentions and desires. Child Development. 73:1727–1747. DOI: 10.1111/1467-8624.t01-1-00502 [PubMed: 12487490]

Schultz W. 1998; Predictive reward signal of dopamine neurons. Journal of Neurophysiology. 80:1–27. [PubMed: 9658025]

Seligman, MEP. The optimistic child: A proven program to safeguard children against depression and build lifelong resilience. New York: Houghton Mifflin Company; 2007.

Shepperd JA, McNulty JK. 2002; The affective consequences of expected and unexpected outcomes. Psychological Science. 13:85–88. DOI: 10.1111/1467-9280.00416 [PubMed: 11892785]

Shepperd JA, Sweeny K, Cherry LC. 2007; Influencing audience satisfaction by manipulating expectations. Social Influence. 2:98–111. DOI: 10.1080/155345106010957

Suddendorf T, Corballis MC. 2007; The evolution of foresight: What is mental time travel, and is it unique to humans? Behavioral and Brain Sciences. 30:299–351. DOI: 10.1017/S0140525X07001975 [PubMed: 17963565]

Sweeny K, Carroll PJ, Shepperd JA. 2006; Is optimism always best? Future outlooks and preparedness. Current Directions in Psychological Science. 15:302–306. DOI: 10.1111/j.1467-8721.2006.00457.x

Sweeny K, Falkenstein A. 2016; Even optimists get the blues: Interindividual consistency in the tendency to brace for the worst. Journal of Personality. doi: 10.1111/jopy.12289

Sweeny K, Reynolds CA, Falkenstein A, Andrews SE, Dooley MD. 2016; Two definitions of waiting well. Emotion. 16:129–143. DOI: 10.1037/emo0000117 [PubMed: 26461244]

Sweeny K, Shepperd JA. 2010; The costs of optimism and the benefits of pessimism. Emotion. 10:750–753. DOI: 10.1037/a0019016 [PubMed: 21038961]

Weller D, Lagattuta KH. 2013; Helping the in-group feels better: Children's judgments and emotion attribution in response to prosocial dilemmas. Child Development. 84:253–268. DOI: 10.1111/j.1467-8624.2012.01837.x [PubMed: 22935167]

Weller D, Lagattuta KH. 2014; Children's judgments about prosocial decisions and emotions: Gender of the helper and recipient matters. Child Development. 85:2011–2028. DOI: 10.1111/cdev.12238 [PubMed: 24611809]

Wellman, HM. Making minds: How theory of mind develops. New York, NY: Oxford University Press; 2014.

Wellman HM, Hollander M, Schult CA. 1996; Young children's understanding of thought bubbles and thoughts. 67:768–788. DOI: 10.2307/1131860

Westermann R, Spies K, Stahl G, Hesse FW. 1996; Relative effectiveness and validity of mood induction procedures: A meta-analysis. European Journal of Social Psychology. 26:557–580. DOI: 10.1002/(SICI)1099-0992(199607)26:4

Wilson TD, Gilbert DT. 2003; Affective forecasting. Advance in Experimental Social Psychology. 35:345–411. DOI: 10.1016/S0065-2601(03)01006-2

