Infant and Child Development
Inf. Child. Dev. **26**: e1963 (2017)
Published online 24 February 2016 in Wiley Online Library
(wileyonlinelibrary.com). DOI: 10.1002/icd.1963

Young Children's Reports of When Events Occurred: Do Event Type and Assessment Method Matter?

Connie M. Tang*, Sarah Dickey and Dana Samuelsen
Stockton University, Galloway, NJ USA

Studying young children's reporting about when various events occurred informs about the development of episodic memory and metacognition. In two experiments, 55 3- to 5-year-old children participated in two activity sessions, a week apart. During the activity sessions, they learned novel animal facts and body movements, and they coloured animal pictures and posed for body movement photos. Immediately after the second activity session, children were interviewed about when they experienced the various events. Overall, children were as accurate about learning events as physical events, but they were more accurate when asked temporal distance (e.g. 'Which did you learn a longer time ago, "X" or "Y"?') than temporal location questions (e.g. 'Which did you learn before today, "X" or "Y"?'). The results suggest that young children's apparent difficulty recognizing new learning is not due to a rapid 'remember-to-know shift'. Rather, the way we ask young children about when they experienced various events determines their accuracy. Copyright © 2016 John Wiley & Sons, Ltd.

Key words: young children; episodic memory; knowledge acquisition; metacognition

Young children learn many new things as they grow and mature. Are they aware that they have just learned something new, thus attuned to the transitions in their knowledge? It would seem that young children experience a lot of difficulty reporting when learning events occurred. For example, Taylor, Esbensen, and Bennett (1994) reported several experiments in which 4- and 5-year-olds were taught, among other things, that the reason tigers' stripes go up and down is to provide them with camouflage. Immediately after the learning episodes, children were asked whether they had known the information for a long time or if they had just learned the information that day. A majority of the 4- and 5-year-olds reported

*Correspondence to: Connie M. Tang, Department of Psychology, Stockton University, 101 Vera King Farris Dr., Galloway, NJ 08205, USA. E-mail: connie.tang@stockton.edu

that they had known the new knowledge for a long time. This pattern of response was elicited across a variety of learning events.

Following this initial research, Esbensen, Taylor, and Stoess (1997) investigated the possibility that children recognized learning events better when the events involved behaviours as opposed to facts. In two experiments, Esbensen and colleagues taught 4- and 5-year-old children a variety of new facts and behaviours. For example, they taught children the fact that 'grambees (a made-up animal that was green with a seal-like head and amoeba-like body) eat grass' and the behaviour of 'zwibbing' (an invented body movement involving standing with feet slightly apart, bending over, and twisting the body to reach for the floor behind one's heels). After fact or behaviour was taught, children were asked whether they had known the knowledge for a long time or a short time, and whether they knew the knowledge 'yesterday'. As it turned out, children recognized behavioural learning more easily than factual learning, although children of this age range exhibited a general difficulty recognizing that they had just learned something new: The majority of 4- and 5-year-olds failed to do this in Esbensen et al. (1997).

Even though preschool children do not seem to recognize that they just learned something new, their reporting about when they just physically obtained something new is more accurate. For example, in the fourth experiment, Taylor et al. (1994) gave children a variety of stickers during the testing session: Nearly all (90%) of the children correctly reported to have just received the stickers (in response to questions such as 'Have you had that sticker for a long time or did you get it today?'). Taylor and colleagues thus concluded that preschool children were able to report when a physical event occurred. Of course, if children have difficulty understanding the questions asked of them [as in the second experiment of Esbensen et al. (1997)], they can have problems recognizing even physical events. In the second experiment, Esbensen et al. (1997) gave children small gifts such as stickers and toy dinosaurs at the same time when children were taught new knowledge. Since children in that experiment appeared not to understand the entire line of questioning, they answered the questions in a random fashion, failing to recognize even when they received the small gifts.

Using a similar research paradigm, Tang, Bartsch, and Nunez (2007) gave young children stickers as they taught children new knowledge. When reporting on a sticker that was given to them just a few minutes ago ('Did you have the seashell sticker yesterday?'), 4-, 5-, and 6-year-olds were 71%, 88%, and 91% correct (when they said 'no' to the above question). Also, in Tang and Bartsch's (2012) Experiment 2, when asked about when they received a small present that was given to them a few minutes ago ('Did you have the play dough yesterday?'), 4- and 5-year-old children were 70% correct (when they responded 'no' to the question).

Taken together, the research by Taylor et al. (1994), Esbensen et al. (1997), Tang et al. (2007), and Tang and Bartsch (2012) indicated that depending on the questions asked, preschool children can perform near ceiling, at chance, or better than chance when reporting when a physical event occurred. Overall then, young children have some difficulty recognizing that a physical event just occurred, even though they appear to have even more difficulty recognizing that a learning event just occurred.

