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Young Children's Memory for the Times of Personal Past Events

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Abstract

Remembering the temporal information associated with personal past events is critical for autobiographical memory, yet we know relatively little about the development of this capacity. In the present research, we investigated temporal memory for naturally occurring personal events in 4-, 6-, and 8-year-old children. Parents recorded unique events in which their children participated during a 4-month period. At test, children made relative recency judgments and estimated the time of each event using conventional time-scales (time of day, day of week, month of year, and season). Children also were asked to provide justifications for their time-scale judgments. Six- and 8-year-olds, but not 4-year-olds, accurately judged the order of two distinct events. There were age-related improvements in children's estimation of the time of events using conventional time-scales. Older children provided more justifications for their time-scale judgments compared to younger children. Relations between correct responding on the time-scale judgments and provision of meaningful justifications suggest that children may use that information to reconstruct the times associated with past events. The findings can be used to chart a developmental trajectory of performance in temporal memory for personal past events, and have implications for our understanding of autobiographical memory development.

Remembering the temporal information associated with past events is a critical part of memory. In fact, our memories would feel incomplete without information about when events took place, and even if we are unable to accurately remember the *precise* times of past events, we still feel that the events of our lives fit into specific times in our past (Friedman & Lyon, 2005). Correspondingly, memory for time is an important feature in theories of event memory. Episodic memory is defined as memory of a past event from a particular *time* and place (Tulving, 1984). Although the capacity to attribute a past event to a particular time is an important, and even defining, feature in memory theories, we know relatively little about the development of memory for time. The majority of research has focused on children's understanding of conventional time and knowledge about when staged events occurred (Friedman, 1991, 1992; Friedman, Gardner & Zubin, 1995; Friedman & Kemp, 1998). We know very little about children's memory for the temporal parameters of personal events. In the current study, we investigate 4-, 6-, and 8-year-olds' memory for the times of naturally occurring personal past events.

An orientation to time figures prominently in memory theories, both in the adult and developmental literatures. The temporal organization of unrelated events and memory for time are defining features of episodic memory (see Tulving, 1972, 1984, 1993, 2002; Wheeler, Stuss, & Tulving, 1997). Temporal information also has a prominent role in theories of autobiographical memory (e.g., Nelson & Fivush, 2004; see also Habermas & Bluck, 2000), which can be defined as episodic memories that are personally relevant (see Bauer, 2007). For example, in social-cultural development theory, “talking about experienced events with parents who incorporate the child's fragments into narratives of the past not only provides a way of organizing memory for future recall but also provides the scaffold for understanding the order and locations of personal time, the essential basis for autobiographical memory” (Nelson & Fivush, 2004, p. 500). Thus the ability to temporally organize the events of the past also is important in theories of autobiographical memory and its development.

Since temporal information about past events is a defining feature of episodic memory, understanding the *development* of memory for temporal information is necessary to determine the developmental status of children's capacity to form and retrieve episodic or autobiographical memories. Research on this capacity could inform debates over whether autobiographical memory emerges relatively early (e.g., Howe & Courage, 1993) or late (e.g., Perner, 2000) in childhood, for example. Additionally, research on the development of memory for temporal information would have vital legal and forensic applications. Child eyewitnesses are often required to talk about contextual information such as when some event occurred, and little is known about when, or even whether, children are reliable in providing this information (see Friedman & Lyon, 2005, for discussion). Thus understanding the development of memory for the ‘when’ is important for theoretical and practical reasons. Yet there is a paucity of relevant studies.