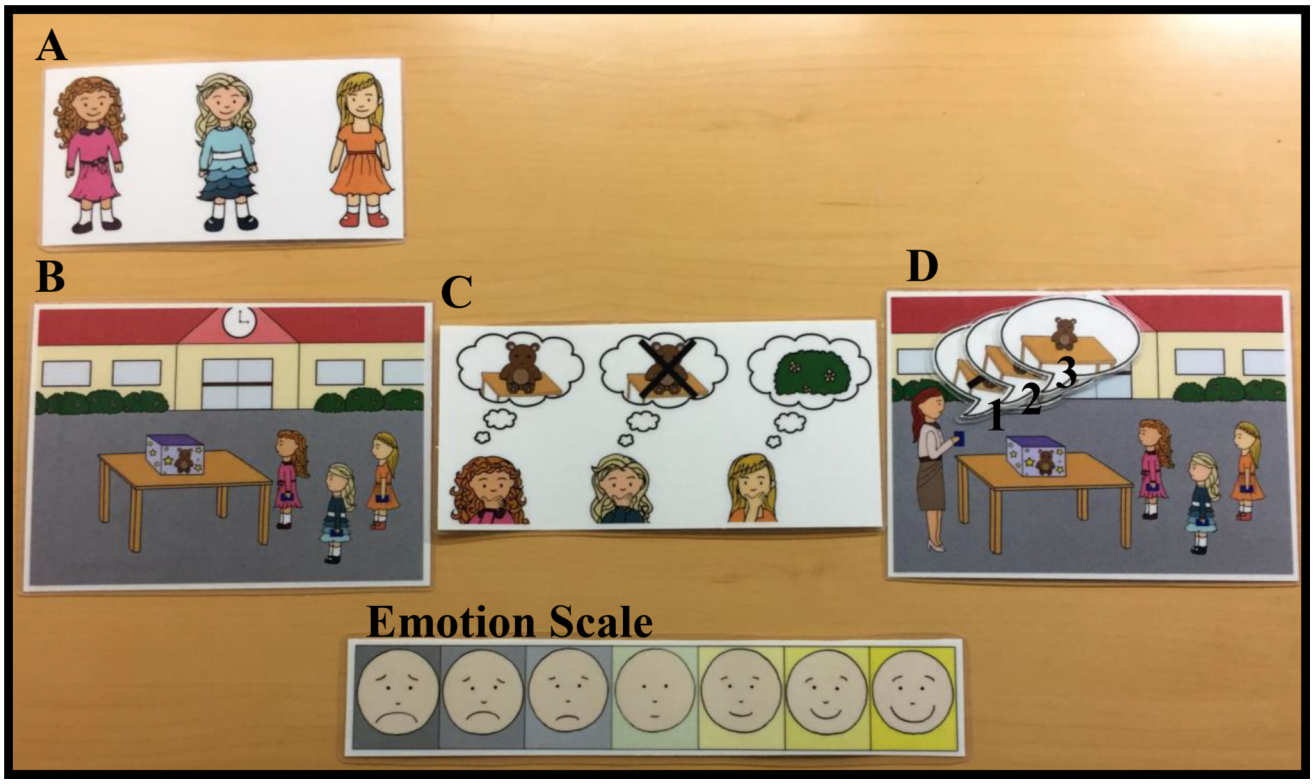


**Figure 1.**
Example scenario and script.

**(Experimenter places A):** I'm going to tell you a story about these three kids.

**(Experimenter places B):** One morning, these three kids get a blue raffle ticket from their school event. Children with the winning color ticket will get a big teddy bear. All of them know that sometimes children win big prizes in raffles and sometimes they win nothing at all. These kids all really want the big teddy bear (*ask control question*; see Method).

**(Experimenter places C):** This one thinks, "I'm sure I will win the big teddy bear" (*ask pre-outcome emotion question using* ***Emotion Scale***; see Method). This one thinks, "I'm sure I will NOT win the big teddy bear." See, the big teddy bear is crossed out. She thinks she will not win (*ask same pre-outcome emotion question*). This one thinks, "I will just think about those flowers right now" (*ask same pre-outcome emotion question*). Let's see what happens next. Remember, all of these kids really want the big teddy bear.

(**Experimenter places D**; order of **D1** to **D3** counter-balanced). (**D1**): Later that day, the teacher says, "Only red tickets win BIG teddy bears, and blue tickets win nothing at all." So, these three kids get nothing at all (*ask about how each character feels in predetermined order, ask for explanations, ask best/worst prompt, ask surprise question*; see Method). (**D2**): Now let's imagine that instead, the teacher says, "All children with blue tickets win BIG teddy bears." So these three kids get big teddy bears (*same questioning as* ***D1***). Now let's imagine one more thing. (**D3**): Let's imagine the teacher says, "Only red tickets win BIG teddy bears, and blue tickets get SMALL ones." So, these three kids get small teddy bears (*same questioning as* ***D1***).

*Note*. The **Emotion Scale** was under **(B)** when predicting pre-outcome emotions and under **(D)** when judging post-outcome emotions. While narrating the stories, experimenters also directly pointed to key features of each current scene to aid in comprehension.