Young children's reporting about the timing of learning and physical events reflects their source monitoring skills. Source monitoring is a metacognitive skill that enables people to think about the context of their learning experience, such as who imparted knowledge, how, when, where, and why information was learned, etc. (e.g. Gopnik & Graf, 1988; Johnson, Hashtroudi, & Lindsay, 1993). Source

DOI: 10.1002/icd

monitoring abilities appear to improve steadily between early and middle childhood, so that by age 10, children can perform as well as adults on many source monitoring tasks (Earhart & Roberts, 2014). Much investigation on the development of source monitoring skills involved young children (e.g. Kondo, 2011; Kovacs & Newcombe, 2006; Robinson, 2000; Thierry, 2009). Hala, Brown, McKay, and San Juan (2013) even worked with 2½-year-olds and uncovered these very young children's competency in source monitoring using a simple action-based task, i.e. identifying who put items (apples, flowers, shovel, watering can, etc.) in a model farm, themselves or the experimenter. As pointed out by Roberts (2002), the development of source monitoring skills in children follows an uneven path: Children demonstrate earlier competency in some aspects (e.g. distinguishing actions performed by self or others, reporting when behavioural learning took place) than other aspects (e.g. differentiating between real and imagined actions, recognizing that factual learning occurred). Overall then, children show at least a rudimentary level of source monitoring ability during the preschool years.

In addition to source monitoring, the distinction between physical and learning events also relates to our episodic (i.e. concrete, specific memory that is linked to personal time and space) and semantic (i.e. our general knowledge base) memory systems (Tulving, 1972, 1976, 2002). Whereas episodic memory refers to memory for events, semantic memory refers to memory for facts: Both fall under the explicit/declarative memory system (Hayne, Gross, McNamee, Fitzgibbon, & Tustin, 2011). Infants as young as 6 months exhibit explicit/declarative memory (Hayne, 2004; Rovee-Collier, Hayne, & Colombo, 2001), but it is unclear whether these memories are episodic (Hayne et al., 2011), with some believing that they reflect semantic memory skills (Colombo & Hayne, 2010). Theorists for the most part agree that episodic memory emerges during the preschool years (Scarf, Gross, Colombo, & Hayne, 2013), although they diverge on the more specific age at which episodic memory first forms. Tulving (2005) believes that episodic memory does not emerge until 4 or 5 years of age, but other researchers (i.e. Hayne et al., 2011; Scarf et al., 2013; Suddendorf, Nielsen, & von Gehlen, 2011) uncovered evidence showing that this ability appears as early as 3 years of age.

Even though episodic memory can be embedded within semantic memory, with the passage of time, a 'remember-to-know shift' (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997, p. 408) often occurs. When this shift takes place, knowledge that was once connected to a learning episode becomes severed from its learning context and incorporated into the network of semantic memory. Whereas this 'remember-to-know shift' often happens to learning events, this shift arguably does not apply to physical events. What occurs to physical events is merely forgetting. Of course, forgetting happens to learning events as well. But could this unique 'remember-to-know shift' for learning events explain young children's particular difficulty placing learning events in time? Also, how soon after a learning event takes place would the 'remember-to-know shift' occur?

Before answering these questions, one needs to be sure that young children indeed place physical events in time more accurately than learning events. This might not be the case because past research was not designed to specifically investigate the distinction between learning and physical events. Consequently, the events themselves were different not just in regard to the aspect of learning (more internal) versus physical (more external) *per se*. Learning events often involved children learning novel animal facts or learning novel body actions. Physical events, on the other hand, were always used as controls (and sometimes serving as selection criteria) for the purpose of ensuring that young children understood

DOI: 10.1002/icd

the questions posed to them: They were frequently children receiving stickers or small presents. Therefore, there was almost nothing in common between the learning and physical events.

When there are such drastic differences between the learning and physical events in past research, it is unclear if young children's increased difficulty reporting about learning events is due to the internal nature of the learning events relative to the external nature of the physical events. It could very well be other idiosyncratic characteristics of the physical events that made them more memorable for children. For example, it is possible that receiving presents is an exciting and joyful event, thus more memorable. Also, when asked about when they received presents, children always had the presents right in their possession, rich in visual and tactile cues, which were absent from the learning events. To compare the learning versus physical aspect of events specifically, the two types of events need to be more carefully constructed so that they are as comparable as possible. The first purpose of the current research was to do just that, filling a void in extant research. This way, more light can be shed on the causes that underlie young children's difficulty recognizing new learning. This investigation can also inform on the inner workings of episodic and semantic memory processes (e.g. Howard & Kahana, 2002).

In addition to event type, the type of questions asked (or assessment method) has also been shown to make a difference in children's reporting about when an event occurred: The different assessment method used with children in Taylor et al. (1994); Esbensen et al. (1997); Tang et al. (2007), and Tang and Bartsch (2012) could have explained children's varied performances in their studies. Questions assessing young children's reporting about the time a past event occurred can be classified into two types: temporal location and temporal distance.

When investigating children's conceptions of time, Friedman (1991, 1992, 1993) has observed that at least one aspect of children's grasp of time may develop rather slowly. Specifically, Friedman (1991, 1992) found that an understanding of temporal *location*, that is, the understanding of time of day, days of the week, months, and years, and so forth, was much less developed in 4-year-olds than in 6- and 8-year-olds. In Friedman's (1992) experiments, 4-year-olds correctly reported when a 7-week-old event occurred with regard to the time of day, but could not place the event in terms of the day of the week, month, or season. Six- and 8-year-olds, in contrast, could additionally localize the event on the three longer time scales.

Friedman (1991, 1993) also contrasts the relatively slow development of children's understanding of temporal *location* with their faster acquisition of a grasp of temporal *distance*, that is, an awareness of the amount of time that has elapsed since the occurrence of an event. Friedman, Garner, and Zubin (1995) showed that children ranging from preschool to 6th-grade did not differ in their abilities to judge which event was longer ago, their birthday or Christmas, suggesting that an understanding of temporal distance is available in early childhood. Physiological evidence consistent with the suggestion that temporal location understanding has a slower developmental trajectory than temporal distance understanding also exists. Curran and Friedman (2003) showed that distance-based time processing in adults is less associated with frontal cortex activity than is location-based time processing. Given the relatively prolonged development associated with the frontal cortex area, this finding accords with the notion of slower development for temporal location understanding.