A great deal of research has established that by the second year of life, infants are able to reliably order a sequence of actions within an event (e.g., Bauer, Wenner, Dropik, & Wewerka, 2000; Carver & Bauer, 1999; see Bauer, 2007 for review). However, tasks that require children to order a series of events on a timeline, for example, are more challenging and developments in memory for this type of temporal information may be relatively protracted (see Friedman, 2003, for review). The limited number of studies that exist ask children about unique staged events that occurred in the laboratory or in the child's classroom. For example, in Friedman (1991) an experimenter videotaped students during recess and then showed the tape to students and gave a lecture on how videotaping works (Event 1). Six weeks later, students listened to a lecture and demonstration on proper tooth brushing given by the children's teacher (Event 2). One week later, an experimenter tested children's judgments about the relative recency of the events (e.g., “Which [event] was a long time ago? Which was a short time ago?”). Also children were asked to estimate the times of the events on conventional time scales (time of day, day of week, month of the year, and season).

Using this type of paradigm, researchers have tracked age-related changes in temporal understanding from preschool to the later school years. When asked to judge the relative recency of unique events that occurred 1 week and 7 weeks from the date of test, 4-year-olds, 6-year-olds and 8-year-olds were more accurate than would be predicted by chance (Friedman, 1991, Experiments 2-3; 4-year-old performance only approached significance in Experiment 1). However, young school-aged children are successful on the task only if at least one of the events is from the recent past and there is a large temporal distance between the two events themselves. When the two events are closer in time to each other and relatively distant from date of test (e.g., 153 days and 139 days in the past) even 7-year-olds do not perform better than would be expected by chance (Friedman & Kemp, 1998). Thus

there seem to be age-related improvements in memory for the temporal order of unique events between the preschool and school years.

There also are improvements in tasks that require participants to place past events on conventional time scales (Friedman, 1991). Five-year-olds, for example, recall events from a particular day in the recent past (e.g., yesterday) or recall one event from an extended period (e.g., summer time) (Friedman, 1992). However, it is not until later in middle childhood that children reliably localize multiple events on a conventional time scale that extends into the past (e.g., Friedman & Lyon, 2005). As an illustration, when asked to put the events on a temporal scale, 4-year-olds did not accurately judge the time of day, month, or season of the events, whereas 6-year-olds and 8-year-olds did (Friedman, 1991; Experiment 1). In summary, consistent age-related improvements in children's memory for the times of past events have been documented from preschool to the school years.

An important feature of the majority of the work to date on developments in children's temporal understanding is that it has been based on staged events. However, staged events may lack some of the autobiographical features (e.g., emotion, meaningfulness) associated with naturally occurring, personally relevant events. Thus staged events may not allow for a generalizable assessment of children's temporal memory. To obtain a more complete picture of this important developmental domain, we need to extend the literature to personally relevant or significant events. Moreover, there is a great deal of evidence that children's memories for personally relevant events are more robust and reliable than memories for laboratory-based events (e.g., Mandler, 1983; Nelson, 1986). Thus past studies may underestimate children's performance on tasks that require the remembering of this type of information.

There is evidence that older school-aged children can approximate the date of personally relevant or autobiographical events. Bauer, Burch, Scholin, and Güler (2007) asked 7- to 10-year-olds to generate specific memories associated with neutral cue words (common nouns such as "pencil"). To help children date their memories, each child was provided with a personal timeline (temporally ordered photographs of the child from each year of life) and a seasons timeline (line drawings that represented the four seasons of the year). Children used these timelines to approximate the year and the season in which the events occurred. According to parental report, children were 92% accurate in judging the year and 75% correct in identifying the season that the events occurred. Thus, older school-aged children are accurate in judging the year and season of personal past events, according to parental report. They also spontaneously provide some temporal information in their descriptions of personal past events.

Only one study has investigated temporal memory for naturally occurring or personal past events in school-aged children as it relates to children's understanding of conventional time scales. Eight- to 12-year-olds approximated the times of parent-nominated past events using conventional time scales (calendar year, month, season, time of day and year in school) and participated in a test of knowledge of conventional time patterns (Friedman, Reese, & Dai, 2010). Events occurred anywhere from 6 months to 4 years prior to testing. Children's and parents' independent time estimates were consistent, suggesting that by 8 to 12 years of age, children temporally localize specific autobiographical events like adults. Age-related improvements in judging when past events occurred were not found across this age range. However, there were age-related improvements in knowledge of conventional time patterns. Further, children who displayed better knowledge of conventional time were also better at estimating the time of past autobiographical events.

