Past and Future Episodic Thinking in Middle Childhood

Qi Wang, Diana Capous, and Jessie Bee Kim Koh

*Cornell University*

Yubo Hou

*Peking University, China*

The abilities of past and future episodic thinking develop hand in hand across the preschool years and are intimately connected in adults. Little is known, however, about the development of episodic thinking in middle childhood and how it is influenced by sociocultural factors. In the present study, one hundred sixty-seven 7- to 10-year-old children from European American and Chinese cultural backgrounds were interviewed individually about temporally near and distant past and future events. The child data were further contrasted with adult data in Wang, Hou, Tang, and Wiprovnick (2011). European American children generated more specific details than did Chinese children in both past and future events. Children of the two cultures relied similarly on general knowledge in their episodic thinking, and yet, they did so to a greater extent when compared with adults. In addition, similar to adults, children exhibited consistency in episodic specificity between past- and future-event construction, and they generated more specific details in past events compared with future events and in near events compared with distant events. The findings provide important insights for the development of episodic thinking in middle childhood and beyond.

Human beings are cognitively equipped to mentally travel backward and forward in time (Tulving, 2002). The ability to travel backward in time to remember and re-experience past events and the ability to project the self forward in time to anticipate future happenings are both in place by the end of the preschool years (Atance, 2008; Nelson & Fivush, 2004; Perner, 2001). There also appears to be an intimate relation between remembering the past and imagining the future even during early development (Atance, 2008; Busby & Suddendorf, 2005). According to the constructive-episodic-simulation hypothesis, individuals use personal memories as the raw materials to simulate possible future episodes, where elements of the past are extracted, recombined, and reassembled into imaginary future events (Addis, Wong, & Schacter, 2007; Suddendorf & Corballis, 1997). Neuropsychological research has further provided evidence to support this view and has shown that remembering past events and imagining future events involve similar cognitive processes and neural substrates (Addis et al., 2007; Addis, Wong, & Schacter, 2008; Szpunar, 2010). Furthermore, the two forms of mental time travel exhibit consistent characteristics within a person, such that people who retain greater details...
in their representation of past events also produce greater details in their representation of future events (D’Argembeau & Van der Linden, 2006; Szpunar, 2010).

Developmental Research on Episodic Thinking

One critical feature of episodic thinking is that it deals with information about unique personal events located at a particular point in time in the past or future, in contrast to more general knowledge about the personal past or future (e.g., personal semantic information and general events; Atance & O’Neill, 2001; Tulving, 2002). The ability to represent events in rich details specific in time and place—that is, episodic specificity—develops with age. When remembering past episodes, children of toddlerhood and early preschool ages often focus on generic or routine information (Bauer, 2007). For example, a 2.5-year-old child recounted a recent camping trip: “And then we woke up and eat dinner. First we eat dinner, then go to bed, and then wake up and eat breakfast” (Fivush & Hamond, 1990, p. 231). During the next couple of years, preschoolers show increasing abilities to retain and recall distinctive aspects of past events (Bauer, 2007; Nelson & Fivush, 2004). Mirroring episodic-memory development, the ability to mentally project into the future also emerges during the preschool years (Atance, 2008; Busby & Suddendorf, 2005; Hayne, Gross, McNamee, Fitzgibbon, & Tustin, 2011; Hudson, Shapiro, & Sosa, 1995; Suddendorf, 2010). Although 3-year-olds often fail to produce specific future events, such as what they may do the next day or what they plan for going to the beach, 4- and 5-year-olds are quite successful in doing so. Thus, by the end of the preschool years, children are competent in mental time traveling to re-experience specific past events and pre-experience specific future episodes.

However, many important questions remain concerning the development of episodic thinking. Current research has focused on similarities in episodic specificity between children’s past and future episodic thinking, which stems from the evidence that the two forms of mental time travel are characterized by a striking overlap in cognitive and neural processes (Addis et al., 2007, 2008; Szpunar, 2010). Findings have generally confirmed the expected similarities (Busby & Suddendorf, 2005; Hayne et al., 2012; Quon & Atance, 2010; Suddendorf, 2010). Yet studies with adults have shown that past events tend to be represented in richer specific details compared with future events (Addis et al., 2008; D’Argembeau & Van der Linden, 2004, 2006; Gamboz, Brandimonte, & De Vito, 2010). This may reflect differing generative processes during past- and future-event construction: Although sensory-emotional elements of a past event are readily available for retrieval, details of a future event require additional processes of extraction and novel recombination to produce (D’Argembeau & Mathy, 2011). This is further evidenced in neural differentiation, where the construction of future events, but not past events, uniquely recruits the right frontopolar cortex and left ventrolateral prefrontal cortex, regions engaged during prospective thinking and generation processes (Addis et al., 2007). Additionally, the right anterior hippocampus exhibits increased activity when constructing future relative to past events (Addis, Cheng, Roberts, & Schacter, 2011). We speculate that the focus on similarities between past and future episodic thinking in developmental literature may suggest that the difference in episodic specificity between past- and future-event construction only emerges later in development. Alternatively, the common usage of categorical coding for episodic specificity in children’s responses (i.e., whether a child is able or unable to produce a specific event) may have prevented researchers from identifying differences between representations of past and future episodes.
Furthermore, extant developmental studies on episodic future thinking have focused on children’s construction of near-future events (e.g., breakfast tomorrow, the next time going to the park; Quon & Atance, 2010; Suddendorf, 2010). Although the construction of near-future events can often draw upon elements from the recent past, distant future events are relatively novel and thus have less stored episodic information to rely on during the event simulation (Arnold, McDermott, & Szpunar, 2011; Trope & Liberman, 2003). Also, compared with distant future events, near-future events tend to be more relevant to current working self-goals, which facilitate rich representations of the events (Conway & Pleydell-Pearce, 2000). Consequently, adults generate near-future events with more specific details than distant future events (Addis et al., 2008; Arnold et al., 2011; D’Argembeau & Van der Linden, 2004; Gamboz et al., 2010). Whether the temporal distance of future events has a similar effect on children’s event simulation has yet to be investigated. Pertaining to past events, memory research has long established that both children and adults are generally able to recall more event details from the recent past than they are from the distant past, given the forgetting function and the decreased relevance to the current self as time elapses (Bauer, 2007; Conway & Pleydell-Pearce, 2000).