Utilizing the above framework developed by Friedman and colleagues, Tang et al. (2007) and Tang and Bartsch (2012) compared young children's reporting

DOI: 10.1002/icd

of when learning events occurred using questions assessing the understanding of temporal location (e.g. 'Did you know X yesterday?') and temporal distance (e.g. 'Which have you known about longer, X or Y?'). In Tang et al. (2007) and Tang and Bartsch's (2012) Experiment 2, young children did significantly better responding to temporal distance questions than temporal location questions. In Tang et al. (2007), 81% of the 4-, 5-, and 6-year-olds were correct under the temporal distance assessment, whereas they were 44% correct with the temporal location assessment. In Tang and Bartsch's (2012) Experiment 2, 4- and 5-year-old children were 83% correct responding to temporal distance questions, but only 35% correct responding to temporal location questions.

Nonetheless, it is also premature to draw the conclusion that temporal distance assessment is better than temporal location assessment in eliciting correct responses from young children regarding their own learning. This is due to the fact that in both Tang et al. (2007) and Tang and Bartsch (2012), the type of temporal assessment was confounded by question frame, such that temporal location was assessed using yes/no questions, but temporal distance was asked with forced-choice questions. Young children may simply perform better with forced-choice questions than with yes/no questions. In both Siegal and Peterson (1998) and Peterson and Grant (2001), 3- to 5-year-old children performed better with forced-choice questions than with yes/no questions. Therefore, the confounding variable of question frame needs to be controlled for in order to know with more certainty that temporal distance assessment works better with young children than temporal location assessment. This was therefore the second goal of the current research.

To recapitulate, the goals of our research were twofold: First, assess the influence of event type on young children's reporting about when events occurred. Based on past research (e.g. Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994) showing young children's general difficulty recognizing new learning and less difficulty recognizing that they just physically obtained something new, we predict that young children will have a harder time reporting when learning events occurred than when physical events occurred. Second, controlling for question frame so that all questions are posed in the forced-choice format, we hypothesize that temporal distance assessment will be better than temporal location assessment in eliciting correct responses from children. The second hypothesis follows from the research of Friedman (1991, 1992, 1993), Friedman, Gardner, and Zubin (1995), Tang et al. (2007), and Tang and Bartsch (2012).

EXPERIMENT 1

Method

Participants

We recruited 26 3- to 5-year-old children ($M = 48.15$ months, range = 37–62; 12 boys) from the preschool affiliated with a rural public liberal arts college in the East coast of the United States. They were mostly children of the students, staff, and faculty at the college and were predominantly White and middle-class. All parents provided informed consent, and children also verbally assented.

Materials and procedure

The study procedure involved three distinct steps, with the first activity session occurring 1 week before the second activity session and the interview session. Materials used in each of the steps were described below in turn.

DOI: 10.1002/icd

First activity session

Three experimenters interacted with small groups of three to five children each time in a quiet room at the preschool. After introducing themselves, the experimenters proceeded first to teach (learning event) children the fictional animal fact of ‘grambees eat grass’, first used by Esbensen et al. (1997). One experimenter showed children a laminated 8½ × 11 in. white poster with a coloured line drawing of a grambee and said:

> Do you know what grambees eat? Well. Grambees eat grass. Look. This is a grambee (the experimenter pointed to the grambee). Grambees are green in color and have a head that looks like a seal’s. They have a large body but have no arms or legs. Grambees eat grass. So now do you know what grambees eat? That’s right (after ensuring that children learned)!

The same experimenter then proceeded to give (physical event) each child a green crayon and an 8½ × 11 in. paper with a black-and-white grambee line drawing: The child’s first name had already been pre-written on the top margin of the paper. The experimenter said to the children: ‘Now you have one minute to color a grambee picture’. As each child turned in the coloured grambee paper, he or she was asked: ‘So one last time: What do grambees eat? Very good (after child gave the correct answer)!’

To teach (learning event) children how to zwib (an invented body movement first used by Esbensen et al., 1997), the second experimenter said:

> Do you know how to zwib? Well, you can zwib with us. To zwib, you stand with feet slightly apart (all three experimenters demonstrated). You then bend over, and twist to the left to reach for the floor behind your heels. Let’s zwib together again: Feet apart, bend over, and twist. So now do you know how to zwib? Show us (if child did not spontaneously demonstrate). That’s right (after child correctly displayed the body movement)!

Next, the third experimenter asked (physical event) each child to zwib and hold the pose for a Polaroid photo. After the photo developed, the experimenter wrote down the child’s first name on the top border of the photo. As each child examined and turned in his or her Polaroid zwib photo, the third experimenter asked: ‘So one last time: How do you zwib? Very good (after child showed the correct body movement)!’

Second activity session

A week later, three different experimenters went to the preschool to work with children in the same small groups and in the same room as in the first activity session. After introducing themselves, the experimenters proceeded to teach (learning event) children the fictional animal fact of ‘wugs sleep in the sand’ (first used in Tang et al., 2007). As in the previous week, the first of the three experimenters presented children a laminated 8½ × 11 in. white poster with a coloured line drawing of a wug and stated:

> Do you know where wugs sleep? Well. Wugs sleep in the sand. Look. This is a wug (the experimenter pointed to the wug). Wugs are orange in colour and have a head that looks like a bird’s. They have a diamond-shaped body and four legs. Wugs sleep in the sand. So now do you know where wugs sleep? That’s right (after ensuring that children learned)!

