Thinking About the Future Because of the Past: Young Children’s Knowledge About the Causes of Worry and Preventative Decisions

Kristin Hansen Lagattuta
University of California, Davis

Two studies investigated 3- to 6-year-olds’ and adults’ (N = 128) knowledge about emotions and behaviors caused by thinking about the future because of the past. Participants listened to stories featuring characters that experienced negative events, and then, many days later, felt worried or changed their behaviors upon seeing an entity associated with the prior harm. Results revealed a significant increase between 3 and 5 years in the frequency that participants explained characters’ reactions as caused by anticipating the reoccurrence of a negative past event. Across age, females more often marked future events as uncertain, as well as predicted that people in ambiguous risk situations would feel worried due to past-to-future connections.

What the future holds is uncertain, but somewhat foreseeable. That is, our thoughts and expectations about what might happen in the future are often critically informed by our past experiences (Karniol & Ross, 1996; Morewedge, Gilbert, & Wilson, 2005; Stein & Levine, 1989). Knowledge about the past can take the form of familiar routines or scripts, as well as memories for novel, person-specific life events. In situations of potential threat, the mental act of imagining future “what ifs” is often accompanied by feelings of worry as well as plans for preventative action. For example, if a person stole from you in the past, then seeing that person on a later occasion will likely cue memories about the past (He stole from me!), as well as thoughts about the future (What will he do this time?). Mentally connecting the past to the future can have emotional and behavioral consequences. That is, you might feel worried (What if he steals again?) and you may take some preventative action (e.g., hide your valuables).

The two studies reported here examine 3- to 6-year-olds’ ability to explain people’s current emotions and behaviors as caused by thinking a negative event will or might occur in the future because a similar incident happened in the past. In doing so, this research addresses the development of a fundamental aspect of adult social cognition—sometimes referred to as mental time travel (see Suddendorf & Busby, 2005). That is, as adults, we understand that what has happened to a person in the past strongly influences his or her interpretations of current events as well as anticipations for the future. Indeed, the “glue” or “thread” that binds the past, present, and future together for an individual is that person’s thoughts: individuated mentalizing about the present and the future grounded in recollections of the past. Children’s achievement of this crucial perspective—seeing people as individuated, mental selves extended through time—draws from development in several areas of cognition: young children’s knowledge about mental causes of emotions and behaviors, their knowledge about the future and of connections between the past and the future, and their understanding about counterfactual or hypothetical events.

Previous research on children’s knowledge about thinking about the past provides a foundation for developing hypotheses about when young children may be able to assemble information about a person’s mind and life history to make sense of his or her current emotions and behaviors. In a series of studies, Lagattuta, Wellman, and Flavell (1997) examined preschoolers’ understanding that sadness can be caused by being reminded about a past experience. They presented 3- to 6-year-olds with scenarios featuring characters that experienced a negative event in the past, and who many days later, felt sad after...
encountering a cue to that past sad event. Children were asked to explain the cause of the characters’ current sadness. Results showed a significant increase between 3 to 6 years of age in the frequency that children provided cognitive cuing explanations across trials. Remarkably, however, even a sizable number of 3-year-olds (39%) could explain for at least one story trial that the person felt sad because he or she had been reminded about a past event. Additional studies by Lagattuta and Wellman (2001) revealed that children’s ability to explain people’s current reactions as caused by thinking about the past is stronger in situations involving negative emotions as opposed to positive emotions or behaviors.

The current studies extend this prior research by assessing children’s knowledge that a person’s memories of the past not only push forward into the present, but they also significantly shape how he or she thinks about, emotionally reacts to, and behaves in response to an anticipated, future state of affairs. Several lines of research give reason to believe that children develop insights about such past-to-future connections during the preschool years. Analyses of parent–child conversations reveal that parents and young children talk about upcoming events starting around age 2 (Adamson & Bakeman, 2006), and that parents frequently make direct references to previous experiences when discussing future plans with their preschool-aged children (Hudson, 2004). Between the ages of 3 and 5 children become more skilled at applying knowledge gained through past experiences to plan for future events (Hudson, Shapiro, & Sosa, 1995), they become more cognizant about how to prepare for future occurrences (Atance & O’Neill, 2005), and they can more reliably report episodic events from their personal past and future (Busby & Suddendorf, 2005). Moreover, during the preschool years, children develop a “temporally extended” sense of self in that they begin to view their current self in relation to the past and the future (see Lemmon & Moore, 2001; Povinelli & Simon, 1998).

Finally, research on children’s reasoning about hypothetical and counterfactual events also provides clues as to whether or not young children may be knowledgeable about how thoughts about the future may elicit changes in emotion or behavior. That is, what is intriguing about future events is that they are, in essence, non-events—they have not and might not ever transpire; they are uncertain. The majority of studies on counterfactual thinking, or thinking about what could be or could have been, have focused on children’s knowledge of the hypothetical past—thinking about events that could have turned out differently. For example, as reviewed by Harris (2000), children as young as 3 years can imagine how an event would have turned out differently had a different antecedent event occurred. Robinson and Beck (2000) argue that reasoning about the hypothetical future may be easier than the hypothetical past because the child does not have to imagine a world contrary to reality; they just have to imagine what could happen next. Indeed, between the ages of 3 and 5, young children evidence knowledge about the uncertainty of the future by increasingly marking future-oriented speech with modals indicating possibility or probability such as would, could, may, or might (Atance & O’Neill, 2001; Bliss, 1988; O’Neill & Atance, 2000).

To summarize, then, the two studies presented here examine an unexplored area of children’s understanding of person, mind, and emotion: 3- to 6-year-olds’ ability to integrate a person’s life history and mind to explain his or her current emotion or behavior as caused by thinking about the future because of the past. Worry was chosen as the target emotion for the scenarios because it is a prospect-based emotion elicited by negative thoughts about possible future occurrences that are often connected to past experience (Muris, Merckelbach, Gadet, & Moulard, 2000; Silverman, La Greca, & Wasserstein, 1995). As well, most young children experience several worries (Ollendick, King, & Frary, 1989; Weems, Silverman & La Greca, 2000). Thus, worry provides an ideal context for measuring children’s understanding about past-to-future connections because of its presumed source (i.e., thinking about negative future possibilities) and its prevalence in children’s everyday experiences. Moreover, because previous research has not systematically explored children’s causal explanations for worry, the current data are also revealing of early knowledge about worry-eliciting thoughts and situations.

Research methodology used by Lagattuta and colleagues to measure young children’s knowledge about emotions and behaviors elicited by thinking about the past (Lagattuta & Wellman, 2001; Lagattuta et al., 1997) provide the core model for the structure of the story vignettes and questioning procedures. In addition to examining whether children provide past-to-future explanations for emotions and behaviors, we also assessed explanations for references to past, present, and future events to examine developmental changes in children’s use of different time frames to interpret people’s current reactions. Because of interest in children’s understanding of the uncertainty of the future, we also evaluated all future-oriented explanations for whether they marked future events as being definite (this will happen) versus hypothetical or uncertain (this might happen). We hypothesized
that there would be significant developmental changes between 3 and 6 years in children’s ability to explain people’s emotions and decisions as caused by thinking a previous negative event would reoccur in the future. Adults participated in these studies to verify that adults would view worry and action decisions in these situations as elicited by past-to-future thinking, as well as to compare adult reasoning to that of young children.