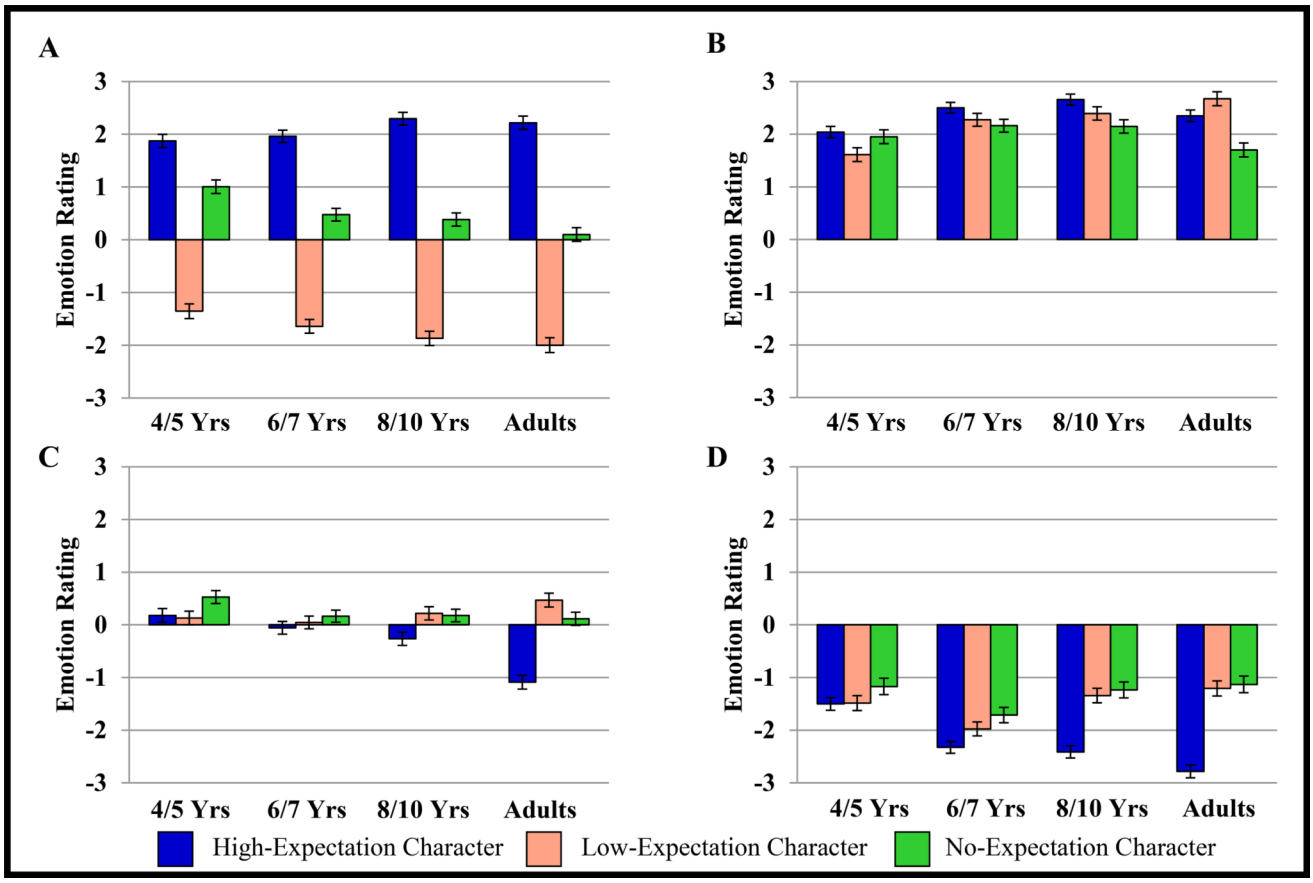


**Figure 2.**

Average Emotion Rating by Age, Outcome, and Character. Error bars represent standard errors. Yrs = years. A = Pre-Outcome, B = Positive Outcome, C = Attenuated Outcome, D = Negative Outcome. *Emotion Rating* represents participants' emotion judgments from very bad (−3) to very good (+3). *Pre-Outcome*, children and adults appreciated the power of thoughts (e.g., thinking positively feels good, thinking negatively feels bad). After *Positive Outcomes*, adults rated low expectations as feeling better than high expectations, children showed the reverse pattern. After *Attenuated Outcomes*, 8- to 10-year-olds and adults judged that high expectations felt worse than low expectations, but 4- to 7-year-olds did not differentiate them. After *Negative Outcomes*, even 6- to 7-year-olds rated high expectations as feeling as worse than low expectations.