Next, the first experimenter gave (physical event) each child an 8½ × 11 in. paper with a black-and-white wug line drawing to be coloured with an orange crayon:

DOI: 10.1002/icd

The child's first name had already been pre-written on the top margin of the paper. The experimenter told the children: 'Now you have one minute to color a wug picture'. As each child turned in the coloured wug paper, he or she was asked: 'So one last time: Where do wugs sleep? Very good (after child gave the correct answer)!'

To teach (learning event) children how to hink (a made-up body movement first used in Esbensen et al., 1997), the second experimenter said:

> Do you know how to hink? Well, you can hink with us. To hink, you stand with feet together (all three experimenters demonstrated). You then lift your right leg out to the side with your knee and ankle bent, and hold this position for a moment. Let's hink together again: Feet together, lift your leg, and hold. So now do you know how to hink? Show us (if children failed to demonstrate at this point). That's right (after child correctly displayed the body movement)!

Right after, each child was asked (physical event) to hink and hold the pose for the third experimenter to take a Polaroid photo. After the photo developed, the experimenter wrote down the child's first name on the top border of the photo. As each child examined and turned in his or her Polaroid hink photo, the third experimenter asked 'So one last time: How do you hink? Very good (after child showed the correct body movement)!'

Interview session

A few minutes after the second activity session, children were interviewed individually by an experimenter who did not appear in either of the two activity sessions. After greeting each child, the interviewer said 'I am talking to children to see how well they can remember things. I have a few questions to ask you. Is that okay?'

After the child assented, the interviewer followed an interview script that contained 12 questions, eight of them being key questions, using the two animal posters, the two crayoned animal pictures, and the child's two Polaroid photos as props. The interviewer also demonstrated the two body movements herself as each body movement was mentioned in her questions.

Four questions were asked to establish a natural lead into the relevant key questions. They were 'So, what do grambees eat?', 'So, where do wugs sleep?', 'So, how do you zwib?', and 'So, how do you hink?'. After either the two animal questions or the two behaviour questions were asked, four key questions about either the animals or the behaviours followed.

Regardless of the child's answer, the interviewer proceeded to ask the following eight (four about the animals and four about the behaviours) key questions: 'Which did you learn before today, "grambees eat grass" or "wugs sleep in the sand"?' (Learning-Location), 'Which did you color before today, the grambee picture or the wug picture?' (Physical-Location), 'Which did you learn a longer time ago, "grambees eat grass" or "wugs sleep in the sand"?' (Learning-Distance), 'Which did you color a longer time ago, the grambee picture or the wug picture?' (Physical-Distance), 'Which did you learn before today, how to zwib or how to hink?' (Learning-Location), 'Which did you pose for before today, the zwib photo or the hink photo?' (Physical-Location), 'Which did you learn a longer time ago, how to zwib or how to hink?' (Learning-Distance), and 'Which did you pose for a longer time ago, the zwib photo or the hink photo?' (Physical-Distance). 'Learning' in the above parentheses represented the first level (i.e. learning event) of the first independent variable (event type); 'Physical' represented the second level (i.e. physical event); 'Location' indicated the first level (i.e. temporal location)

DOI: 10.1002/icd

of the second independent variable (i.e. assessment method); and 'Distance' indicated the second level (i.e. temporal distance).

There were eight different interview scripts, providing across-the-subjects counterbalancing over the order of the event type inquired about, the order of the assessment method used, and the order of the two forced-choice options posed in the questions. After the interviewer asked all of the questions, she thanked the children and debriefed the child by saying 'Just so you know, wugs and grambees are imaginary animals, and hinking and zwibbing are made-up body movements'.

RESULTS

Children received a score of '1' for each correct answer and '0' for each incorrect answer. Thus, each child could score 0, 1, or 2 on each of the four types of questions (collapsing over animal and body movement tasks). The four question types were temporal location assessment of learning events (Learning-Location), temporal location assessment of physical events (Physical-Location), temporal distance assessment of learning events (Learning-Distance), and temporal distance assessment of physical events (Physical-Distance).

Preliminary data analyses revealed no age difference across the 3-, 4-, and 5-year-old groups. We therefore collapsed over age for the rest of the data analyses. We conducted a 2 (Event Type: learning, physical) × 2 (Assessment Method: location, distance) within-subjects ANOVA. There were no significant main effects of either Event Type or Assessment Method. There was a significant interaction between Event Type and Assessment Method, F (1, 18) = 10.83, p = .004, $\eta^2 = 0.376$ (Figure 1). Simple effects analyses revealed that whereas there was no difference between children's answers to temporal location and distance questions about physical events, temporal distance questions ($M = 1.53$, $SD = 0.61$) better helped young children than temporal location questions ($M = 1.00$, $SD = 0.82$) in recognizing when learning events occurred, $F(1, 18) = 4.57$, $p = .047$, $\eta^2 = 0.202$.

Because children were asked forced-choice questions, correct responses could have been lucky guesses. Therefore, we compared children's scores to chance level performance (one out of a possible two, as each of the four types of questions contained two options). Children performed no better than chance answering temporal location questions or answering temporal distance questions regarding physical events (all p's $>.05$). However, they were better than chance answering temporal distance questions about learning events, t (22) = 3.45, $p = .02$.