Study 1

Method

Participants

Sixty-four children and adults from four different age groups participated: sixteen 4-year-olds (range [years;months] = 4;0 to 4;11, M = 4;6), sixteen 5-year-olds (range = 5;0 to 5;10, M = 5;4), sixteen 6- to 7-year-olds (range = 6;3 to 7;11, M = 6;11), and 16 adults (range = 18;6 to 23;6, M = 19;9). We will refer to the 6- to 7-year-old age group as 6-year-olds because the mean age fell within the 6-year-old age range. All age groups were comprised of equal numbers of males and females except for the 4-year-old group, which contained 9 boys and 7 girls. Children were recruited from several preschools and grammar schools serving ethnically diverse populations of largely middle-class families (67% Caucasian, 19% Asian-American, 13% other ethnicities). Adults were college undergraduates (50% Caucasian, 38% Asian-American, 13% other ethnicities).

Materials and Procedures

Participants were presented with six stories that each featured a character that experiences a sad event in the past and then, many days later, reencounters the same entity that caused the prior negative experience. All stories consisted of colorful illustrations on 5-in. × 5-in. cards. A variety of different negative events were included to assess knowledge in multiple contexts: Two stories featured mishaps with an animal (dog chases away pet rabbit, goat knocks over child), two with an object (car breaks bicycle, popped ball ruins friendship), and two with a person (boy steals toy, girl makes child fall off monkey bars). Figure 1 shows the illustrations for “David’s Story.” Here, David’s favorite teddy bear is stolen by a red-haired boy. Many days later, when David and his friend Henry are outside playing with their toy cars, David sees the red-haired boy. Note that the picture of the perpetrator was drawn so he, she, or it looked exactly like the entity from the past. Moreover, the definite article the (as opposed to the generic a) was used to further indicate that the past and present entities were identical (e.g., “David sees the red haired boy”).

As shown in Figure 1, each story had two possible endings: an emotion ending and a behavior ending. For the emotion ending, the character starts to feel worried (e.g., “David sees the red-haired boy. David starts to feel worried.”), whereas for the behavior ending the character engages in an action after witnessing the entity from the past event (e.g., “David sees the red-haired boy. David quickly hides his cars behind the tree.”). For both types of story endings, the target character’s friend was always shown from the back when the entity from the past event appeared so that no emotional response could be discerned. Moreover, for the behavior ending trials, the protagonist’s face was drawn from the side so that no emotion could be discerned. (See the Appendix for complete wording of the “David” story.)

Questioning procedures were modeled after those used by Lagattuta and colleagues (Lagattuta & Wellman, 2001; Lagattuta et al., 1997). Specifically, at the conclusion of the primary negative incident (e.g., David’s teddy bear is stolen) the experimenter asked the control question: “Why is [David] sad?” to ensure that the participant understood the initial story event. After the final scene, the experimenter asked the test question: “Why does [David] start to feel worried?” (for emotion endings) or, “Why does [David hide his cars]?” (for behavior endings). The supplemental test question, the source of future thought question: “Why does [David] think that [future event] will/might happen?” was also asked if that participant explained that the character was thinking that an event might or will occur in the future but he or she did not provide a reason for the thought.

If participants explained a character’s emotion or behavior as caused by a future event but they did not make explicit reference to the character’s mental state (e.g., “He’s worried because the boy might take his cars” instead of “Because David thinks the boy might take his cars”), then they were asked the thinking prompt: “Is [David] thinking the [future incident] might/will happen?” This prompt was used to assess whether participants believed the character was thinking about the proposed future event. Thus, the thinking prompt was contingent upon the participant first spontaneously explaining the character’s worry or behavior as caused by something that will or might happen next. If participants answered “yes” to the thinking prompt, but they did not spontaneously describe the source of the thought, then they were
also asked the open-ended source of thought question (as above). Responses requiring the thinking prompt were coded as prompted (see Coding) and treated separately for some analyses.

To help participants clarify and expand their explanations, the experimenter paraphrased their responses and encouraged them to provide additional information. When it was clear that the participant...
had no further explanations, the experimenter proceeded to the next story trial. Critically, at no time did the experimenter make reference to the past or to the future unless the participant suggested events from these time frames first.

After explaining the focal character’s emotion or behavior, the experimenter asked the naive friend’s reaction question: “What about [Henry]. He also sees [the red-haired boy]. Do you think [Henry] feels worried or okay?” (for emotion endings) or, “Do you think [he’ll quickly hide his cars too, or just keep playing]?” (for behavior endings). The order of these forced-choice alternatives was counterbalanced across trials so that if participants had a response bias to pick either the first or second alternative they would perform at chance.

All participants were interviewed individually in a quiet room by a female experimenter. During the testing procedure, children and adults listened to three emotion ending and three behavior ending stories as the experimenter attached the picture cards on an upright board. Half of the participants in each age group received a block of three emotion ending trials first followed by a block of three behavior ending trials, with the other half of participants receiving the opposite order. Each particular story × ending type appeared equally (eight times) across each age group. Sixteen unique combinations incorporating these conditions were created, with one version randomly assigned to each participant in each age group. Interviews were tape-recorded and transcribed verbatim. The procedure lasted 15-20 min.

**Coding of Explanations**

Central analyses focus on whether participants explained the characters’ current reactions as caused by thinking about the future because of the past. To be counted as a past-to-future explanation (PTF explanations) the participant had to (a) explain that the emotion or behavior was elicited by a future negative event, (b) state (spontaneously or in response to the thinking prompt) that the person was thinking about this future event, and (c) connect the source of the future-oriented thought to the past experience. Thus, PTF explanations connect together a future-oriented thought with a past event, as in, “Because he thinks the boy might steal his cars because he took his teddy bear last time.”

All PTF explanations were further categorized as (1) hypothetical versus definite and (2) unprompted versus prompted. Hypothetical PTF explanations were those in which the participant marked the future as hypothetical or uncertain using a modal auxiliary or adjunct such as might, possibly, probably, may, maybe, or could. In contrast, definite PTF explanations referred to the future as certain—something that is going to or will happen. PTF explanations were coded as unprompted if the participant used mental language in reference to the future without the use of the thinking prompt (see Methods), as in, “Because he thinks the boy will take his toy, because he did it before with his bear.” An example of a prompted PTF explanation is: P: “(David feels worried) because the boy might steal his cars.” Exp: “Is he thinking the boy might steal his cars?” P: “Yes, ’cause he took that bear before.” Thus, prompted PTF explanations were only prompted in the sense that participant agreed, in response to the thinking prompt, that the character was thinking about the participant-suggested future episode. The participant provided both the future episode and source of the thoughts in response to open-ended questions.

In addition to the focal category of past-to-future explanations, we also assessed the general time frame (or time frames) that children and adults referenced in their explanations. More specifically, present event explanations referred to something in the current event as the cause of the character’s emotional or behavioral reaction (e.g., “Because he’s eating a cookie.”). Past event explanations indicated that the character felt worried or engaged in an action because of a past experience (e.g., “Because the rabbit ran away before.”). Future event explanations stated that the person’s worry or behavior was elicited by a future event (e.g., “Because the car is going to crash into his scooter.”). Future event explanations in which the participant explained the character’s reaction as caused by thinking about the future were marked as the subtype, future-oriented thought explanations (e.g., “Because she thinks the ball is going to pop.”). Future-oriented thought explanations were categorized as either prompted or unprompted, using the criteria provided above for PTF explanations. Thus, the only difference between future-oriented thought explanations and past-to-future explanations is whether or not the participant connected the source of the future thinking to the past event.

The coding scheme and questioning procedures allowed participants to provide multiple explanations for each story trial. As well, the coding scheme was hierarchical in that past-to-future explanations were also coded into the broader categories of past event and future event explanations because these explanations make reference to both these time periods.