In summary, approximating the times of personal past events on conventional time scales is relatively well-developed in the school years, with performance relating to conventional knowledge of time scales for older school-aged children. Yet it is unknown how memory for temporal information associated with personal past events develops. As described earlier, with staged events, age-related improvements have been documented between preschool and school-aged children. Friedman et al.'s (2010) study, in which they found no age-related changes in temporal memory of personal past events with children who were 8 years old and older, was a first step in understanding the developmental trajectory for this capacity. The next step is to examine memory for temporal information for personal events in younger children – the same ages tested in past studies with laboratory-based or staged events.

In the present study, we investigated memory for temporal information associated with past autobiographical events in 4-, 6-, and 8-year-old children. We selected these ages because temporal memory improvements have been reported in previous investigations using staged events. To obtain the corpus of events, we asked parents to record on a calendar unique events in which their children participated during a 4-month period. Asking parents to record events as they occurred (as opposed to recalling them in retrospect) is desirable since even adults have difficulty remembering the precise times of past events (e.g., see Friedman & Wilkins, 1985). At the end of the 4-month period, in the laboratory, children were asked to make a relative recency judgment and to estimate the time (using conventional time scales) of two of the calendar events. Based on previous work on temporal understanding, we expected the youngest children to perform more poorly than older children with age-related differences most obvious when estimating time based on conventional time scales. In addition, we examined the types of explanations or justifications children gave for their answers, in order to explore how children of different ages may reconstruct information pertaining to time. Reconstruction seemingly is the most common way that adults approximate the times of past events (Friedman, 1993). Little is known about reconstructive processes in children when dating the times of staged events (Friedman, 1991; Friedman & Lyon, 2005) and nothing is known about reconstructive processes when dating the times of naturally occurring events. Overall, this study will help to delineate the development of memory for temporal information for naturally occurring events and help to shed light on episodic and autobiographical memory development.

Method

Participants

Participants were 87 children: 25 4-year-olds (14 female; $M = 4.12$, range = 3.97 – 4.31), 33 6-year-olds (15 female; $M = 6.13$, range = 5.89 – 6.30), and 29 8-year-olds (15 female; $M = 8.17$, range = 8.02 – 8.85). An additional 13 children were excluded because they did not complete the task ($n = 8$), did not have enough events on the calendar from which to choose ($n = 3$), or did not remember the events selected for the task ($n = 2$; see Autobiographical events temporal memory task section in Materials and Procedure). Participants were recruited from a pool of families maintained by the Institute of Child Development, University of Minnesota. The pool contained names and contact information for families who had expressed interest in participating in research at the time of their children's birth. All participants were not Hispanic or Latino and the majority was Caucasian. The University of Minnesota Institutional Review Board approved the protocol, and parental consent was obtained for each child. Children received a small toy and parents were given a gift certificate.

Materials and Procedure

Children participated in two sessions (approximately 1.5 hours each) spaced one week apart ($M = 7.5$ days, $SD = 1.9$; range = 6-20 days). All sessions were videotaped. Parents remained in the room during the sessions but were instructed not to help their children; parents complied with this instruction. Participants completed several tasks at each session. Data from some of the other tasks are published elsewhere (e.g., Larkina & Bauer, 2010); however, data reported here are unique to this paper. For present purposes, we focus on the temporal understanding task, which was administered during Session 2. Four female experimenters administered all tasks; children were tested by the same experimenter at both sessions. Task procedures were outlined in a written protocol, and the experimenters regularly reviewed and discussed videotaped sessions to ensure protocol fidelity.

Children's language—In order to control for possible relations between language and performance on the memory tasks, children's language was measured at Session 1 using four subscales of the Test of Verbal Comprehension taken from Woodcock-Johnson Test of Cognitive Abilities (Woodcock, McGrew, & Mather, 2001): picture vocabulary, synonyms, antonyms, and verbal analogy. The four subscales were combined into a single measure of children's language ability.