DISCUSSION

We hypothesized that young children would have a harder time reporting when learning events occurred than when physical events occurred; we also hypothesized that temporal distance assessment would be better than temporal location assessment in eliciting correct responses from children. Our first hypothesis was not supported. This was not entirely surprising. To make the learning and physical events as comparable as possible, we removed a confounding variable from previous research (e.g. Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994) in which physical events always involved children getting

DOI: 10.1002/icd

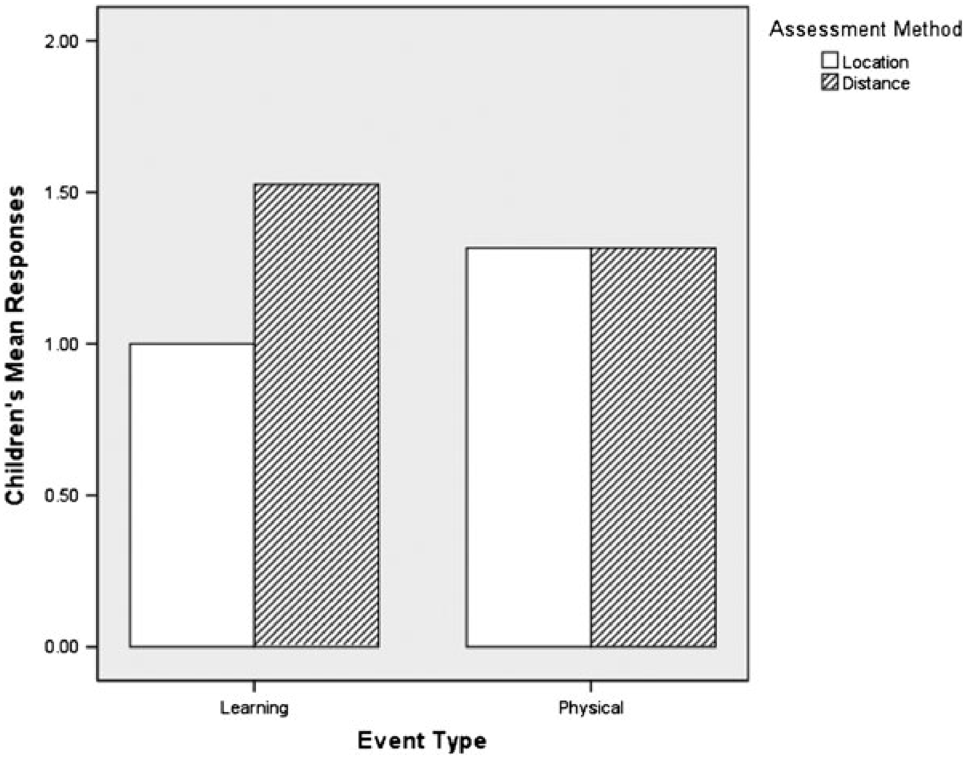

Figure 1. Experiment 1: children's mean response scores as a function of event type (Learning vs. Physical) and assessment method (Location vs. Distance).

tangible objects. Now that physical events were more like learning events in that there was no longer any concrete external cue indicating to the children that they just experienced them, young children in Experiment 1 also had difficulty recognizing when physical events occurred.

Our second hypothesis was partially supported. Even though temporal distance assessment did not help children more than temporal location assessment in recognizing physical events, temporal distance assessment did help children more than temporal location assessment when recognizing learning events. In fact, young children's performance on the recognition of learning events when assessed with temporal distance questions was improved above chance level performance. This research in essence replicated the research of Tang et al. (2007) and Tang and Bartsch (2012) even after controlling for the confounding variable of question frame, solidifying the internal validity of those research.

Since Experiment 1 was the first effort that we know of to directly compare children's reporting of when learning and physical events occurred, replication was in order. Also, to make sure that the various tasks were not more or less memorable for young children, we needed to switch the order of the two activity sessions to achieve a balanced study design. Finally, extant research investigating young children's source monitoring almost always samples from White, middle-class children. Recruiting from a more diverse demographic could enhance the external validity of our research findings. With the above three considerations in mind, we conducted a second experiment.

DOI: 10.1002/icd

EXPERIMENT 2

Method

Participants

In this experiment, we recruited 29 3- to 5-year-olds ($M = 52.48$ months, range = 38–67; 15 boys) from one of the 31 Abbott school districts in the state of New Jersey. Abbott school districts were created after 1985 as a result of *Abbott v. Burke* (1985), to ensure state funding for poorer and more disadvantaged school districts. Therefore, participating children were predominantly Black, Hispanic, and came from poorer neighbourhoods. Before the experiment commenced, parents provided informed consent and children verbally assented.

Materials and procedure

The materials and procedure involved in Experiment 2 was identical to those in Experiment 1, except that children now experienced the two activity sessions in the reversed order. Specifically, participating children learned 'wugs sleep in the sand', 'how to hink', coloured a wug picture, and posed for a hink photo in the first activity session. In the second activity session a week later, children learned 'grambees eat grass', 'how to zwib', coloured a grambee picture, and posed for a zwib photo.