Another deficiency in extant developmental studies is that the studies have focused primarily on preschool children (for reviews, see Atance, 2008; Bauer, 2007). Little is known about the development of mental time-travel ability, particularly pertaining to the future, in middle childhood following the initial emergence of episodic thinking. There is also a lack of data examining developmental differences in future episodic thinking between children and adults. As a result, how episodic thinking functions beyond the preschool years and whether it continues to develop into adulthood are still unanswered questions.

Finally, to the best of our knowledge, there is no study to date to examine the link between children’s past and future episodic thinking across cultures. Cultural differences in episodic specificity of past events have been consistently identified in previous studies of autobiographical memory development (see Wang, 2009b, for a review), which reflect varied cultural beliefs and memory practices manifested early in children’s lives (Nelson & Fivush, 2004; Wang & Fivush, 2005). However, cultural effects on future episodic thinking in children have yet to be examined. A recent cross-cultural study with adults showed that European Americans consistently produced more specific details than did Chinese adults for both past and future events and that, independent of group factors (i.e., culture and gender), participants who exhibited greater episodic specificity when remembering the past also exhibited greater episodic specificity when imagining the future (Wang, Hou, Tang, & Wiprovnick, 2011). It is of theoretical interest to examine whether children in middle childhood, whose episodic memory and future thinking are both in place, show similar patterns of past- and future-event construction as adults, at both the group and individual levels.

The Present Study

We examined past and future episodic thinking in Chinese immigrant (CI) and European American (EA) 7- to 10-year-old children. We interviewed children about specific past and future events taking place in two temporal distances from the present—namely, in the near and distant past and future. We examined episodic specificity in children’s responses using a standardized scoring procedure that distinguishes episodic information from nonepisodic or
general information in an event (Addis et al., 2008; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002; Wang et al., 2011). We segmented each generated event into distinct details, and then classified the details as either specific, if they concerned episodic information pertaining to the event (e.g., what, where, when), or general, if they only concerned semantic facts or other information nonspecific or “external” to the event.

We expected that regardless of temporal distance, EA children would produce more specific details than would CI children for both past and future events. The parallel between past- and future-event construction would also be evident at the individual level, such that independent of culture, children who recalled past events with greater episodic specificity would also construct future events with greater episodic specificity. In addition, the fine-grained coding may allow us to identify differences between representations of past and future episodes. Thus, in congruence with adult findings (Addis et al., 2008; D’Argembeau & Van der Linden, 2006; Wang et al., 2011), we expected children to represent past events in greater specific detail than they would for future events. We further examined the effects of temporal distance on event construction and expected children to represent temporally close events in greater specific detail than that of distant events, in line with adult data (Addis et al., 2008; Arnold et al., 2011; D’Argembeau & Van der Linden, 2004; Gamboz et al., 2010).

We included children of a wide age range to examine developmental patterns of past and future episodic thinking in middle childhood. Research has shown that children’s social-cognitive skills that are important for mental time travel, including narrative competence (Van Abbema & Bauer, 2005), self-concept (Harter, 1999), and knowledge of time (Friedman, 1986, 2007; Friedman & Lyon, 2005), continue to develop during middle childhood, which may then facilitate children’s episodic thinking. On the other hand, the preteen period is generally characterized as relatively stable and uneventful in the developmental literature (Cole, Cole, & Lightfoot, 2005). Given the lack of prior data, we made no a-priori predictions about age differences in episodic specificity within the middle childhood group.

To further investigate the development of mental time travel in middle childhood and beyond, we used the adult data from Wang and colleagues (2011) to examine developmental similarities and differences between children’s and adults’ episodic thinking. Similar to the current study, adult participants in Wang et al. (2011) answered questions about near and distant past and future events, and the responses were coded following the same coding scheme (see details in the “Method” section). The parallel in methodology and coding affords us an opportunity for developmental comparison. Given that general knowledge initially plays an important role in guiding young children’s episodic thinking (Atance, 2008; Bauer, 2007) and may continue to do so during middle childhood, we expected children’s responses for both past and future events to contain proportionally more general relative to specific information compared with adults’ responses.