Autobiographical events temporal memory task—Approximately four months prior to Session 1, parents received a calendar and instructions to record at least one unique event per week in which parents and children participated together (protocol followed that used in Morris, Baker-Ward, & Bauer, 2010). Parents were asked to select events that were of interest to their children (e.g., trips to the zoo or museum, special school events, events with friends, or “first time” events like a first airplane ride) and avoid routine events, such as going to the grocery store (unless something especially unique happened on the trip). At the beginning of Session 1, the experimenter selected four potential events from the calendar to be discussed with the children. The selection of events was pseudo-random, with the constraint that the events were a minimum of 4 weeks apart. Thus, for example, events were drawn from weeks 1, 5, 9, and 13 (or from weeks 2, 6, 10, and 14). In addition, the events could not have lasted more than an entire day. Examples of events selected and recalled by children are provided in the Results section. From these four potential events, two events were used for the temporal memory tasks (see below). The event that was closest in time to Session 1 was designated as the *recent* event, and the other was the *distant* event.

At the beginning of the task, the experimenter introduced the event to the child by saying “Do you remember when you XXX?” As a general rule, the experimenter introduced the event with the name of the event and one piece of information about the people involved, the activities undertaken, or the specific location of the event (e.g., “Do you remember when you went to the zoo with your cousin?”). The experimenter then asked the child to recall the event by saying, “Tell me everything you remember about the time when you XXX.” The experimenter used general prompts to elicit further recall, such as, “What else happened?” or “Do you remember anything else about XXX?” If the child provided at least two unique pieces of information about the event then the event was accepted for the temporal memory task (the criterion of two unique pieces of information to determine whether an event is or is not remembered is commonly used in the related literature: e.g., Fivush & Schwarzmüller, 1998; Morris et. al., 2010; Van Abbema & Bauer, 2005). If the child provided fewer than two pieces of unique information about the event, the event was replaced by another event selected for this task (as noted above, 2 children failed to recall sufficient information about any of the 4 events and thus were excluded from the sample). After the child recalled two events, the experimenter proceeded to the primacy/recency judgment and temporal scale judgments tasks. The same two events were used in both tasks for each child.

Primacy/recency judgment: The child was prompted to make a judgment about the relative recency of the two selected events. The experimenter said: “Do you remember when you XXX and when you YYY? One of these things was a long time ago and the other was a short time ago. Which one was a long time ago? Which one was a short time ago?” The child was then prompted to state the event that occurred in the more distant past, and then prompted to state the event that occurred more recently.

Temporal scale judgments and justifications: After the primacy/recency judgment, for each of the selected events in turn, the child was asked to answer specific questions about each event in relation to four *temporal scales*. The scales and questions are provided in Table 1 and are the same as those used in Friedman (1991). Two events were presented to the child in random order and the questions about the temporal scales were presented in fixed order: time of day, day of week, month, and season. For example, for the time-of-day judgment, the experimenter asked: “Do you remember what time of day it was either on the clock or like morning, afternoon, evening, or night?” If the child did not make the selection, the child was prompted to take a guess. Next the child was asked to justify her or his answer by answering the question “How do you know it was ... (e.g., morning)?”

Scoring

For the judgment of the relative recency of two events, a child received a score of 2 if events were ordered correctly, and 0 if they were not. For each of the temporal scale estimates (time of day, day of week, month of year and season) a child's answer was assessed as correct, incorrect, or “not verifiable” in the case that a parent did not indicate the time of day for the event (see below). Appendix A contains further details on scoring. Note that for all time scales, except time of day, children's responses were verifiable by using the parent calendar. For time of day, parents made a retrospective judgment at the time of the session. In addition, justification scores were recorded for each child. A child received a justification score of 1 on a particular time scale judgment if s/he gave a justification and the participant received a score of 0 if s/he responded, “I do not know,” “I guessed,” or “I just know.”