Two undergraduate research assistants were trained how to code explanations by the primary
investigator. For this training, 25% of transcripts were collaboratively analyzed. The two research assistants then independently coded the remaining 75% of transcripts. The pooled kappa values were high for all categories: .98 for explanation type, .93 for use of hypothetical tense, and .99 for coding past-to-future and future-oriented thought explanations as prompted versus unprompted. All discrepancies were resolved by discussion.

Results

Primary analyses focus on children’s and adults’ explanations for why the focal character started to feel worried or engaged in a new behavior. Additional analyses then examine participants’ predictions and explanations for how the naive friend would feel or act in the same situation. Because preliminary analyses revealed no effect for story episode (e.g., human vs. animal perpetrator) or order (behavior trials first vs. emotion trials first), these factors were not considered further. All participants correctly answered the control questions.

Preliminary analyses further confirmed that neither prompted nor unprompted past-to-future explanations significantly increased across story trials. Thus, there was no indication that the inclusion of the thinking prompt changed how participants responded to subsequent trials. Moreover, analyses on just unprompted PTF scores yielded the same trends and differences as those for total (prompted and unprompted) PTF explanations. Therefore, primary analyses were conducted on the larger data set of prompted and unprompted PTF explanations combined.

Except when otherwise noted, data were analyzed using repeated measures analysis of variance (ANOVA), with the significance level set at \( p < .05 \). Significant main effects were followed up with Tukey’s honestly significant difference (HSD) tests to evaluate pairwise comparisons, with only significant pairwise comparisons among means reported. Simple effects tests were used to examine significant interactions. Partial eta squares, computed using SPSS, are provided as a measure of effect size for all significant main effects and interactions. For ease of interpretation, all mean scores were converted to percentage of trials for the data tables.

Past-to-Future (PTF) Explanations

Centrally, we examine children’s and adults’ provision of PTF explanations: explanations that describe the focal character’s emotions or behaviors as caused by thinking about the future because of the past (e.g., “Because he’s thinking the car is going to crash his scooter . . . ‘cause it broke his bike.”). The high majority of participants from every age group provided one or more PTF explanations, with no difference by age: 88% of 4-year-olds and 100% of 5- and 6-year-olds and adults, \( \chi^2(3, N = 64) = 6.19, p = .10 \).

To analyze the frequency of PTF explanations across story trials, participants were given a score from 0 to 3 for the number of behavior ending trials and a score from 0 to 3 for the number of emotion ending trials for which they provided PTF explanations. The top half of Table 1 shows these data with scores converted to percentage of trials. A 4 (age: 4, 5, 6, adult) × 2 (gender) × 2 (character response type: behavior vs. emotion) repeated measures ANOVA for PTF explanation score resulted in a main effect for age, \( F(3, 56) = 7.31, p < .001, \eta_p^2 = .28 \). Although all age groups offered PTF explanations for the majority of trials (Ms > 70% of trials), 4-year-olds provided such explanations significantly less often than all other age groups, \( ps < .05 \). There was no difference by character response type or participant gender. Descriptively, 50% of 4-year-olds’, 62% of 5-year-olds’, 67% of 6-year-olds’, and 74% of adults’ PTF explanations were unprompted in that they spontaneously used mental language in reference to the future event without the thinking prompt.

Next, we considered hypothetical past-to-future explanations. As described in the Introduction, hypothetical PTF explanations are particularly compelling

<table>
<thead>
<tr>
<th>Category of analysis</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totala</td>
<td>70(63m/76f)</td>
<td>90(93m/85f)</td>
<td>99(98m/100f)</td>
<td>99(98m/100f)</td>
</tr>
<tr>
<td>Worryb</td>
<td>67(15m/42f)</td>
<td>92(13m/46f)</td>
<td>100(42m/45f)</td>
<td>98(37m/40f)</td>
</tr>
<tr>
<td>Behaviorb</td>
<td>73(15m/42f)</td>
<td>88(13m/46f)</td>
<td>98(42m/45f)</td>
<td>100(37m/40f)</td>
</tr>
<tr>
<td>Hypothetical past-to-future explanations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totalb</td>
<td>28(15m/42f)</td>
<td>29(13m/46f)</td>
<td>43(37m/40f)</td>
<td>39(37m/40f)</td>
</tr>
<tr>
<td>Worryb</td>
<td>39(15m/42f)</td>
<td>33(13m/46f)</td>
<td>50(37m/40f)</td>
<td>43(37m/40f)</td>
</tr>
<tr>
<td>Behaviorb</td>
<td>16(15m/42f)</td>
<td>25(13m/46f)</td>
<td>37(37m/40f)</td>
<td>33(37m/40f)</td>
</tr>
</tbody>
</table>

*pPercentage of trials out of 96 per age group. Percentages of trials for male “m” and female “f” participants are shown in parentheses. 

**Percentage of trials out of 48 per age group.**
because they reveal understanding that people’s emotions or behaviors can be influenced by thinking that a negative experience from the past could or might reoccur—a possibility versus a definite event. The majority of participants from every age group provided one or more hypothetical PTF explanations, with no difference by age: 63% of 4- and 5-year-olds, 75% of 6-year-olds, and 88% of adults, $\chi^2(3, N = 64) = 3.40, p = .33$.

The bottom of Table 1 shows data on the percentage of trials for which participants provided hypothetical PTF explanations. A 4 (age) $\times$ 2 (gender) $\times$ 2 (character response type) repeated measures ANOVA for hypothetical PTF explanation scores revealed a main effect for character response type, $F(1, 56) = 7.87, p < .01, \eta_p^2 = .12$, and for gender, $F(1, 56) = 3.89, p < .05, \eta_p^2 = .10$. All age groups used hypothetical PTF explanations more frequently when explaining worry versus behaviors (Ms = 42% vs. 28% of trials). Moreover, females provided more frequent hypothetical PTF explanations than males (Ms = 42% vs. 27% of trials).

### Future, Past, and Present Explanations

Table 2 shows the findings for the broader categories of future, past, and present event explanations for the focal characters. These data are the number of story trials (0-6) for which participants provided an explanation that referred to each specific time frame, regardless of whether the explanation also included references to multiple time frames (including providing a full PTF explanation). Thus, percentages for each age group can total over 100%. Preliminary analyses revealed no significant main effects or interactions for character response type so this factor was not considered further.

A 4 (age) $\times$ 2 (gender) MANOVA for future event, past event, and present event explanation scores resulted in a main effect for age, $F(9, 168) = 2.16, p < .05, \eta_p^2 = .10$. When the results for the dependent variables were considered separately, age emerged as a significant main effect for all three, $ps < .01$, all $\eta_p^2 > .21$. Four-year-olds provided significantly fewer future and past event explanations and significantly more present event explanations than all other age groups, $p < .05$. Although not shown in Table 2, it was rare for any age group to exclusively refer to the present when explaining the characters’ current reaction (Ms = 7%, 2%, 1%, and 0% of 4-, 5-, and 6-year-olds and adults’ trials, respectively). Also notable, 96% of 4-year-olds’, 100% of 5-year-olds’, and 100% of adults’ future event explanations stated that the character was thinking about the future event; with

<table>
<thead>
<tr>
<th>Type of explanation</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future event$^a$</td>
<td>86</td>
<td>95</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Past event$^a$</td>
<td>76</td>
<td>95</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Present event$^a$</td>
<td>44</td>
<td>21</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

$^a$Percentage of trials out of 96 per age group.

49%, 62%, 66%, and 75% of 4-, 5- and 6-year-olds’ and adults’ future-oriented thought explanations (respectively) provided without the aid of the thinking prompt.