RESULTS

We used the same coding scheme on children's responses as in Experiment 1. Similarly, preliminary data analyses revealed no age difference across the 3-, 4-, and 5-year-old groups. We therefore collapsed over age for the rest of the data analyses for this experiment as well. As before, we conducted a 2 (Event Type: learning, physical) × 2 (Assessment Method: location, distance) within-subjects ANOVA on the dependent variables. There was a significant main effect of Assessment Method: Children were more accurate in recognizing when events occurred when asked temporal distance questions ($M = 1.25$, $SE = 0.13$) than when asked temporal location questions ($M = 0.87$, $SE = 0.12$), $F(1, 25) = 4.66$, $p = .041$, $\eta^2 = 0.157$. There was no main effect of Event Type; neither was there any interaction between Event Type and Assessment Method.

Again, since children were asked all forced-choice questions, correct responses could have reflected lucky guessing. We next compared children's scores to chance level performance.

Children performed at chance answering temporal location questions regarding either learning or physical events (both p's $>.05$). However, they were marginally better than chance answering temporal distance questions on learning events, $t\ (27) = 1.89$, $p = .070$, and they were better than chance answering temporal distance questions regarding physical events, $t\ (28) = 2.42$, $p = .023$.

DISCUSSION

After instituting tighter experimental control, whereas physical events were no longer operationalized as receiving small presents, young children in Experiment 2 also recognized similarly when learning and physical events occurred, at least

DOI: 10.1002/icd

within the first week of the events' occurrence: Our first research hypothesis was not supported.

Now that two experiments have failed to find children having an easier time recognizing physical events than learning events, it would seem that past research (e.g. Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994) showing the above was likely due to previous physical events' containing the tangible cues that comparable learning events lacked.

Our second research hypothesis was supported in Experiment 2. Temporal distance assessment was better than temporal location assessment in improving children's performance. Consistent with the initial research effort (e.g. Esbensen et al., 1997; Taylor et al., 1994) in this area, Experiment 2 confirmed that young children for the most part experienced difficulty answering temporal location questions about learning events. Further, they experienced similar amount of difficulty answering temporal location questions about physical events. Their performance, however, was improved when it came to answering temporal distance questions. Children nearly (in Experiment 1 children actually did) performed better than chance answering temporal distance questions about learning events, and they were better than chance when those temporal distance questions concerned physical events. The advantage of asking young children temporal distance questions bolstered the research of Tang et al. (2007) and Tang and Bartsch (2012), especially since we had specifically controlled for the confounding variable of question frame.

GENERAL DISCUSSION

In this research, we set out to examine the influence of event type and assessment method on young children's reporting on when events occurred. We first posited that young children would find it more difficult to report when learning events occurred than when physical events occurred (in line with the research of Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994). We then hypothesized that temporal distance assessment would be better than temporal location assessment in helping children recognize when events occurred (following from the research of Friedman, 1991, 1992, 1993; Friedman et al., 1995, Tang et al., 2007; Tang & Bartsch, 2012).

Due to the demographic differences between the participants in our two experiments, we must use caution when drawing general conclusions. With the above caveat in mind, we observe that across both experiments, our first hypothesis was not supported. After controlling for the confounding variable of differential visual and tactile cue in past research (less in learning events but more in physical events), 3- to 5-year-old children reported when learning and physical events occurred in a similar way. In other words, once we evened out the tangible external cues available to both types of events, physical events were no longer better recognized than learning events. We were unable to find any difference due to event type regardless of the study sample or the order of the activity sessions (Experiment 2 employed a reverse order from Experiment 1). Consequently, the two experiments in totality revealed that at least within the first week of the experience, young children report the timing of learning and physical events similarly. Past research (e.g. Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994) that showed young children's particular difficulty with learning events was likely due to the learning events' lack of association with personally

DOI: 10.1002/icd

significant external cues (i.e. getting small presents), and not the internal nature of the learning events.

Even though our first hypothesis was not supported, we are in a better position to describe young children's memory development (e.g. Colombo & Hayne, 2010, 2013; Hayne, 2004; Hayne et al., 2011; Rovee-Collier et al., 2001; Suddendorf et al., 2011; Tulving, 1972, 2005) and related source monitoring skills (e.g. Earhart & Roberts, 2014; Gopnik & Graf, 1988; Hala et al., 2013; Johnson et al., 1993; Kondo, 2011; Kovacs & Newcombe, 2006; Roberts, 2002; Robinson, 2000; Thierry, 2009). Specifically, we can speak to the observation that the 'remember-to-know shift' (Conway et al., 1997, p. 408) that is unique to learning events does not occur right away, at least not in the first week of the learning experience. As a reminder, the 'remember-to-know shift' happens when learning that was initially embedded in an episodic memory became later separated from its learning context (i.e. the sources of knowledge) and merged into the network of semantic memory. Based on our research, after one week, young children maintained episodic memories about learning events much like physical events. Therefore, the reason for young children's difficulty recognizing that they had just learned something new (e.g. Esbensen et al., 1997; Tang et al., 2007; Tang & Bartsch, 2012; Taylor et al., 1994) was not likely an immediate 'remember-to-know shift'.

In other words, young children's problem with recognizing new learning in past research does not appear to reflect their emergent ability for episodic memories. Our research thus resonated with Bemis, Leichtman, and Pillemer (2013) who worked with 4- and 5-year-old children using two staged learning events that occurred 4 to 5 days apart. Two to 3 days later, children reported an episodic memory of how they learned the answer in 27.8% of their responses. Further, 73% of the children reported at least one episodic memory. In an earlier research, Bemis, Leichtman, and Pillemer (2011) interviewed 4- to 9-year-old children about their memories of naturally occurring learning episodes. Overall, 35% (25% of the 4- and 5-year-olds) of the children's responses indicated that they remembered the moment that they learned the answers to the factual questions, which mostly occurred months before. Therefore, instead of immediately, the proposed 'remember-to-know shift' likely occurs gradually, weeks, months, or perhaps even years after the learning episode.