In order to examine the types of justifications children provided for their judgments, we qualitatively analyzed responses *a posteriori*. All responses were transcribed and an independent rater classified each response as falling into one of 4 categories based on the type of information the child used to justify her or his answer. The 4 categories were *environmental cue*, *routine event*, *holiday or calendar event*, and *other*. Responses that fell into the environmental cue category were those in which the child referred to, for example, weather, lighting conditions, temperature, and so forth. An example of an environmental cue response is “I knew it happened in the winter because there was snow on the ground.” An example of a response that would be classified as a daily routine is “I knew that it occurred in the morning because we usually go to church in the mornings.” The response, “I knew that this event occurred in February because it happened soon after my birthday” was classified as a holiday or calendar event. Responses that were classified as other did not fit into the above categories. An example of a response that was classified as ‘other’ was “I knew that it occurred in the evening because I remember what the invitation said and it said the birthday party would be at 7pm.” If the child provided more than one justification, the first one provided was classified. A second rater independently classified 20% of children's responses. The average inter-rater reliability (percent agreement) was 87% across time scales (92% for time of day justification, 88% for day of week justification, 85% for month justification and 83% for season justification). In cases of disagreement, the classifications of the primary rater were used in analyses.

Results

Description of the Events Selected

Each child recalled two events, one recent and one distant. This resulted in a total of 174 recalled events (87 recent and 87 distant). Most of the events that parents recorded on the calendar and were selected for this task were positive or neutral events. This is consistent with previous research in which parents were asked to select any events their children experienced in the past (e.g., Hudson, 1990; Reese, Haden & Fivush, 1993). Only 8 events (4.7%) were explicitly negative (e.g., visits to a hospital, death of a pet, attending a funeral). Among non-negative events, the majority was family events (55% of all recent events and 60% of all distant events; e.g., going to a beach, library, children's museum, visiting relatives, attending baseball games); school or girl/boy scout events (27% of all recent events and 21% of all distant events; e.g., field trips, fire drill, school carnival, mother helped in the classroom, and open house); and events involving interactions with friends (7% of all recent events and 6% of all distant events; e.g., sleepover, play days, and friend's birthday parties). There were 21 events with fixed dates, such as public/religious holidays (7% of all recent events and 6% of all distant events; e.g., Christmas/New Year Eve, Passover dinner, St. Patrick parade, and Halloween show), and birthdays of a child or close relatives (6% of all recent events and 6% of all distant events).

For 77% of children, the season of the recent event and the season during test were the same (e.g., both the recent event and the test session occurred during the summer). In contrast, the season of the distant event matched the season during test for only 32% of children. For about half the children (55%), the season in which the recent event occurred was the same as the season in which the distant event occurred.

Preliminary Analyses

As described in the Materials and Procedure section, each child's recent and distant temporal task events were chosen randomly from the calendar provided by the child's parent. Analyses were conducted to test whether (a) recent events occurred more recently than distant events, and (b) there were age group differences in how long ago the events occurred. A 3 (age) $\times$ 2 (event type: recent, distant) analysis of variance (ANOVA) revealed a main effect of Event Type, $F(1, 84) = 420.05$, $p < .0001$. Overall, recent events (weeks in the past: $M = 4.83$, $SD = 2.97$) occurred more recently than distant events (weeks in the past: $M = 11.36$, $SD = 3.37$). Neither the main effect of Age, $F(2, 84) = 2.51$, $p = .09$, nor the interaction, $F(2, 84) = 1.71$, $p = .19$, was significant. Importantly, this suggests that any age group differences in primary analyses that follow are not due to differences in how recently the events occurred for particular age groups.

The temporal distance between the two events was a minimum of 4 weeks and selected pseudo-randomly across age groups (see Materials and Procedures section). On average the number of weeks between events was 7.36 weeks ($SD = 3.15$), 6.48 weeks ($SD = 3.05$), and 5.86 weeks ($SD = 2.71$), for 4-, 6-, and 8-year-olds, respectively. A one-way ANOVA was conducted to test for age group differences in the number of weeks that elapsed between the two events. This analysis revealed no age group differences, $F(2, 86) = 1.71$, $p = .19$. This suggests that any age group differences in primary analyses that follow are not due to differences in the temporal distance between the two events used in the temporal memory tasks.