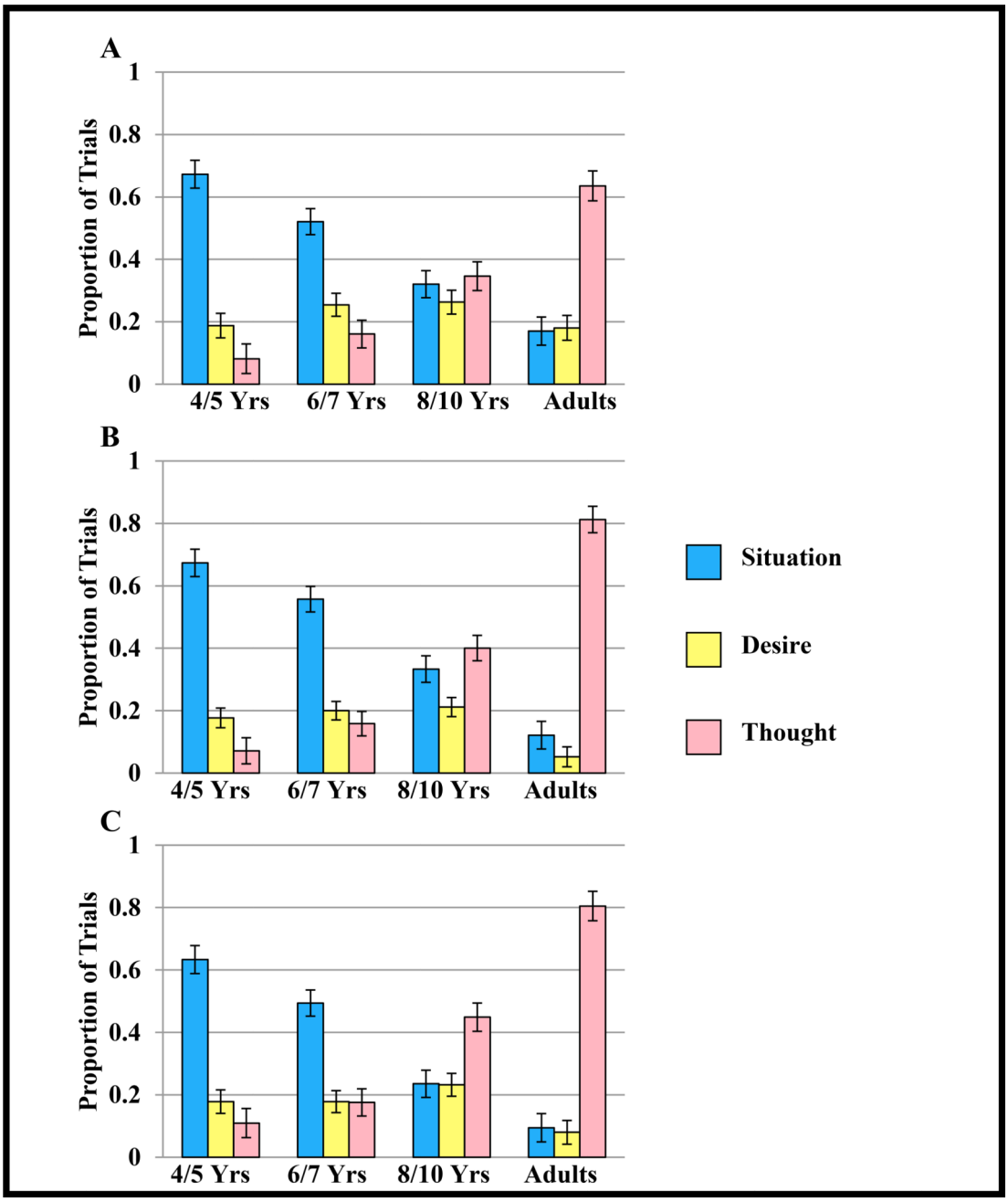


**Figure 3.**

Explanations by Age, Outcome, and Explanation Type. Error bars represent standard errors. Yrs = years. A = Positive Outcome, B = Attenuated Outcome, C = Negative Outcome. Situation = explanation references the current situation but not characters' desire(s) or thought(s); Desire = explanation references characters' desire(s) but not prior thought(s); Thought = explanation references prior expectation(s). There was an age-related decrease in referencing only the *situation* and an age-related increase in referring to prior *thought*.