We also investigated gender effects on the episodic specificity of past and future events. Studies have shown that women exhibit greater episodic specificity than do men in tasks relevant to autobiographical recollections (Herlitz & Rehnman, 2008). Compared with men, women are better able to retrieve memories of specific episodes and recall more specific details of personal experiences (Nelson & Fivush, 2004; Pillemer, Wink, DiDonato, & Sanborn, 2003; Ross & Holmberg, 1990). The gender differences in episodic memory emerge early and exist across cultures (Bauer, 2007; Herlitz & Rehnman, 2008; Wang et al., 2011). Based on the literature, we expected girls to produce more specific details than boys in both past- and future-event construction.
In addition, as the constructive-episodic-simulation hypothesis posits, mental time travel relies on relational processes to integrate information, where event elements are pieced together to construct past episodes and simulate future happenings (Addis et al., 2007; Suddendorf & Corballis, 1997). In line with this theoretical view, Addis and colleagues (2008) found that among older adults, relational processing, as measured by a relational memory task from the Verbal Paired Associates I (VPA) subscale of the Wechsler Memory Scale-Third Edition, was positively correlated with episodic specificity for both past and future events. We included a simplified version of the task to examine the role of relational processes for mental time-travel ability among children. Also, research has suggested positive influences of verbal ability on children's episodic memory performance (Nelson & Fivush, 2004; Simcock & Hayne, 2003). We therefore included a measure for verbal skills.

**METHOD**

**Participants**

A total of 167 children participated in the study, including 88 EA children (48 girls, 40 boys; \(M_{age} = 8;10\); age range = 7;4–10;5) and 79 first-generation CI children (38 girls, 41 boys; \(M_{age} = 8;7\); age range = 7;1–10;6) from a university town and suburban areas in Upstate New York. All children were from middle-class families. Children were recruited through local schools and by word of mouth, and they were taking part in a longitudinal study of social-cognitive development. Parents gave permission for their children to participate and informed assent was further obtained from children.

**Procedure**

Two female researchers visited the participating children at home. English-Chinese bilingual researchers visited CI children and conducted the interviews in the language of the children’s choice. All except three CI children chose to speak English. All materials were written in both English and Chinese and a translation and back-translation procedure was carried out to ensure their equivalence in both literal and sense meaning. The entire home visit took approximately 2 hr and was video tape-recorded. The tasks relevant to the present article are described in the following sections.1

**Past and future events.** This task was adapted from previous studies of autobiographical memory in children, with an additional future component (Han, Leichtman, & Wang, 1998; Wang, 2004). After interacting with the child and establishing rapport, the interviewer invited the child to play a ‘‘past and future game.’’ She explained to the child that the game was to talk about specific events from the past and future and that specific events meant things happening at a particular time and place. She provided examples to show what would (e.g., ‘‘I went to the Science Museum last Saturday’’) or would not (e.g., ‘‘I went to the Science Museum all the

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1The home visit started with tasks involving mother–child interactions, followed by an interview with the child (including the past- and future-event task and relational memory test). During the child interview, the mother completed questionnaires (including the Child Communication Survey) in a separate room.
time’’) be considered specific events. She then asked the child to recall two specific past events, one happening to the child recently and one when the child was little, and to imagine two specific future events, one that could happen to the child soon and one when the child was a grown-up. Autobiographical rather than conventional time patterns (e.g., days of the week, months, seasons, and years) were used in the questions because children of this age range do not have a fully developed knowledge of the latter (Friedman, 1986, 2007). Following each event question, the interviewer used standard prompts such as, “Can you tell me more?” and “What else happened (will happen)?” until the child indicated that the event was finished. To reduce cognitive load, the two temporal distances (near and distant) were blocked within each temporal direction (past and future), and their order of presentation was counterbalanced. The order of the past and future sections was further counterbalanced. This task took approximately 20 min.

We coded the data following the standardized scoring procedure from previous studies (Addis et al., 2008; Levine et al., 2002; Wang et al., 2011). For each event description, we first identified the central event. If a child mentioned more than one event, the one that garnered the most details and occurred within a relatively brief timeframe was selected as the central event. We then segmented each event description into distinct informational details, with each detail being a unique occurrence, observation, or thought. For example, “We played games at the Science Museum last Saturday” contains three details: playing games (an event happening), Science Museum (a location), and last Saturday (a time). The details were further categorized as either specific or general. Specific details were episodic information directly relevant to the central event (e.g., “I’m gonna have to go on 4 plane rides”), including happenings or the unfolding of the story, characters, place, time, perceptual experiences, emotions, and thoughts. General details were nonepisodic, external information (e.g., “They live in Montana in the summer and Mexico in the winter”), including semantic facts, information pertaining to other noncentral events or extended events, and repetitions. The numbers of specific and general details were tallied for each event. Off-topic talk (e.g., talking about the tape recorder) was very rare among children of this age group and was not coded.

One trained research assistant coded the data. A second assistant independently coded 20% of the data for a reliability check. Both coders were unaware of the study hypotheses. The average intercoder reliability $r$ (Rosenthal & Rosnow, 1991) across the four events was .91 for specific details and .86 for general details. Disagreements were resolved by discussion among the coders.

**Relational memory.** Following Addis and colleagues (2008), we assessed children’s relational memory using the VPA subscale of the Wechsler Memory Scale-Third Edition. We simplified the task by substituting words familiar to children of this age range (e.g., truck, tree, clown) and by presenting the task as a “word game.” Following the standard procedure, the interviewer read to the child a list of eight word pairs (e.g., truck–arrow, bug–tree, animal–clown). A recall test followed immediately after the reading, during which the interviewer said the first word of a pair (e.g., animal) and asked the child to tell her the word that went with it (e.g., clown). If the child responded correctly, the interviewer proceeded to the next word pair. If the child responded incorrectly or gave no response within 5 s, the interviewer provided the child with the correct response and proceeded to the next pair. Children received 1 point for each correct response and 0 for each incorrect response or no response (maximum recall score = 8). The same procedure was then repeated for another three trials (i.e., four trials in total), in which
the same list was read and tested again except with the word pairs in a different order each time as predetermined in the standard task. (A complete procedure of the task can be obtained by contacting the first author). Following Addis and colleagues (2008), the Recall Total Score summed across the four trials was used to index children’s performance on the relational memory task, which has a possible range of 0 to 32. The actual score range for children of the current sample was 4 to 31, with a mean of 21.34 and a median of 22.00. There were no indications of ceiling or floor effects.