As a further test for possible differences in the temporal distance between events, we calculated a temporal distance ratio that captured the temporal distances between each event in the past and the test. Following Friedman (1991), the ratio was calculated as the number of days between the recent event and the test divided by the number of days between the

distant event and the test. The temporal distance ratios were .42 ($SD = .16$), .49 ($SD = .17$), and .47 ($SD = .18$) for the 4-, 6-, and 8-year-olds, respectively. A one-way ANOVA confirmed that temporal distance ratios did not differ as a function of age: $F(2, 86) = 1.38$, $p = .26$. The results of this analysis are further evidence that the temporal distances between the recent and distant events and the test did not differ across age groups.

Finally, to determine whether any effects could be explained by age-related improvements in language skills, we conducted correlational analyses between standardized scores on the language measure (Woodcock Johnson Test of Verbal Comprehension or WJ) and scores on the temporal memory tasks. The correlation between the language measure and scores on the primacy/recency task was nonsignificant, $r(82) = .09$, $p = .41$. Further, the correlation between the language measure and the temporal-scale judgments was nonsignificant. Specifically, for recent events all four temporal judgments were not related ($rs < .18$, $ps > .14$). For distant events, the time, day and season judgments were not significant ($rs < .19$, $ps > .17$); the month judgment ($r(56) = .32$, $p = .02$) was not significant with Bonferroni correction for multiple comparisons ($\alpha = .006$). Thus, the age-related improvements in performance on the autobiographical event temporal tasks are unlikely to be due to age-related improvements in language.

Although the correlations between language and the temporal-scale judgments were nonsignificant, as would be expected, there were some relations between language and the justification responses children provided. Even with correction for multiple comparisons, the language measure was positively correlated with justifications provided for the distant event month ($r = .42$, $p = .001$), and day ($r = .40$, $p = .002$) time-scales, and for the recent event month ($r = .36$, $p = .005$) time-scale. This analysis should be interpreted with caution since only three of the eight justification judgments showed relations. However, it suggests that children who had higher standardized language scores provided more verbal justifications for their responses.

Autobiographical Event Ordering (Primacy/Recency Task)

The mean scores for each age group are provided in Figure 1. A one-sample chi-square test was conducted for each age group to assess whether children accurately recalled the order of two autobiographical events in the past. For 4-year-olds, the number of children who answered correctly (13) and incorrectly (12) did not differ from the frequency expected by chance (50% answering correctly and 50% answering incorrectly), $\chi^2(1, N = 25) = .04$, $p = 1.00$. However both groups of older children showed frequency distributions those were different from that expected by the null hypothesis. The number of 6-year-olds who answered correctly (28) was greater than expected, $\chi^2(1, N = 33) = 16.03$, $p < .0001$, and the number of 8-year-olds who answered correctly (27), was greater than expected, $\chi^2(1, N = 29) = 21.55$, $p < .0001$.

To statistically determine whether 4-, 6-, and 8-year-old children performed differently from each other on the primacy/recency task, we conducted a logistic regression with age group as a predictor; individual groups were compared with contrasts (SAS 'proc logistic' statement and 'contrast' statement). There was a main effect of age group, $\chi^2(2, N = 87) = 17.27$, $p < .001$, and contrast comparisons showed that the difference was between 4-year-olds and both groups of older children. Both contrasts between 4- and 6-year-olds, $\chi^2(1) = 8.21$, $p < .01$, and 4- and 8-year-olds, $\chi^2(1) = 10.32$, $p < .01$, were significant, whereas the contrast between 6- and 8-year-olds was not, $\chi^2(1) = 1.00$, $p = .32$. In summary, 4-year-old children were reliably less accurate on the primacy/recency task relative to both 6- and 8-year-olds.