References to *desire* were stable within childhood, but dropped between childhood and adulthood following the attenuated and negative outcomes.

## Table 1

Example Explanations by Age and Explanation Type

| | 4/5 Yrs | 6/7 Yrs | 8/10 Yrs | Adults |
|---|---|---|---|---|
| Situation | (Attenuated Outcome) "Because **they have to wait a little time**." | (Negative Outcome) "Because **they got so much homework**, because normally when I get so much homework I'm like, 'Come on!'" | (Positive Outcome) "Because **they won it**!" | (Attenuated Outcome) "Because **at least they have a cookie, they have something**." |
| Desires | (Negative Outcome) "Cause they **wanted** the snowman to stay." | (Positive Outcome) "Because they all **wanted** the big teddy bear." | (Attenuated Outcome) "Because they **didn't want** a lot of homework, but a little is better than a lot." | (Positive Outcome) "Uh because they all **wanted** it [the chalk drawings] to stay there." |
| Thoughts | (Positive Outcome) "Um cause this one **thought they [the chalk drawings] were going to fade** but this one **thought they were going to stay** and they did, and this one was **just thinking of the bird**." | (Attenuated Outcome) "He **thought it [the snowman] wouldn't melt to the ground** and it didn't, and that guy feels that way because he **thought it would totally melt** and he's kind of happy because it melted a little bit, and that guy is super happy because he **didn't even think about it**." | (Negative Outcome) "He feels a little bad because he **was pretty sure it [the snowman] was going to melt and he was right**, and that guy he feels okay because **he wasn't really thinking about it**, and he felt medium bad because **he thought it would stay completely** and he's kinda sad about that." | (Negative Outcome) "Umm he was **expecting to have his favorite dessert** but ended up not getting it, the second one was **already set up for disappointment** so the situation turned out okay for him, for the third one I guess it turned out okay because he **wasn't even thinking about dessert**." |

*Note*. Yrs = years.

**Table 2**

Means (and Standard Deviations) for Emotion Ratings by Age, Outcome, and Character.

| | 4/5 Yrs | | | |
|---|---|---|---|---|
| | Pre-Outcome | Positive Outcome | Attenuated Outcome | Negative Outcome |
| High-Expectation Character | 1.87 (1.13) | 2.04 (1.14) | 0.18 (1.17) | −1.50 (1.33) |
| Low-Expectation Character | −1.35 (1.14) | 1.61 (1.43) | 0.13 (1.19) | −1.49 (1.08) |
| No-Expectation Character | 1.01 (1.20) | 1.95 (1.11) | 0.53 (1.25) | −1.17 (1.42) |
| | 6/7 Yrs | | | |
| | Pre-Outcome | Positive Outcome | Attenuated Outcome | Negative Outcome |
| High-Expectation Character | 1.96 (0.90) | 2.50 (0.59) | −0.06 (0.89) | −2.33 (0.68) |
| Low-Expectation Character | −1.64 (1.04) | 2.27 (0.77) | 0.04 (0.90) | −1.98 (0.84) |
| No-Expectation Character | 0.48 (1.01) | 2.16 (0.85) | 0.16 (0.90) | −1.71 (0.97) |
| | 8/10 Yrs | | | |
| | Pre-Outcome | Positive Outcome | Attenuated Outcome | Negative Outcome |
| High-Expectation Character | 2.29 (0.71) | 2.66 (0.51) | −0.27 (0.73) | −2.41 (0.69) |
| Low-Expectation Character | −1.87 (0.98) | 2.39 (0.68) | 0.22 (0.75) | −1.34 (1.22) |
| No-Expectation Character | 0.38 (0.81) | 2.15 (0.85) | 0.18 (0.61) | −1.24 (1.11) |
| | Adults | | | |
| | Pre-Outcome | Positive Outcome | Attenuated Outcome | Negative Outcome |
| High-Expectation Character | 2.22 (0.69) | 2.35 (0.65) | −1.09 (0.76) | −2.78 (0.38) |
| Low-Expectation Character | −2.00 (0.65) | 2.67 (0.55) | 0.47 (0.73) | −1.21 (0.77) |
| No-Expectation Character | 0.10 (0.26) | 1.70 (0.85) | 0.11 (0.48) | −1.13 (0.76) |

*Note*. Yrs = years.