### Naïve Friend Predictions and Explanations

After explaining the cause of the focal character’s emotion or behavior, children and adults predicted and explained how the focal character’s friend, a person who did not share the same past experience, would feel or act (see Methods). Preliminary analyses revealed no effect for gender, so this factor was not considered further.

A 4 (age) $\times$ 2 (character response type) repeated measures ANOVA for total number of trials that participants “predicted a different reaction by the naïve friend” resulted in no main effects or significant interactions. All age groups frequently predicted (Ms = 60% of 4-year-olds’, 73% of 5-year-olds’, 60% of 6-year-olds’, and 87% of adults’ trials) that the naïve friend would feel okay instead of worried and would not change his or her behavior in line with the focal character. Only 5-year-olds and adults, however, predicted different responses for the friend significantly greater than expected by chance alone, 50% ($ps < .01$, t tests, two-tailed).

Table 3 displays data on explanations that link the naïve friends’ emotions and behaviors to an event in the past or future. Two separate 4 (age) $\times$ 2 (character response type) repeated measures ANOVAs for future event and past event explanations resulted in main effects for age, $ps < .001$ ($\eta_p^2 = .17$; .26). Adults provided significantly fewer future event explanations and more past event explanations than other age groups, $ps < .05$. The repeated measures ANOVA for past event explanations further revealed a main effect for character response type, $F(1, 60) = 4.41, p < .04, \eta_p^2 = .10$. All age groups more frequently explained the naïve friend’s emotions versus behaviors in relation to the past (Ms = 54% vs. 45%).
Past event explanations were rarely used exclusively by any age group (<=7% of trials). Thus, young children coherently integrated information about an individual’s past history, the present situation, and thoughts about the future to make sense of his or her current emotions and behaviors.

Children’s provision of PTF explanations was not influenced by whether they were asked to explain a person’s negative emotions versus their actions. These data contrast with findings from Lagattuta and Wellman (2001) that young children demonstrate more sophisticated reasoning in situations involving negative emotions. Importantly, however, the behavior stories used in the current study had a strong emotional component to them—participants were told that the past event made the person sad, and the character’s behavior in the present had a preventative quality. The behavior cuing stories used by Lagattuta and Wellman (2001) focused on non-emotional actions linked to benign past events. Thus, it may not be the response type per se (behavior vs. emotion) that encourages children to think about individual minds and lives, but rather the emotional significance of the events that prompt those reactions.

Type of response (emotion vs. behavior) did emerge as significant, however, when analyses focused just on PTF explanations phrased in the hypothetical future tense. Participants of all ages more frequently marked references to future events as uncertain—what might or could happen—when explaining the cause of worry versus behavior. Thus, young children show awareness that action decisions typically arise from being certain a negative event will occur in the future, whereas worry can be elicited by thinking about only the possibility of future harm.

Notably, at every age females were more likely than males to mark the future in their past-to-future explanations as hypothetical or uncertain. Although it is possible that females’ more frequent use of the hypothetical future may have stemmed from greater linguistic skills, the present data provide no support for this conjecture. Moreover, prior research (Bliss, 1988; O’Neill & Atance, 2000) has shown that children use epistemic modals to mark uncertainty by 3–4 years, and gender has not been a significant factor in children’s general production. What is known from mental health research is that females outweigh males in the frequency of anxiety disorders and self-reports of worrying (e.g., Robichaud, Dugas, & Conway, 2003; Silverman et al., 1995). This finding requires replication before any stronger argument can be made.

Finally, young children frequently predicted (>60% of trials) that another person, naïve to the past event, would not experience the same emotion nor engage in the same behavior. Thus, they showed
recognition that the bridging of past, present, and future occurrences for one person does not apply to the thoughts of a different person with a different life history. Still, there was room for development. When explaining the naïve friend’s reaction, adults more frequently referred to distinctive past events (e.g., the focal character’s unique past history, the friend’s lack of knowledge about the prior event) than child participants of all ages. Moreover, adults provided both a PTF explanation for the focal character’s reaction as well as predicted a different reaction for the naïve friend (on the same story trial) significantly more often than 4-year-olds, but not differently than 5- and 6-year-olds. Thus, after age 4, children demonstrate stronger awareness that past-to-future thinking is person-specific and dependent on life history.

Study 2
In the scenarios of Study 1, the entity that elicited worry in the present scene was the same animal, object, or person that had caused harm in the past. This raises the question of whether children and adults would likewise assume that an entity that looks only similar to the perpetrator of a negative past event, but that played no part in the prior mishap, could also induce worry. In Study 2, therefore, the scenarios were modified so that the entity appearing in the final scene shared a similar appearance with, but was noticeably different than the person, animal, or object from the past event. This modification enabled examination into whether children, like adults, recognize that people’s past experiences shape how they think about the future even through more indirect pathways. Moreover, by comparing data across Study 1 and Study 2, we could investigate whether children more readily recognize past to future connections for same exact versus similar perpetrators of past negative episodes.

Prior research has shown that young children more often refer to people’s mental states and to their past experiences when explaining a person’s emotion that is atypical versus typical for the present circumstances (see Gnepp, 1989; Lagattuta & Wellman, 2001). In Study 1, participants were told that the character started to feel worried in an event that should not be worrisome (e.g., seeing a boy walking). This raises the issue of whether young children would spontaneously predict that people would feel worried in these kinds of situations. Questioning was changed in Study 2 so that, for the first half of trials, participants predicted and explained the character’s emotion and, for the last half of trials, they were told the character started to feel worried and they were asked to provide an explanation. We could then examine young children’s ability to coherently assemble past to future connections “on the spot” to attribute feelings of worry. Moreover, we could directly assess whether children provide more frequent past-to-future explanations for emotions when asked to explain worry versus when explaining an emotion that they predicted for the character.

Finally, based on the strong performance of 4-year-olds in Study 1, Study 2 included 3-year-olds to assess whether even younger children can bridge together past and future to explain current emotions.

To summarize then, Study 2 incorporated the same core format as Study 1 with four modifications: (1) all entities appearing in the current scene only looked similar to the object, person, or animal from the past, (2) participants were asked on the first half of story trials to predict and then explain the characters’ emotional response, (3) the youngest age of child participants was lowered to 3-year-olds and 6-year-olds were excluded, and (4) story trials focused only on emotions to keep the number of story trials reasonable given the new ending variations. As with Study 1, we primarily focused on the frequency with which young children explained worry as caused by thinking a negative event will or might occur in the future because a similar incident occurred in the past (PTF explanations). As well, we further assessed whether children also know that this emotion response is person specific by having them predict and explain a naïve friend’s emotional reaction to the same current event.

Method

Participants
Sixty-four children and adults from four different age groups participated: sixteen 3-year-olds (10 girls, 6 boys; range = 3;3 to 3;11, M = 3;7); sixteen 4-year-olds (9 girls, 7 boys; range = 4;0 to 4;11, M = 4;6); sixteen 5-year-olds (7 girls, 9 boys; range = 5;0 to 6;2, M = 5;6), and 16 adults (10 women, 6 men; range = 18;2 to 23;5, M = 20;1). Children were recruited from multiple preschool and grammar school classrooms serving ethnically diverse populations (63% Caucasian, 19% Asian-American, 19% other ethnicities), and adults were college undergraduates (44% Caucasian, 38% Asian-American, 19% other ethnicities). No participants from Study 1 took part in Study 2.