**Verbal skills.** Mothers filled out a Child Communication Survey adapted from Feagans and Farrans (1997) that assesses school-aged children’s narrative and discourse abilities, including comprehension, production, rephrase, listening, spontaneity, and fluency. Mothers answered each of the 18 questions (e.g., “Child is easily understood when he/she is talking to you”) by rating on a scale of 1 (well-below average) to 5 (well-above average). This survey has shown excellent internal consistency reliability and discriminant validity (Feagans & Farrans, 1997). In the current sample, the questions formed a reliable scale (Cronbach’s $\alpha = .95$), and the ratings were aggregated to index the children’s verbal skills (maximum score of 90). CI mothers gave ratings on their children’s abilities to communicate in English and Chinese, respectively, and the scores for the children’s language of interview were used in analysis.

**Procedure and coding of Wang et al. (2011).** A total of 99 EA and 110 CI college students participated in the study. They each completed a written questionnaire in which they recalled three past events and imagined three future events happening to them at different time points (for the past, last week, last year, last 10 to 15 years; for the future, next week, next year, next 10 to 15 years). Following the general procedure of previous studies (Addis et al., 2007, 2008; D’Argembeau & Van der Linden, 2004, 2006), participants were instructed to recall and imagine specific events that occurred at a particular time and place, and they were provided with examples of what would or would not be considered as a specific event. They were asked to describe each of the events in as much detail as they could within 3 min. The order of the past and future sections was counterbalanced, and the three time periods (week, year, 10 years) were blocked within each temporal direction (past, future) to reduce cognitive load. Completion of the questionnaire took 20 min to 30 min (see Wang et al., 2011, for additional details).

The event descriptions provided by adults were coded following the exact same coding scheme as in the current study. For both the adult and child data sets, specific and general detail scores were averaged across events of different temporal distances for the past and the future, respectively. Thus each child and adult received a specific score and a general score for past events and a specific score and a general score for future events. In spite of the parallels in method and coding, there was one notable difference between the two studies. Children in the current study verbally reported the events, as appropriate for this age group, and adults in Wang et al. (2011) provided written responses, a common method in adult research of episodic thinking (Arnold et al., 2011; D’Argembeau & Van der Linden, 2004, 2006; Wang & Ross, 2005). Children thus produced lengthier narratives than those of adults. Nevertheless, this difference did not affect the test of the hypothesis that children would draw on more general knowledge relative to episodic information in mental time travel when compared with adults. To test the hypothesis, the ratio of general to specific scores for past and future events was calculated, respectively, for each child and adult and was submitted to analysis (see additional discussion in the “Results” section).
RESULTS

Preliminary Analyses

Two 2 (culture) × 2 (gender) analyses of variance (ANOVAs) showed no cultural or gender differences in relational memory (EA, $M = 20.69$, $SD = 6.24$; CI, $M = 22.08$, $SD = 5.08$; girls, $M = 20.81$, $SD = 6.08$; boys, $M = 21.91$, $SD = 5.35$) or verbal skills (EA, $M = 68.49$, $SD = 11.21$; CI, $M = 66.86$, $SD = 11.86$; girls, $M = 69.19$, $SD = 11.62$; boys, $M = 66.14$, $SD = 11.25$), $F(1, 161) < 2.65$, $p > .11$, $d < .26$. Age was correlated with relational memory ($r = .29$, $p < .0001$) and verbal skills ($r = .15$, $p = .05$), whereas relational memory and verbal skills were uncorrelated ($r = .07$, $ns$). Analyses with and without the three CI children who were interviewed in Chinese showed identical patterns of results. We therefore present results based on data of all children.

Additional 2 (culture) × 2 (gender) ANOVAs showed that EA children ($M = 163.92$, $SD = 137.73$; $M = 121.86$, $SD = 91.24$) provided lengthier event descriptions than did CI children ($M = 114.57$, $SD = 77.07$; $M = 85.63$, $SD = 68.79$) for both the past, $F(1, 162) = 6.94$, $p = .009$, $d = 0.41$, and the future, $F(1, 160) = 7.29$, $p = .008$, $d = 0.43$, as indexed by the average number of words per event. Girls ($M = 163.09$, $SD = 136.68$; $M = 122.94$, $SD = 98.71$) provided lengthier event descriptions than did boys ($M = 116.08$, $SD = 80.80$; $M = 84.93$, $SD = 56.40$) for both the past, $F(1, 162) = 6.06$, $p = .01$, $d = 0.39$, and the future, $F(1, 160) = 7.96$, $p = .005$, $d = 0.45$. Event length was correlated with both specific ($rs = .81--.92$, $ps < .0001$) and general details ($rs = .56--.80$, $ps < .0001$) across past and future events.