Our experiments did not reveal any age difference among 3-, 4-, and 5-year-old children in any of our task performance. Whereas an age difference might be revealed in future studies with larger sample sizes, the current research resonated with Roberts (2002), who observed that source monitoring skills development in children follows an uneven path, such that children demonstrate earlier competency in some aspects than others. Perhaps our choice of tasks and the use of forced-choice question frame are especially helpful in uncovering early competence in children. Given that even our youngest 3-year-old participants performed better than chance on at least one measure across both experiments, we extended the work of Bemis et al. (2011, 2013) by showing that children as young as 3 years could form some type of episodic memory for learning events.

On the other hand, via the mostly supportive findings on our second study hypothesis across two experiments, our research affirms that rather than an immediate 'remember-to-know shift', one likely reason for young children's difficulty reporting when new learning events occurred was the less than optimal assessment method used with young children. Overall, 3- to 5-year-old children who came from diverse ethnic and socioeconomic backgrounds performed better with temporal distance assessment than with temporal location assessment. In Experiment 1, temporal distance questions improved children's recognition of learning

DOI: 10.1002/icd

events more than temporal location questions; in Experiment 2, relative to temporal location questions, temporal distance questions helped children better recognize both learning and physical events. Our research thus replicated the findings of Tang et al. (2007) and Tang and Bartsch (2012) after controlling for the extraneous variable of question frame that confounded the above two investigations. The replication was remarkable considering the close resemblance of the two assessment methods as a result of our effort to strengthen experimental control: Both temporal location and temporal distance questions were asked in the forced-choice format and with the exact the same two choices. The two assessment methods were only different from each other by two to three words in a rather long sentence.

In addition to hypothesis testing, comparisons of children's performance to chance revealed that children in Experiment 1 performed better answering temporal distance questions about learning events, whereas children in Experiment 2 were marginally better than chance answering temporal distance questions about learning events, but exceeded chance level performance when answering temporal distance questions about physical events. Methodological differences across the two experiments could have shed light on the above discrepancy. For one, our two experiments recruited children from very different ethnic and socioeconomic background: These demographic differences could have contributed to the inconsistency. For another, changes in the order of the activities between Experiments 1 and 2 could have led to the difference between the results. For example, in Experiment 1, children needed to choose colouring the grambee picture and posing for the zwibbing photo a longer time ago than colouring the wug picture and posing for the hinking photo to be correct on the physical events. This was reversed for children in Experiment 2. Perhaps the wug picture and the hinking photo just felt a little more familiar to children than the grambee picture and the zwibbing photo, facilitating the above chance recognition of physical events in Experiment 2 but not in Experiment 1. In the future, randomizing and counterbalancing the order of tasks within the same study would enable an examination of order effects, or at a minimum, would enable the balancing out of any order effects. In the same vein, blinding the interviewer to both the activities and the study hypotheses could introduce better control over any possible experimenter bias.

Overall then, research on young children's reporting about when various personally experienced events occurred can deepen our understanding of how young children's episodic and semantic memories develop, in addition to helping us describe young children's source monitoring and metacognitive skills. In practice, this line of inquiry carries the potential for us to build an enriched learning experience for children and has implications for the forensic interviewing of young victims/witnesses.

ACKNOWLEDGEMENTS

The authors would like to thank the children, parents, and directors at the following preschools for their participation and support: Free to Be Child Care Center, Galloway, NJ; AtlantiCare Kids, Pleasantville, NJ; and Beginners First Academy, Weymouth, NJ.

REFERENCES

Abbott v. Burke, 100 N.J. 269, 495 A.2d 376 (1985) ("Abbott I").

DOI: 10.1002/icd

Bemis, R. H., Leichtman, M. D. & Pillemer, D. B. (2011). 'I remember when I learned that!' developmental and gender differences in children's memories of learning episodes. *Infant and Child Development*, *20*(4), 387–399. DOI:10.1002/icd.700.

Bemis, R. H., Leichtman, M. D. & Pillemer, D. B. (2013). I remember when you taught me that! Preschool children's memories of realistic learning episodes. *Infant and Child Development*, *22*(6), 603–621. DOI:10.1002/icd.1807.

Colombo, M. & Hayne, H. (2010). Episodic memory: comparative and developmental issues. In M. S. Blumberg, J. H. Freeman, & S. R. Robinson (Eds.), Oxford handbook of developmental behavioral neuroscience (pp. 617–636). Oxford: Oxford University

Conway, M. A., Gardiner, J. M., Perfect, T. J., Anderson, S. J. & Cohen, G. M. (1997). Change in memory awareness during learning: the acquisition of knowledge by psychology undergraduates. *Journal of Experimental Psychology: General*, *126*, 393–413.

Curran, T. & Friedman, W. J. (2003). Differentiating location- and distance-based processes in memory for time: an ERP study. *Psychonomic Bulletin & Review*, *10*(3), 711–717. DOI:10.3758/BF03196536.

Earhart, B. & Roberts, K. P. (2014). The role of executive function in children's source monitoring with varying retrieval strategies. *Frontiers In Psychology*, *5*, 1–12.