Materials and Procedures
The endings for the stories used in Study 1 were modified so that the person, animal, or object
appearing in the final scene looked similar to but was clearly different than the entity from the past event. So, for example, the Study 2 ending for “David’s Story” read: “Well, many days later, David and his friend Henry are having fun playing outside with their cars. They zoom the cars all around. Suddenly, David sees a red-haired boy.” We purposely used the indefinite article a X and avoided using the phrase “different X” because we did not want to unduly prompt children to consider the past event.

There were two ending question types: (1) the predict-first endings and (2) the explanation-only endings. For the predict-first endings, the experimenter showed the participant two picture cards: one featuring the focal character feeling worried (the same card as used in Study 1) and the other showing the focal character with a neutral, “okay” expression. The participant was asked to choose how the person was feeling and to provide an explanation (e.g., “How do you think David feels right now? Does he feel worried or okay? Why do you think he feels X?”). After predicting and explaining the focal character’s emotion, the participant answered the same questions for the naïve friend (e.g., “What about Henry? Henry also sees a red-haired boy. How do you think Henry feels? Worried or okay? Why do you think Henry feels X?”).

For the explanation-only endings, the experimenter told and showed the participant that the character started to feel worried and asked him or her to provide an explanation (e.g., “Why does David start to feel worried?”). The participant was then asked to explain why the naïve friend had a different emotion (e.g., “Here is Henry. He also sees a red-haired boy. Henry does not feel worried. Why do you think Henry feels okay?”).

Follow-up questioning followed the same format as Study 1, including the control question, the source of future thought question, and the thinking prompt. Again, the experimenter never referenced past or future events in her questions unless these events were first stated by the participant. As well, the experimenter matched the participant’s choice of hypothetical or definite future tense for all future-oriented references.

Participants were interviewed individually in a quiet room by a female experimenter. Four-year-olds, 5-year-olds, and adults received six story trials: three predict-first trials, followed by three explanation-only trials. Three-year-old received a reduced subset of four trials: two predict-first and two explanation-only because of the extended time it took to read the stories and elicit responses from these young participants. The block of predict-first trials always came first so that participants would not be primed to predict worry based on the explanation-only endings (where we inform participants that the characters felt worried).

As with Study 1, each particular story × ending question type appeared equally across each age group. Sixteen unique combinations incorporating these conditions were created, with one version randomly assigned to each participant from each age group. The order of all forced-choice prediction questions for focal characters and for naïve friends (i.e., worried vs. okay) was also counterbalanced across story trials. Interviews were tape-recorded and transcribed verbatim. The testing procedure lasted 15–20 min.

Coding of Explanations

Participants’ explanations were classified into the same coding categories as Study 1. These included the focal category of past-to-future explanations (including the subcategories of hypothetical vs. definite and unprompted vs. prompted), as well as the broader categories of present event, past event, and future event explanations (including the subtype future-oriented thought explanations). Interrater reliability (pooled kappa) based on 75% of the transcripts (the remaining 25% were coded collaboratively for training) was .97 for explanation type, .94 for use of hypothetical tense, and 1.0 for coding past-to-future or future-oriented thought explanations as prompted versus unprompted. All discrepancies were resolved by discussion.

Results

Primary analyses focus on children’s and adults’ predictions of worry and provision of past-to-future explanations (PTF explanations) for the focal character. Additional analyses then examine predictions and explanations for how the naïve friend would feel. Preliminary analyses revealed no effect for the order of worried versus okay response choices or for story episode (e.g., human vs. animal perpetrator), so these factors were not considered further. Preliminary analyses further confirmed that neither prompted nor unprompted past-to-future explanations significantly increased across story trials and that analyses on just unprompted PTF scores yielded the same trends and differences as those for total (prompted and unprompted) PTF explanations. Thus, as with Study 1, we conducted analyses on the larger data set of prompted and unprompted explanations combined. For all analyses, 3-year-olds’ scores were multiplied by 1.5 so that analyses could be conducted on a normalized scale because they received a reduced
number of story trials. All participants correctly answered the control questions.

Predicting Worry and Providing PTF Explanations

Consider first children’s and adults’ attributions of worry to a person who encounters an entity that looks similar to a person, object, or animal that caused harm in the past. Table 4 displays these data. As shown at the top of Table 4, a 4 (age) × 2 (gender) ANOVA for predict worried scores resulted in a main effect for age, F(3, 64) = 4.50, p < .01, ηp² = .20. Three-year-olds predicted worry significantly less often than 5-year-olds and adults, ps < .05, and they were also the only age group that did not predict worry significantly above chance (p > .05, t test, two-tailed). Aside from the 3-year-olds, predictions of worry were high (>70% of trials) for all ages.

The bottom of Table 4 displays data for the frequency that children and adults predicted that a character felt worried and then provided a PTF explanation for that same story trial, as in, “She’s worried because Julia thinks her might tickle her and her’ll bump her head . . . because that girl did it before.” A 4 (age) × 2 (gender) ANOVA resulted in main effects for age, F(1, 64) = 27.39, p < .0001, ηp² = .34, and for gender, F(1, 64) = 5.33, p < .05, ηp² = .10. All pairwise age comparisons were significant at p < .05. As well, females were more likely than males to predict that characters felt worried and then to explain that worry as caused by PTF connections.

The Influence of Question Type on PTF Explanations

The influence of question type on PTF explanations was investigated by comparing children’s provision of PTF explanations, including the subtype of hypothetical PTF explanations, when they were directly told that the character started to feel worried (the explanation-only trials) versus when they, themselves, provided both the emotion prediction and the explanation (the predict-first trials). Note that PTF explanations also apply to predictions that the character feels okay, as in, “(She’s okay) ’cause she doesn’t think this dog will do anything bad because it’s not the same one.” Adults were excluded from this analysis because they provided PTF explanations for 100% of trials.

As shown at the top of Table 5, a 3 (age) × 2 (gender) × 2 (question type) repeated measures ANOVA for total PTF explanation scores resulted in main effects for age, F(2, 42) = 11.05, p < .0001, ηp² = .35, and for question type, F(1, 42) = 11.45, p < .01, ηp² = .21. The frequency of PTF explanations significantly increased between 4 and 5 years, with no difference between 3- and 4-year-olds, ps < .05. Child participants provided PTF explanations significantly more often in the explanation-only versus the predict-first trials, ps < .001. Descriptively (not shown in Table 5), 38% of 3-year-olds’, 40% of 4-year-olds’, 63% of 5-year-olds’, and 40% of adults’ PTF explanations were unprompted in that they used mental language in reference to a future event without the thinking prompt.

Question type had no influence on the frequency that participants provided the subtype of hypothetical PTF explanations. As shown at the bottom of Table 5, a 4 (age) × 2 (gender) × 2 (question type) repeated measures ANOVA for the frequency of hypothetical PTF explanations resulted in main effects for age, F(3, 56) = 8.58, p < .001, ηp² = .32, and for gender, F(1, 56) = 6.22, p < .05, ηp² = .10. Three-year-olds provide hypothetical PTF explanations significantly less often than 5-year-olds and adults. Replicating Study 1, females of all age groups provided hypothetical PTF explanations more frequently than males (M = 40% vs. 22% of trials).