Notably, there is always the question of whether to analyze frequencies or proportions in data such as these. Prior research on episodic thinking in children and adults has focused on frequency (Addis et al., 2008; Fivush, 1998; Levine et al., 2002; Wang, 2004). As discussed in the introduction, the number of event-specific details is, in and of itself, a theoretically important variable that indexes episodic specificity. On the other hand, although frequency addresses the question of how much detail children produce in remembering past events and imagining future ones, proportion addresses the question of to what extent children rely on general knowledge relative to episodic information in event construction. Consider the following example: Child A generated an event with one specific detail and one general detail, and Child B generated an event with five specific details and five general details. Obviously, the mental time travel of Child B involves richer re-experience of the past or pre-experience of the future (i.e., greater episodic specificity) than that of Child A, although the two children relied to the same degree on general knowledge in event construction (general-to-specific ratio = 1). The different questions addressed by frequency and proportion are equally important for understanding the development of episodic thinking.

When comparing children’s and adults’ responses, given the developmental differences between children and adults in general cognitive-linguistic abilities pertaining to episodic thinking (Bauer, 2007), the question of interest is not the sheer amount of detail each group can produce but the relative roles of general knowledge and episodic information in event construction across age groups. Proportion is therefore more informative for the adult–child comparison.

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2Among the CI children, Chinese verbal skills ($M = 54.35$, $SD = 17.14$) were not correlated with specific details ($rs = -.09$ to .16, $ns$), general details ($rs = -.09$ to .12, $ns$), or general-to-specific ratio scores ($rs = -.19$ to .15, $ns$).
In the following sections, we first examined children’s responses in both frequencies and proportions. We then compared children’s and adults’ responses, analyzing general-to-specific ratio scores for past and future events from the current study and from Wang et al. (2011).

Analyses of Frequencies of Children’s Responses

We conducted a 2 (culture: EA vs. CI) × 2 (gender: girls vs. boys) × 2 (direction: past vs. future) × 2 (distance: near vs. distant) × 2 (detail: specific vs. general) mixed-model analysis using the SAS PROC MIXED program (Singer, 1998), with culture and gender being between-subject factors, direction, distance, and detail being within-subject factors, and subject being a random factor. The model included all main effects and up to three-way interactions. Children’s age, relational memory, and verbal skills were included in the model as covariates. Figure 1 illustrates the mean number of specific and general details as a function of culture, temporal direction, and temporal distance.

A main effect of culture emerged, \( F(1, 157) = 5.41, p = .02, \Delta R^2 = .07 \), qualified by a Culture × Distance interaction, \( F(1, 1076) = 4.43, p = .04, \Delta R^2 = .007 \). Follow-up Tukey honest significant difference (HSD) tests \( (p < .05) \) showed that EA children produced more specific and general details than did CI children for both temporally near events (least squares mean (LSM) difference = 3.64) and distant events (LSM difference = 1.27), although the cultural difference was significant only for the near events. This pattern was consistent between past and future events; that is, there were no interactions involving temporal direction.

There was also a gender effect, \( F(1, 157) = 8.45, p = .004, \Delta R^2 = .08 \), qualified by a Culture × Gender interaction, \( F(1, 157) = 4.79, p = .03, \Delta R^2 = .03 \), a Gender × Distance interaction, \( F(1, 1076) = 4.14, p = .04, \Delta R^2 = .006 \), a Gender × Detail interaction, \( F(1, 1076) = 7.31, p = .007, \Delta R^2 = .02 \), a Culture × Gender × Distance interaction, \( F(1, 1076) = 4.03, p = .04, \Delta R^2 = .003 \), and a Culture × Gender × Detail interaction, \( F(1, 1076) = 11.31, p = .001, \Delta R^2 = .009 \). Follow-up Tukey HSD tests \( (p < .05) \) showed that EA girls produced more specific details than did EA boys for temporally close events (LSM difference = 12.28). There was no significant gender difference among CI children, for distant events, or for general details. This pattern was consistent across past and future events; that is, there were no interactions involving temporal direction.

Furthermore, a significant main effect of direction emerged, \( F(1, 1076) = 40.56, p < .0001, \Delta R^2 = .09 \), qualified by a Direction × Detail interaction, \( F(1, 1076) = 54.01, p < .0001, \Delta R^2 = .05 \), and a Direction × Distance × Detail interaction, \( F(1, 1076) = 4.84, p = .03, \Delta R^2 = .004 \). Tukey HSD tests \( (p < .05) \) confirmed that children reported more specific details in past events than in future events, with the difference being larger for near events (LSM difference = 9.97) than for distant events (LSM difference = 5.46). General details remained similar across temporal directions and temporal distances. Figure 2 illustrates the number of specific and general details as a function of temporal direction and temporal distance. In addition, the analysis revealed a significant distance effect, \( F(1, 1076) = 42.90, p < .0001, \Delta R^2 = .07 \), a detail effect, \( F(1, 1076) = 416.56, p < .0001, \Delta R^2 = .33 \), and a Distance × Detail interaction, \( F(1, 1076) = 22.09, p < .0001, \Delta R^2 = .02 \). Tukey HSD tests \( (p < .05) \) confirmed that children reported more specific details for near events than for distant events (LSM difference = 6.33), whereas the number of

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3 Analyses were also conducted on frequencies with event length as a covariate. The results were consistent with those from analyses of proportions.
general details did not differ across temporal distances. In general, children reported significantly more specific than general details for both past and future events. Age, relational memory, and verbal skills were not significant covariates.

To examine the relation between specificity of past and future events at the individual level, partial correlations were calculated between past- and future-detail scores averaged across the two temporal distances, controlling for culture and gender. Children who recalled more specific details in the past events also generated more specific details when imagining the future events ($r = .50$, $p < .0001$), and those who included more general details in the past events also included more general details in the future events ($r = .35$, $p < .0001$). These partial correlations between

![FIGURE 1](image1.png)

**FIGURE 1** Mean number of specific and general details as a function of culture, temporal direction, and temporal distance. Error bars represent standard errors of the means.