Esbensen, B. M., Taylor, M. & Stoess, C. (1997). Children's behavioral understanding of knowledge acquisition. *Cognitive Development*, *12*, 53–84.

Friedman, W. J. (1991). The development of children's memory for the time of past events. *Child Development*, *62*, 139–155.

Friedman, W. J. (1992). Children's time memory: the development of a differentiated past. *Cognitive Development*, *7*(2), 171–187. DOI:10.1016/0885-2014(92)90010-O.

Friedman, W. J. (1993). Memory for the time of past events. *Psychological Bulletin*, *113*, 44–66.

Friedman, W., Gardner, A. & Zubin, N. (1995). Children's comparisons of the recency of two events from the past year. *Child Development*, *66*, 970–983 doi: 10.2307=1131792.

Gopnik, A. & Graf, P. (1988). Knowing how you know: young children's ability to identify and remember the sources of their beliefs. *Child Development*, *59*, 166–1371. DOI:10.2307/1130499.

Hala, S., Brown, A. B., McKay, L. & San Juan, V. (2013). Two-and-a-half-year-olds' memory for sources of actions: contextual support facilitates recall. *Journal of Cognition and Development*, *14*(2), 343–358. DOI:10.1080/15248372.2012.664594.

Hayne, H. (2004). Infant memory development: implications for childhood amnesia. *Developmental Review*, *24*, 33–73. DOI:10.1016/j.dr.2003.09.007.

Hayne, H., Gross, J., McNamee, S., Fitzgibbon, O. & Tustin, K. (2011). Episodic memory and episodic foresight in 3- and 5-year-old children. *Cognitive Development*, *26*(4), 343–355. DOI:10.1016/j.cogdev.2011.09.006.

Howard, M. W. & Kahana, M. J. (2002). When does semantic similarity help episodic retrieval? *Journal of Memory and Language*, *46*(1), 85–98. DOI:10.1006/jmla.2001.2798.

Johnson, M. K., Hashtroudi, S. & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3–28. DOI:10.1037/0033-2909.114.1.3.

Kondo, A. (2011). Developmental changes in external source monitoring abilities to distinguish between audio and video presentations in young children. *The Japanese Journal Of Cognitive Psychology*, *8*(1), 73–82. DOI:10.5265/jcogpsy.8.73.

Kovacs, S. L. & Newcombe, N. S. (2006). Developments in source monitoring: the role of thinking of others. *Journal of Experimental Child Psychology*, *93*(1), 25–44. DOI:10.1016/j.jecp.2005.06.006.

Peterson, C. & Grant, M. (2001). Forced-choice: are forensic interviewers asking the right questions? *Canadian Journal of Behavioural Science*, *33*(2), 118–127. DOI:10.1037/h0087134.

Roberts, K. P. (2002). Children's ability to distinguish between memories from multiple sources: implications for the quality and accuracy of eyewitness statements. *Developmental Review*, *22*(3), 403–435. DOI:10.1016/S0273-2297(02)00005-9.

Robinson, E. J. (2000). Belief and disbelief: children's assessments of the reliability of sources of knowledge about the world. In K. P. Roberts, M. Blades, K. P. Roberts, M. Blades (Eds.), Children's source monitoring (pp. 59–83). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Rovee-Collier, C., Hayne, H. & Colombo, M. (2001). The development of implicit and explicit memory. Amsterdam, the Netherlands: John Benjamins Publishing Co.

Scarf, D., Gross, J., Colombo, M. & Hayne, H. (2013). To have and to hold: episodic memory in 3- and 4-year-old children. *Developmental Psychobiology, 55*(2), 125–132. DOI:10.1002/dev.21004.

Siegal, M. & Peterson, C. C. (1998). Preschoolers' understanding of lies and innocent and negligent mistakes. *Developmental Psychology, 34*, 332–341.

Suddendorf, T., Nielsen, M. & von Gehlen, R. (2011). Children's capacity to remember a novel problem and to secure its future solution. *Developmental Science*, *14*(1), 26–33. DOI:10.1111/j.1467-7687.2010.00950.x.

Tang, C. M. & Bartsch, K. (2012). Young children's recognition of how and when knowledge was acquired. *Journal of Cognition and Development*, *13*(3), 372–394. DOI:10.1080/15248372.2011.577759.

Tang, C. M., Bartsch, K. & Nunez, N. (2007). Young children's reports of when learning occurred. *Journal of Experimental Child Psychology, 97*, 149–164.

Taylor, M., Esbensen, B. M. & Bennett, R. T. (1994). Children's understanding of knowledge acquisition: the tendency for children to report that they have always known what they have just learned. *Child Development*, *65*, 1581–1604.

Thierry, K. L. (2009). Practice retrieving source enhances young children's discrimination of live and story events. *Journal of Applied Developmental Psychology, 30*(4), 552–562. DOI:10.1016/j.appdev.2008.12.030.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), Organization of memory (pp. 381–403). New York: Academic Press.

Tulving, E. (1976). Role of semantic memory in the storage and retrieval of episodic information (edn, pp. 19–25). Spec Annual: Bulletin de Psychologie.

Tulving, E. (2002). Episodic memory: from mind to brain. *Annual Review of Psychology, 53*(1), 1–25. DOI:10.1146/annurev.psych.53.100901.135114.

Tulving, E. (2005). Episodic memory and autonoesis: uniquely human? In H. S. Terrace & J. Metcalfe (Eds.), The missing link in cognition: origins of self-reflective consciousness (pp. 3–56). New York: Oxford University Press.