We also conducted exploratory analyses to determine whether there was a relation between the temporal distance ratio and performance on the primacy/recency task. This analysis could tell us about whether distance-based processes (i.e., direct impressions of how long ago an event occurred; see Friedman, 1996) were involved in temporal ordering. We found no significant correlation between the temporal distance ratio and scores on the primacy/recency task, $r(85) = -.10$, $p = .35$. The same null result obtained when we conducted the analysis separately for each age group (4-year-olds: $r(23) = -.17$, $p = .40$; 6-year-olds: $r(31) = -.24$, $p = .17$; 8-year-olds: $r(27) = -.19$, $p = .33$). Thus, as assessed with this analysis, we did not find evidence that distance-based processes contributed to the pattern of results.

Autobiographical Event Temporal-Scale Judgments

Temporal-scale judgments—The four time scale judgments scores were first collapsed to create a *total* temporal judgment score (time of day + day of week + month + season). The data are presented in Figure 2. An Age Group (4, 6, 8) $\times$ Event (recent, distant) analysis of variance revealed a main effect of Age for total temporal judgment score, $F(2, 84) = 27.54$, $p < .0001$. Follow-up Tukey's showed that 4-year-olds' performance was lower than 6-year-olds' performance, which in turn was lower than 8-year-olds' performance. No main effect of Event or interaction was found ($F_s < .90$, $p_s > .40$).

Table 2 reflects the proportion of children who answered correctly for each of the individual temporal scale judgments. We conducted loglinear analyses for each temporal scale to examine age group and event type differences. Each analyses was conducted for a 3-way contingency table: Frequency (number of children who answered correctly, number of children who answered incorrectly) $\times$ Event (recent, distant) $\times$ Age Group (4, 6, 8). For interaction effects, we report conditional odds and conducted chi-squared analyses. The expected frequencies for the chi-squared tests were the numbers of children expected to answer correctly and incorrectly if they chose randomly among the alternatives for each temporal scale judgment (i.e., chose each alternative equally often). For example, for day of week, by chance we would expect 1/7 of children to answer correctly and 6/7 of children to answer incorrectly (since there are 7 possible answers corresponding to the 7 days of the week).

At all but the most precise temporal scale tested (time of day), there were effects of age; the patterns differed depending on the particular temporal scale. For time of day, there was no three-way interaction, $G^2(7) = 13.10$, $p = .07$, nor any two-way interactions (all $G^2_s < 3.00$, $p_s > .20$) between frequency, event, and age group. For day of week, there was a significant two-way interaction between frequency and age group, $G^2(2) = 8.34$, $p < .02$. The conditional odds, collapsed across event type, of correctly judging the day of week was highest for the oldest group of children: .47, .41, and 1.27, for 4-, 6-, and 8-year-olds, respectively. To follow-up the loglinear analysis interaction, we conducted separate chi-squared tests for each age group. As a group, four-year-olds did not show evidence of recalling the day of the week for recent, $\chi^2(1) = 3.65$, $p = .06$, or distant, $\chi^2(1) = 1.32$, $p = .25$, events. Six-year-olds showed evidence of recalling the day of the week for distant, $\chi^2(1) = 4.19$, $p < .05$, but not recent events, $\chi^2(1) = 1.74$, $p = .18$. In contrast, 8-year-olds showed evidence of recalling the day of the week accurately for both recent, $\chi^2(1) = 41.71$, $p < .0001$, and distant, $\chi^2(1) = 24.24$, $p < .0001$, events.