![FIGURE 2](image2.png)

**FIGURE 2** Mean number of specific and general details as a function of temporal direction and temporal distance. Error bars represent standard errors of the means.
past- and future-event details were comparable to those in Wang et al. (2011) controlling for culture and gender (specific details, $r = .57$, $p < .0001$; general details, $r = .21$, $p = .003$). Furthermore, children’s specific and general detail scores were positively correlated for both past ($r = .61$, $p < .0001$) and future events ($r = .24$, $p = .003$). In contrast, adults’ responses in Wang et al. (2011) exhibited a negative correlation between specific and general details for past events ($r = -.21$, $p = .002$) and no correlation for future events ($r = -.05$, $ns$). A similar negative association or no correlation between specific and general details has also been found in Addis et al. (2008) with young and older adults. Age, relational memory, and verbal skills were not correlated with any of the detail scores ($rs < .10$, $ns$).

Analyses of Proportions of Children’s Responses

Next, we analyzed proportions to test the extent to which children focused on general relative to specific details when recalling past events and imagining future events. For each past or future event children provided, a general-to-specific ratio score was calculated. We then conducted a 2 (culture, EA vs. CI) × 2 (gender, girls vs. boys) × 2 (direction, past vs. future) × 2 (distance, near vs. distant) mixed-model analysis on the ratio scores, with culture and gender being between-subject factors, direction and distance being within-subject factors, and subject being a random factor. The model included all main effects and up to three-way interactions, as well as children’s age, relational memory, and verbal skills as covariates.

A significant main effect of direction emerged, $F(1, 437) = 28.22$, $p < .0001$, $\Delta R^2 = .04$. In both cultures, children reported more general relative to specific details in future events than in past events. In addition, the analysis yielded a significant main effect of temporal distance, $F(1, 437) = 8.43$, $p = .004$, $\Delta R^2 = .01$, whereby children reported more general relative to specific details in distant events than in near events. There were no significant effects pertaining to culture or gender. Child age, relational memory, and verbal skills were not significant covariates. Figure 3 illustrates the mean general-to-specific ratio as a function of temporal direction, temporal distance, and culture.

Comparing Episodic Thinking in Children and Adults

Finally, we examined the extent to which children drew on general relative to episodic information when recalling past events and imagining future events, in comparison to adults in Wang et al. (2011). The ratios of mean general to specific detail scores for past and future events were submitted to analysis. A repeated-measures analysis with group (child vs. adult) and culture (EA vs. CI) as between-subject factors and temporal direction (past vs. future) as a within-subject factor yielded a significant main effect of group, $F(1, 336) = 124.73$, $p < .0001$, $\eta^2_p = .27$, qualified by a Group × Culture interaction, $F(1, 336) = 8.74$, $p = .003$, $\eta^2_p = .03$, and a Group × Culture × Direction interaction, $F(1, 336) = 3.99$, $p = .05$, $\eta^2_p = .01$. Further focused analyses indicated that in both cultures, children represented past and future events in more general relative to specific details than did adults: EA, past $t(174) = 9.21$, $p < .0001$, $d = 1.40$, and future $t(176) = 7.07$, $p < .0001$, $d = 1.07$; CI, past $t(184) = 6.49$, $p < .0001$, $d = 0.96$, and future $t(170) = 5.55$, $p < .0001$, $d = 0.85$. The age-group differences were more pronounced for EA than they were for CI and were more pronounced for future events than for past events (Tukey HSD tests,
p < .05; EA, past LSM difference = 0.21, and future LSM difference = 0.59; CI, past LSM difference = 0.14, and future LSM difference = 0.33). Figure 4 illustrates the mean general-to-specific ratio as a function of age group, temporal direction, and culture.
In addition, a main effect of temporal direction emerged, \( F(1, 336) = 37.08, p < .0001, \eta_p^2 = .10 \), qualified by a Group \( \times \) Direction interaction, \( F(1, 336) = 29.32, p < .0001, \eta_p^2 = .08 \). Although adults drew on general knowledge relative to episodic information in a similar manner when constructing past and future events, \( F(1, 192) = 1.63, p = .20, \eta_p^2 = .01 \), children reported more general relative to specific details when imagining the future than when remembering the past, \( F(1, 146) = 28.60, p < .0001, \eta_p^2 = .16 \).

**DISCUSSION**

To the best of our knowledge, this is the first study to examine episodic future thinking in middle childhood, in relation to children’s episodic memory. It is also the first cross-cultural study to examine this topic among children. Furthermore, the comparison between child and adult data provides valuable information concerning the development of past and future episodic thinking beyond the preschool years.

The parallel between past- and future-event construction was evident at both group and individual levels. Consistent with adult data (Wang et al., 2011) as well as previous studies of autobiographical memory development (Han et al., 1998; Wang, 2004, 2006, 2007), EA children produced more specific details than did their CI peers for both past and future events, with the difference particularly pronounced for temporally close events. Thus, in line with the constructive-episodic-simulation hypothesis (Addis et al., 2008; Suddendorf & Corballis, 1997), EA children remember their past experiences in richer episodic details, which they can then extract, combine, and recombine to simulate potential future events. As a result, they are able to produce more detailed future events than are CI children.