Similar Versus Same Exact Perpetrators

We compared data from the three explanation-only trials of Study 2 to the parallel three emotion ending trials of Study 1 to examine the influence of entity type (similar vs. same exact perpetrator) on children’s and adults’ provision of PTF explanations. Three-year-olds were excluded because this age group did not participate in Study 1. As shown at the top of Table 6, the frequency of total PTF explanations for worry was not influenced by whether the entity in the current scene was the same versus only similar to the perpetrator of prior harm. A 3 (age: 4, 5, adult) × 2 (gender) ×

---

**Table 4**

<table>
<thead>
<tr>
<th>Category of analysis</th>
<th>Age</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predict worry for focal character</td>
<td>Total</td>
<td>53</td>
<td>71</td>
<td>87</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>45</td>
<td>71</td>
<td>78</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>60</td>
<td>71</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Predict worry + provide PTF explanation</td>
<td>Total</td>
<td>14</td>
<td>33</td>
<td>57</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>10</td>
<td>21</td>
<td>48</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>18</td>
<td>46</td>
<td>67</td>
<td>100</td>
</tr>
</tbody>
</table>

*Percentage of trials out of 48 per age group (out of 32 trials for 3-year-olds).*
Hypothetical past-to-future explanations resulted in a main effect for gender, $F(1, 96) = 8.06, p < .01, \eta_p^2 = .10$. At every age group, females provided more hypothetical PTF explanations than males.

**Additional Focal Character Analyses**

Percentage of participants with one or more PTF explanations. Chi-square analyses showed that significantly fewer 3-year-olds ($M = 63\%$) provided one or more PTF explanations than 5-year-olds or adults ($M = 100\%$), $\chi^2(3, 64) = 12.8$, $p < .005$. No other pairwise comparisons among means were significant (4 years $M = 75\%$). Three-year-olds were also less likely to offer one or more hypothetical PTF explanations as well ($Ms = 13\%$ of 3-year-olds, $56\%$ of 4-year-olds, $81\%$ of 5-year-olds, and $88\%$ of adults), $\chi^2(3, N = 64) = 23.06, p < .001$.

Past, present, and future event explanations. Table 7 displays data for children's and adults' more general use of past, present, and future events to explain emotions. A 4 (age) $\times$ 2 (gender) MANOVA for future event, past event, and present event explanations resulted in a significant main effect for age, $F(9, 168) = 7.67, p < .0001, \eta_p^2 = .29$. When the results for the dependent variables were considered separately, all three analyses revealed a significant main effect for age, $ps < .0001$, all $\eta_p^2 > .32$. Three-year-olds explained emotions in relation to future and past events significantly less often than all other age groups, and 4-year-olds also provided fewer future- and past-oriented explanations than adults, $p < .05$. Descriptively, as with Study 1, nearly all future explanations mentioned that the character was thinking about the future ($Ms = 94\%$ of 3-year-olds, $98\%$ of 4-year-olds, $100\%$ of 5-year-olds, and $100\%$ of adults).

**Naïve Friend Predictions and Explanations**

Test questions about the naïve friend followed the same format as those for the focal character. For the first half of trials participants predicted and explained the emotion, and for the last half of trials they explained why the naïve friend felt okay. Preliminary tests revealed no significant main effects or interactions for gender, so this factor was excluded in the analyses that follow.

A 4 (age) univariate ANOVA for number of trials in which participants predicted that the naïve friend would feel okay resulted in a main effect for age, $F(3, 64) = 2.78, p < .05, \eta_p^2 = .13$. Adults were more likely than 4-year-olds to predict that the naïve friend would feel okay in the current situation ($Ms = 90\%$ of adults', $62\%$ of 5-year-olds', $48\%$ of 4-year-olds', and $59\%$ of 3-year-olds' prediction trials). Post hoc $t$ tests (two-tailed) revealed that both adults and 5-year-olds

---

**Table 6**

Comparing Total and Hypothetical Past-to-Future Explanations for Similar (Study 2) Versus Same Exact (Study 1) Perpetrators

<table>
<thead>
<tr>
<th>Category of analysis</th>
<th>Age</th>
<th>4</th>
<th>5</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total past-to-future explanations</td>
<td></td>
<td>61</td>
<td>91</td>
<td>100</td>
</tr>
<tr>
<td>Similar (Study 2)</td>
<td></td>
<td>56</td>
<td>89</td>
<td>100</td>
</tr>
<tr>
<td>Same exact (Study 1)</td>
<td></td>
<td>67</td>
<td>92</td>
<td>100</td>
</tr>
<tr>
<td>Hypothetical past-to-future explanations</td>
<td></td>
<td>34</td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>Similar (Study 2)</td>
<td></td>
<td>29</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>Same exact (Study 1)</td>
<td></td>
<td>39</td>
<td>33</td>
<td>43</td>
</tr>
</tbody>
</table>

*pPercentage of trials out of 192 per age group. Percentages of trials for male “m” and female “f” participants are shown in parentheses.

bPercentage of trials out of 96 per age group.*
predicted okay emotions for the naïve friend significantly above chance (50%), \( p < .01 \).

Table 8 displays data for how children and adults explained the cause of the naïve friends’ emotions. As shown at the top of Table 8, a 4 (age) \( \times \) 2 (question type) repeated measures ANOVA for future-oriented explanations resulted in no main effects or interactions. As shown at the bottom of Table 8, a parallel 4 (age) \( \times \) 2 (question type) repeated measures ANOVA for past-oriented explanations revealed a main effect for age, \( F(3, 60) = 15.31, p < .001, \eta_p^2 = .43 \), and a significant Age \( \times \) Question Type interaction, \( F(3, 60) = 3.36, p < .05, \eta_p^2 = .14 \). Adults explained the naïve friend’s emotion in relation to past events significantly more than all other age groups, and 3-year-olds referred to past events significantly less than all other age groups, \( p < .05 \). Question type only mattered for 5-year-olds, who provided past event explanations significantly more often in the explanation-only trials versus the predict-first trials (\( Ms = 64\% \) vs. \( 39\% \)), \( p < .05 \).

<table>
<thead>
<tr>
<th>Type of explanation</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future event(^a)</td>
<td>56</td>
<td>73</td>
<td>91</td>
<td>100</td>
</tr>
<tr>
<td>Past event(^a)</td>
<td>45</td>
<td>73</td>
<td>86</td>
<td>100</td>
</tr>
<tr>
<td>Present event(^a)</td>
<td>48</td>
<td>25</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^a\text{Percentage of trials out of 96 per age group (out of 64 trials for 3-year-olds).}\)

<table>
<thead>
<tr>
<th>Category of response</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future event explanations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total(^a)</td>
<td>31</td>
<td>21</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>Predict-first(^b)</td>
<td>31</td>
<td>17</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>Explanation-only(^b)</td>
<td>31</td>
<td>25</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Past event explanations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total(^a)</td>
<td>11</td>
<td>50</td>
<td>51</td>
<td>81</td>
</tr>
<tr>
<td>Predict-first(^b)</td>
<td>3</td>
<td>50</td>
<td>39</td>
<td>77</td>
</tr>
<tr>
<td>Explanation-only(^b)</td>
<td>19</td>
<td>50</td>
<td>64</td>
<td>85</td>
</tr>
</tbody>
</table>

\(^a\text{Percentage of trials out of 96 per age group (out of 64 trials for 3-year-olds).}\)

\(^b\text{Percentage of trials out of 48 per age group (out of 32 trials for 3-year-olds).}\)

Discussion

Results of Study 2 replicated and extended the central findings of Study 1: age-related increases in explaining worry as caused by thinking about the future because of the past, age-related increases in knowledge that a naïve friend would not feel worried due to a different past history, and gender differences in reasoning about PTF connections. Children demonstrated stronger knowledge about worry caused by past-to-future thinking when asked to explain why characters started to feel worried versus when asked to predict and then explain characters’ emotions. Finally, a comparison of data across studies showed that children and adults provided equivalent numbers of PTF explanations when current perpetrators were exactly the same as those from past events (Study 1) as when they only looked similar to past perpetrators (Study 2).