The cultural differences in past and future episodic thinking may stem from different cultural beliefs and socialization practices. EA culture prioritizes autonomy and individuality. Detailed memories of personal experiences and plans for the future may highlight one’s uniqueness and thus facilitate the development of individuality and a personal identity. Accordingly, EA parents often engage in elaborative conversations with their young children about past experiences and future planning. They frequently supplement rich embellished information about the event under discussion and assist children in constructing detailed and coherent narratives of the past and future (Hudson, 2006; Nelson & Fivush, 2004). Such conversations model for children how to represent and reinstate personal event information in linguistic forms, provide children with an organizational framework to structure the information, help children understand and use temporal concepts, and highlight to children the personal significance of their experiences (Fivush, Reese, & Haden, 2006). Consequently, they have been shown to directly facilitate children’s abilities to represent details of personal events (e.g., Fivush et al., 2006; Harley & Reese, 1999; Hudson, 2006; Jack, MacDonald, Reese, & Hayne, 2009). In contrast, Chinese culture places a primary emphasis on social harmony and interrelatedness. Detailed personal memories and future plans may signal excessive focus on the self, which is incongruent with the cultural norms. When discussing the past and future with their young children, Chinese parents tend not to focus on details of the event but emphasize rules and behavioral expectations (Koh & Wang, 2011; Wang, 2001b; Wang & Fivush, 2005). Such low-elaborative conversations partly explain the lower episodic specificity in CI children than in EA children (Wang, 2006, 2007).

Gender differences emerged in the EA group, whereby for both the past and the future, girls produced more specific details than did boys for temporally close events. There was no
significant gender difference among CI children. Similarly, in prior cross-cultural studies, although gender differences in episodic specificity favoring women have been observed in both EA and CI samples (Wang, 2001a, 2009a; Wang et al., 2011), there are variations in magnitude such that the differences are sometimes more prominent among EAs (Han et al., 1998) and sometimes more prominent among CIs (Wang, 2001a). In both cultural contexts, there exist gendered ideologies and practices where women and girls often share intimate details of past experiences and future dreams for social bonding. Having elaborate personal stories meets the gendered expectation. When sharing memories with their young children, parents in both cultures often try to elicit greater interest in girls and talk in more detailed and elaborate ways with girls than with boys (Bauer, 2007; Fivush, 1998; Wang, Leichtman, & Davies, 2000). Gender differences in episodic memory in favor of women may reflect this interactive history (Davis, 1999; Mullen, 1994; Wang, 2001b). Variations in memory-sharing practices for boys and girls may be translated into parent–child future talk and further shape children’s episodic future thinking. Notably, although the existence of gender differences in episodic thinking may reflect gendered experiences and socialization, it may also be a function of different cognitive characteristics between males and females (e.g., visuospatial vs. verbal processing; Herlitz & Rehnman, 2008). Further research is clearly needed to delineate the causes.

At the individual level, children who recalled past events with more specific details also produced future events with more specific details, and children who included more general details in the past events also included more general details in the future events, independent of culture and gender. This is consistent with previous findings with preschool children and adults (Addis et al., 2008; Atance, 2008; D’Argembeau & Van der Linden, 2006), suggesting that episodic specificity is a common factor in memory construction and future simulation. Individual differences in episodic specificity may stem from a variety of factors, such as emotion regulation and visual imagery (D’Argembeau & Van der Linden, 2006), which can influence the processes in which children attend to and encode information, use cues and resources in memory search, and construct events to reflect their goals and motivations. Further developmental research is required to examine the specific mechanisms underlying past- and future-event construction.

In spite of the parallel between past and future episodic thinking at both group and individual levels, differences also emerged. Just like adults (Addis et al., 2008; D’Argembeau & Van der Linden, 2004, 2006; Wang et al., 2011), children represented past events in greater specific detail than they represented future events. The simulation of future events entails additional cognitive and neural processes in mentally projecting into the future, generating and extracting elements from memories, and integrating them to form plausible future scenarios (Addis et al., 2007). Consequently, representations of future events are less elaborate or detailed than are representations of past events. Furthermore, children utilized more general relative to specific details in the construction of future events than they did in the construction of past events. This finding supports the theoretical notion that compared with remembering, future episodic thinking requires more intensive constructive processes and therefore may rely on, to a greater extent, semantic or general information to guide event simulation (D’Argembeau & Mathy, 2011). Interestingly, the greater reliance on general knowledge in constructing future events compared with past events is also evident in parent–child conversations. Hudson (2002) observed that when talking about the past, 18% of maternal utterances referred to general event knowledge (e.g., “What do we do at the library?”), in contrast to 40% when discussing the future. Such general references were found to facilitate preschoolers’ ability to contribute to conversations...
about future events (Hudson, 2006). To link parent–child conversations of past and future events to children’s independent event construction during middle childhood would be a fruitful area for future research.

Furthermore, consistent with adult data (Addis et al., 2008; Arnold et al., 2011; D’Argembeau & Van der Linden, 2004; Wang et al., 2011), children in our study represented temporally near events in greater specific detail than they represented distant events. Given the forgetting function, information of near-past events is generally more richly represented and more readily accessible than information of distant events (Bauer, 2007). The rich details of near-past events may be further used to construct near-future events, given that they are likely modulated by similar schemas, goals, and motivations in relation to the current self (Conway & Pleydell-Pearce, 2000). In contrast, there may be fewer details from past experiences available in the simulation of distant, and oftentimes unfamiliar, future events. In addition, in line with the theoretical prediction that temporally distant events tend to be more abstract and decontextualized than near events (Trope & Liberman, 2003), children represented distant events in more general relative to specific details than they represented near events.

In contrast to specific details, the sheer amount of general detail remained relatively constant across temporal directions and temporal distances, consistent with findings of adults (Addis et al., 2008; D’Argembeau & Van der Linden, 2006; Wang et al., 2011). Semantic and other non-event-specific information may modulate the sampling and recombining of relevant episodic details, provide a conceptual framework to organize those details, and further supplement a contextual background for interpreting the generated event (D’Argembeau & Mathy, 2011; Szpunar, 2010). General knowledge is therefore necessarily involved in mental time travel. Furthermore, the degree to which individuals rely on general knowledge in mental time travel may be a function of basic neurocognitive processes (e.g., memory consolidation, information binding) that are likely to change with age and remain unsusceptible to sociocultural influences (Addis et al., 2007; Bauer, 2007). Indeed, there were no cultural or gender differences in reporting general relative to specific details in the current study.

On the other hand, developmental differences emerged in general-to-specific ratio scores. Although children produced considerably more specific than general details for both past and future events, they were more likely than adults to draw on general knowledge relative to episodic information when remembering the past and imagining the future, regardless of culture. The developmental differences were particularly pronounced for future events, the construction of which is more cognitively demanding and requires additional generative processes (Addis et al., 2007; D’Argembeau & Mathy, 2011; Gamboz et al., 2010). The fact that there were no cultural or gender differences but only age-group differences in general-to-specific ratio scores suggests again that the relative reliance on general knowledge in mental time travel may reflect basic neurocognitive processes independent of sociocultural influences. In line with this suggestion, aging is found to be associated with a greater reliance on general information in mental time travel, as a result of decline in cognitive functioning and neural processing (Addis et al., 2008; Levine et al., 2002). The current findings support the theoretical notion that general knowledge plays a greater role in guiding young children’s mental time travel (Atance, 2008; Bauer, 2007), and it appears to continue to do so during middle childhood.

Another important developmental difference concerns the relationship between specific and general details. For children in our study, specific and general detail scores were positively correlated for both past and future events, and this was true at both individual and group
levels: Children who provided more specific details in their event construction also provided more general details, and EA children provided both more specific and general details than did CI children. In contrast, for adults in previous studies (Addis et al., 2008; Wang et al., 2011), specific and general detail scores were either negatively correlated or uncorrelated at both the individual and group levels. In other words, adults who provide more specific details in past or future events tend to include either fewer or no more general details in these events. This developmental difference may further indicate the greater role of general knowledge in children’s episodic thinking: To generate more specific details, more general details are required. It may also suggest that specific and general details are less differentiated among children than they are among adults. Children’s event construction may be driven by general production such that specific and general details go hand in hand among children who produce lengthier narratives. The episodic system that supports mental time travel, although having been well established by the end of the preschool years (Atance, 2008; Bauer, 2007; Perner, 2001), may continue to develop into young adulthood so that individuals increasingly rely less on general knowledge and focus more on episodic details that allow them to re-experience the past and pre-experience the future.

Interestingly, there were no age differences in children’s past- and future-event construction across this middle childhood sample. This is consistent with general developmental literature suggesting that middle childhood is a relatively stable period prior to a large developmental spurt in adolescence (Cole et al., 2005). Although research has shown social-cognitive growth during middle childhood that may facilitate mental time travel (Friedman & Lyon, 2005; Harter, 1999; Van Abbema & Bauer, 2005), the changes may be too incremental to produce marked age differences until the shift in adolescence. Children’s verbal skills were not related to their event production, which suggests that the interview questions were within the linguistic competence of children at this age range. In addition, relational memory was uncorrelated with the number of specific details in either past or future events provided by children. This result differs from findings of older adults by Addis and colleagues (2008). It is not clear based on extant data whether relational processing, as measured by the relational memory task, functions in event construction only among older adults, or if it plays an increasing role as children reach adolescence and young adulthood. Further research, particularly longitudinal research, is needed.

There are some important limitations to the current study. We did not have a preschool sample that would otherwise allow us to examine the developmental trajectories of episodic thinking from preschool to middle childhood. Also, although the adult data from Wang et al. (2011) provided us with an opportunity for comparison between children’s and adults’ episodic thinking, they were not collected specifically for the current study. Future cross-sectional as well as longitudinal studies will be required to further enrich the current understanding of the development of episodic thinking. In addition, pertaining to cultural and gender differences, there is evidence that EAs exhibit greater episodic specificity than do Asians when remembering story materials (Wang, 2009a, 2009b; Wang & Ross, 2005) and that women outperform men on a variety of episodic memory tasks (Bauer, 2007; Herlitz & Rehnman, 2008). Nevertheless, it will be informative to conduct additional controlled laboratory research of event construction as well as contextually embedded tests with items such as words, photos, and objects in real-life settings. Such research will allow us to further examine whether individual and group differences in remembering and simulating personal events are also evident in other episodic memory tasks and episodic future-thinking tasks and to test the mechanisms underlying the differences.
In summary, past and future episodic thinking continues to develop during middle childhood and well into young adulthood. Children of middle childhood exhibit both similarities to and differences from adults in the construction of past experiences and envisioning of future episodes. Furthermore, although human beings are all equipped with the capacity of mental time travel, the prominence, accessibility, or actual usage of the capacity is likely a result of functional adaptation to specific cultural and gendered ideologies and the associated socialization practices. The development of mental time-travel ability may thus reflect the interaction between cognitive-neurological growth and sociocultural influences, a process contributing to both universality and diversity among individuals and across groups.

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