Study 2 also contributed unique data regarding 3-year-olds’ knowledge. Although a sizable number of 3-year-olds (\( M = 63\% \)) provided a complete PTF explanation for at least one trial, 3-year-olds explained worry as caused by PTF connections infrequently across trials (\( M = 25\% \) of trials), a rate significantly lower than 4- and 5-year-olds. Moreover, 3-year-olds predicted “worry” for the focal character and “not worried” for the naïve friend at chance levels. These data thus support previous findings (Lagattuta & Wellman, 2001; Lagattuta et al., 1997) that, although 3-year-olds have some understanding about life-historical and mental causes of emotions, their knowledge is weak and expressed inconsistently across trials.

Most difficult for 3-year-olds was not explaining worry as caused by future-oriented thoughts (they did so for >50% of trials when considering prompted and unprompted explanations combined), but rather identifying the source of these thoughts—in knowing why the character started to have these negative future expectations. Indeed, 3-year-olds’ PTF explanations were less than half the rate of their future-oriented thought explanations. These data confirm findings that young preschoolers have significant difficulty identifying the sources of thinking (Flavell & Green, 1999; Flavell, Green, & Flavell, 1995; Lagattuta & Wellman, 2001; Lagattuta et al., 1997; Roberts, 2000). Questioning methods guarded against young preschoolers having lower performance simply as a result of lower linguistic skills. That is, anytime a participant stated that the character was thinking about a future
event, he or she was asked, “What made [character] think about that right now?” The following transcript from a 3-year-old illustrates this phenomenon:

C: [David’s worried] “Because the red-haired boy was here and he thinks he’s gonna take it (points to his cars) away.” Exp: “Why is David thinking that the red-haired boy’s gonna take his cars?” C: “Because . . . Because he’s a mean boy.” Exp: “How does he know he’s a mean boy?” C: “Because he has, he has mad hair.” Exp: “Any other reason?” C: “No.”

**General Discussion**

The 19th-century poet Henry Wadsworth Longfellow wrote, “Look not mournfully into the past. It comes not back again . . . Go forth to meet the shadowy future, without fear” (1878, p. 378). Although Longfellow was imparting sage advice, the current data reveal that this instruction directly challenges early developing ideas about connections between past and future. Quite the contrary, young children’s and adults’ predictions and explanations aligned with the premise that negative events from the past do forecast negative events for the future. Although there were significant age-related changes in reasoning about past-to-future connections between the ages of 3 and 5 years, even 3-year-olds revealed some initial insights about how people’s prior experiences shape their future-oriented thoughts, emotions, and decisions.

**Life History, Mind, and Emotion**

Numerous studies have examined the development of children’s knowledge that mental states motivate actions and feelings (see Wellman, 2002). The current data reveal that young children develop an even deeper psychological understanding of people—the awareness that minds underpin everyday lives by providing a coherent, individual trajectory of personhood. Here, the data for children 5 years and older were most robust. That is, 5-year-olds not only explained worry and behavior as caused by future-oriented thoughts for nearly 100% of trials, but they also connected the source of these thoughts to the past by providing complete past-to-future explanations as in, “He feels worried ‘cause he thinks that car will break his scooter ‘cause that other one crashed his bike.” Across both studies, 5-year-olds predicted significantly above chance that the naïve friend would feel okay and would not engage in the same action. As well, 5-year-olds consistently provided PTF explanations for the focal character in conjunction with predictions of different reactions for the naïve friend (Study 1). Thus, by age 5, children reliably detected when a person was thinking about the future, the life-historical cause of that thought, and the person-specific nature of this past-to-future thinking. In doing so, 5-year-olds revealed early awareness that minds connect a person’s unique past, present, and future.

What is especially impressive about 5-year-olds’ explanations in the current studies is that they went beyond just connecting a person’s current reaction to thinking about an event from another time period; rather, they explained reactions by making connections between two events on opposite sides of the time spectrum—between what happened before and what the person thinks will or might happen next. As well, the two events were qualitatively different in the sense that one was actual (the past) and one was only an imagined possibility (the future)—something purely “in the head.” Moreover, they provided these explanations in response to open-ended questions, not to forced-choice alternatives. Thus, not only can episodes of fantasy or imagination evoke emotions in young children (see Harris, 2000), but young children can also recognize these imagination–emotion connections. Moreover, not only can young children engage in episodic future thinking (see Atance & O’Neill, 2005), but they also appreciate the impact of this future-oriented thinking on current emotions and behaviors. Finally, not only do children and parents include talk about the past in their conversations about upcoming future events (see Hudson, 2004), but young children can also readily use these connections between the future and the past to make sense of people’s current actions and feelings.

**Developmental Change**

Five-year-olds’ ability to use this past–future, real–imagined explanatory framework across multiple scenarios builds on achievements developed earlier in the preschool years. Three-year-olds displayed some initial, albeit fragile knowledge, by providing PTF explanations for 25% of trials. Four-year-olds exhibited understanding at a level intermediate between the 3-year-olds and the 5-year-olds (i.e., significantly higher than the 3-year-olds and significantly lower than the 5-year-olds on most measures). Indeed, a high number of 4-year-olds provided PTF explanations for at least one story trial (M = 88% of participants in Study 1, 75% in Study 2), they offered
PTF explanations across the majority of trials, and they predicted at greater than chance levels that the focal character would feel worried upon seeing an entity that looked similar to the perpetrator of a past negative episode (Study 2). As described in the Discussion of Study 2, the largest difficulty for young preschoolers (including 4-year-olds) was not explaining characters’ reactions as caused by thinking about the future, but rather, in locating the source of thoughts in the prior experience. By age 5, children’s knowledge solidified to a level where they reliably recognized both the future-oriented thought and the past-related cause.

Comparisons of children’s explanations in the predict-first trials versus the explanation-only trials in Study 2 provide further information about the development of past-to-future reasoning. Centrally, the frequency of 3- to 5-year-olds’ PTF explanations was significantly higher for trials where they were specifically told that a person started to feel worried (and they were asked to explain why) versus when they were asked to predict the emotion first. This greater competence on the explanation-only trials underscores the value of this methodology for eliciting more advanced causal reasoning in children. That is, prior studies have also shown that young children exhibit stronger mental and social knowledge when asked to explain versus predict and explain a person’s emotion or behavior (see Lagattuta, 2005; Tardif, Wellman, & Cheung, 2004). Importantly, however, the fact that 3- to 5-year-olds exhibited weaker performance on the predict-first trials reveals that young children’s ability to demonstrate knowledge about PTF connections may require highly structured experimental conditions like the ones used in the current studies. Comparatively, adults’ responses were unaffected by questioning type: They provided PTF explanations in 100% of trials.

Finally, developmental change was evident in the children’s reasoning about the emotions and behaviors of the naïve friend. Although there were no significant age effects in predicting that the naïve friend would not feel worried or change his or her behavior (all age group predicted different reaction in >50% of trials), significant age differences emerged in children’s explanations for the causes of these differences. In both Studies 1 and 2, 4- to 6-year-olds provided significantly fewer past-oriented explanations for the naïve friends’ reactions than adults. Examples include: “She feels okay because she doesn’t know about the rabbit,” and “He doesn’t run to his teacher because the other goat never pushed him down before.” Moreover, such references to between-character differences in past experiences were strikingly absent in the explanations of 3-year-olds (M = 11% of trials). Although directly asking children to explain differences in the two characters’ reactions augmented their ability to provide past-oriented explanations for the naïve friend (Study 2), 5-year-olds still never matched adults. Importantly, then, knowledge about life-historical causes of person-specific differences in future-oriented thoughts, emotions, and decisions continues to develop beyond early childhood.

**Gender, Uncertainty, and Worry**

Although there were no gender differences in the frequency of PTF explanations, in both Study 1 and Study 2 females (including adults) more frequently marked the future in these explanations as being uncertain—what might versus what will happen. Moreover, in the predict-first trials of Study 2, females (including adults) more frequently stated that people encountering “similar perpetrators” would feel worried and went on to explain these worries as caused by thinking about the future because of the past. This across-age gender difference in predicting and explaining worry and preventative actions is intriguing in light of research showing that female children and adults have more frequent and intense worries (see Ollendick et al., 1989; Robichaud et al., 2003), more often perceive risk in ambiguous situations (Dugas, Schwartz, & Francis, 2004; Gustafson, 1998), and have higher rates of anxiety disorders than males (Kessler et al., 1994; Muris et al., 2000; Ollendick et al., 1989; Walsh, Stewart, McLaughlin, & Comeau, 2004). Indeed, the current results suggest that gender differences in reasoning about potential risk situations may begin during the preschool years. Young girls on our tasks showed more robust knowledge that worry and actions can be caused by thinking about future events that only might happen because they occurred in the past. Although the scenarios used in the current studies focused on a wide range of worry-eliciting situations, these data need to be supplemented by further research before any strong conclusions can be made about whether females may think about emotions and behaviors caused by past-to-future connections differently than males.

**Categories and Stereotypes**

Children 4 years and older and adults readily explained people’s worries as being caused by PTF connections regardless of whether the entity appearing in the final scene was the same exact perpetrator (Study 1) or only similar looking (Study 2). Moreover, children 4 years and older and adults
overwhelmingly predicted that “similar perpetrator” situations would elicit worry (>70% of trials). Why did participants expect that this new X might or will cause harm when there had been no direct prior history? Potentially, children and adults simply confused the current and the past entities as being the same, and, as a result, they were merely predicting consistency in the same entity’s behavior over time. As described in the methods for Study 2, however, anytime a participant’s explanation referenced the entity from the past, the experimenter asked, “Is this the same X as before?” Participants answered “No” 100% of the time. A more viable explanation comes from developmental research on children’s categorical reasoning. That is, because the “similar perpetrator” was given the same label as the entity from the past (e.g., a “spotted dog,” a “red-haired boy”), children used this category membership and resemblance to make an inductive inference about its future behavior (see also Gelman, 2003).

From the perspective of stereotype development, these findings raise alarm because they show that young children believe that people can form negative expectations about a category as a whole, including a category of people (e.g., “red-haired boys”), after a single encounter with one exemplar. This tendency to assume similarity between members of a category likely serves a protective function, particularly in situations involving a salient negative incident. As aptly argued by Fiske (2000) in her research on stereotyping, “Predicting the future is a fool’s task, and like the weather forecast, maybe the safest prediction is ‘more of the same.’” (p. 311; see also Suddendorf & Busby, 2005, for the adaptive value of considering the future in light of the past). Because the current studies only examined children’s knowledge in situations involving potential for harm, it is unknown whether the same categorical assumptions would occur in situations involving potential for benefit. For example, if a red-haired boy shared with you in the past, would you assume that another red-haired boy would share with you as well? Even within risk situations, it would be important to examine the strength of children’s belief that “similar perpetrators” induce worry. That is, how similar do the past and current entities have to be for the worry to generalize—same color, same type, same age, same family, same peer group?

Other Concerns

Young children’s ability to explain people’s current emotions and behaviors as caused by thinking about the future because of the past is surprising in light of research showing that 3- to 6-year-olds often demonstrate difficulty understanding time concepts. For example, previous research has shown that preschoolers have trouble classifying events as occurring in the past, present, or future, estimating duration of time, and distinguishing between the recent versus distal past and the distal versus near future (see Friedman & Lyon, 2005). This raises the question as to whether children, themselves, are construing the prior history information in the scenarios as the “past,” the current situation as the “present,” and what might or will happen next as the “future.”

Analyses of children’s explanations provide evidence that children clearly construed these story events as occurring in temporally ordered sequences. That is, in their PTF explanations, children appropriately used the future tense to signify episodes that might or will happen next, the past tense to refer to events that had already occurred, and they often included temporal markers (e.g., before, again) when connecting the future to the past.

A further concern involves whether the testing procedures artificially inflated children’s ability to demonstrate knowledge about emotions and behaviors caused by past-to-future connections. That is, perhaps the thinking prompt provoked children to consider characters’ thoughts when they would not otherwise have done so, enabling them to provide prompted PTF explanations by guessing. Experimental safeguards and data argue against this conjecture. Nevertheless, because 50% or less of 3- and 4-year-olds’ PTF explanations were unprompted, it remains an important empirical question as to how robust preschoolers’ knowledge may be in their everyday lives, outside of the comparatively simpler situations used in this research.

Future Directions and Conclusions

In the current studies, we purposely created scenarios where PTF connections would be salient and obvious. Although the findings reveal that by age 5 children reliably explain people’s worries and behaviors as caused by thinking about the future because of the past, we are not arguing that children always expect the past to repeat or that children’s knowledge does not develop further after the preschool years. Foremost, in our everyday lives, our expectations for the future are often informed by multiple encounters with the same person (object or animal), or by multiple interactions with different members of the same category or social group. Not all these exchanges are exclusively negative or positive. Because the current studies utilized very basic
one-past-event scenarios, it is unknown how children would reason about past-to-future connections in situations involving numerous past events, especially those with mixed valences (both positive and negative events). Indeed, investigations with more complicated variants of this task would yield important data about how knowledge about past-to-future connections continues to evolve and develop during middle to late childhood. Presentation of multiple past event scenarios, especially those of mixed valence, may also be useful for identifying individual or gender-linked differences in reasoning about the impact of people’s prior experiences on their expectations for the future.

In conclusion, successful adaptation to everyday life requires an orientation toward the future. From everyday decisions about what to wear, what to eat, or what activities to engage in to more compelling questions about choosing a career or starting a family, our daily schedules and plans demand that we frequently live our present lives by considering or imagining the possibilities of what will or might happen next. Between the ages of 3 and 6 young children develop surprisingly rich insights about emotions and behaviors caused by thinking about the future because of the past, as well as awareness that each person’s unique past history significantly shapes how he or she comes to interpret current events and to anticipate what will or might happen next. Indeed, the biggest challenge for young children and adults alike in thinking about the future may be to actually let go of the past, particularly memories of a traumatic past, so that they can look toward the future with a less biased, more optimistic view on life.

References


Appendix: Complete Wording and Questions for Story Example from Study 1

This is a story about a boy named David.

One day David brings his favorite teddy bear to the park. He plays with it in the sandbox. Suddenly, a red-haired boy comes over. He takes David’s teddy bear, and never gives it back! David feels sad.

Control question: Why is David sad?

Well, many days later, David and his friend Henry are having fun playing outside with their cars. They zoom the cars all around. Suddenly, David sees the red-haired boy.

Emotion ending: David starts to feel worried.

Test Question: Why does David start to feel worried?

Naïve friend reaction: What about Henry. He also sees the red-haired boy. How do you think Henry feels? Worried/okay? /Okay/worried?

Behavior ending: David quickly hides his cars behind the tree.

Test Question: Why does David quickly hide his cars?

Naïve friend reaction: What about Henry? He also sees the red-haired boy. Do you think he’ll quickly hide his cars too, or just keep playing? Just keep playing/ quickly hide his cars too?