The month of year judgment analysis revealed a three-way interaction, $G^2(7) = 48.58$, $p < .0001$, and a two-way interaction between frequency and age group, $G^2(2) = 44.68$, $p < .0001$. For recent events, the conditional odds of answering correctly were .04, .43, and 2.62, for 4-, 6-, and 8-year-olds, respectively, and .20, .57, and 2.71, for distant events. Thus, 8-year-olds were more than twice more likely to correctly recall the month than incorrectly recall the month for both types of events. Chi-squared analyses revealed that 4-year-olds as a

group did not accurately recall the month of the year for recent, $\chi^2(1) = .17, p = .68$, or distant, $\chi^2(1) = .27, p = .60$, events. In contrast, both groups of older children accurately recalled the month of the year. Six-year-olds accurately recalled the month of recent, $\chi^2(1) = 18.08, p < .0001$, and distant, $\chi^2(1) = 19.11, p < .0001$, events. Eight-year-olds also answered accurately: $\chi^2(1) = 147.61, p < .0001$ and $\chi^2(1) = 134.32, p < .0001$, for recent and distant events, respectively.

Finally, for the season judgment, there was a three-way interaction, $G^2(7) = 16.98, p < .02$, and a Frequency $\times$ Age Group interaction, $G^2(2) = 15.44, p < .0005$. Again the conditional odds of answering correctly increased with age. For recent events, the odds of answering correctly were .83, 2.75, and 6.25, for 4-, 6-, and 8-year-olds, respectively. For distant events, the odds of answering correctly were 1.43, 1.90, and 8.00, for 4-, 6-, and 8-year-olds, respectively. Separate chi-squared analyses revealed that, unlike the more precise time-scales, all groups of children recalled the season correctly more often than would be expected by chance for both recent and distant events: recent events [$\chi^2(1) = 3.88, p < .05$; $\chi^2(1) = 34.84, p < .0001$; $\chi^2(1) = 54.72, p < .0001$, for 4-, 6-, and 8-year-olds, respectively]; distant events [$\chi^2(1) = 8.65, p < .005$; $\chi^2(1) = 23.28, p < .0001$; $\chi^2(1) = 55.41, p < .0001$, for 4-, 6-, and 8-year-olds, respectively].

Temporal-scale justifications—Fewer preschool children made justifications for their temporal scale judgments than older school-aged children. For each temporal scale judgment justification (time of day, day of week, month of year and season) we conducted separate loglinear analyses (Frequency $\times$ Event $\times$ Age Group) to examine whether there were age-related differences in the number of children who provided justifications for their temporal scale judgments. The time of day justification analysis revealed a three-way interaction, $G^2(7) = 34.38, p < .0001$, and a two-way interaction between frequency and age group, $G^2(2) = 28.18, p < .0001$. The conditional odds of reporting a justification were .47, 2.00, and 26.00, for 4-, 6-, and 8-year-olds, respectively, for recent events, and .58, 3.00, and 2.83, for distant events. Thus, for recent events, 6-year-olds were two times more likely to report a justification than not provide a justification, and 8-year-olds were 26 times more likely to provide a justification than not provide a justification. In contrast, four-year-olds were more likely to *not* provide a justification than provide one for their time of day judgments. For day of the week, there was a two-way interaction between frequency and age group, $G^2(2) = 13.1, p < .002$. The conditional odds of reporting a justification were .25, .57, and 1.40, for 4-, 6-, and 8-year-olds, respectively, for recent events, and .23, .50, and 1.36, for distant events. The oldest group of children was more likely to provide justifications compared to younger children for this temporal scale.

The month of year justification analysis revealed a three-way interaction, $G^2(7) = 28.36, p < .0003$, and a two-way interaction between frequency and age group, $G^2(2) = 27.12, p < .0001$. The conditional odds of reporting a justification were .22, .92, 2.50, for 4-, 6-, and 8-year-olds, respectively, for recent events, and .09, .62, and 3.17, for distant events. For season, there was, again, a three-way interaction, $G^2(7) = 21.72, p < .003$, and a two-way interaction between frequency and age group, $G^2(2) = 19.42, p < .0001$. The conditional odds of reporting a justification were .75, 2.33, 8.67, for 4-, 6-, and 8-year-olds, respectively, for recent events, and 1.83, 1.90, and 12.50, for distant events. In summary, loglinear analyses revealed that there were strong age-related increases in the frequency of providing justifications for temporal scales. Based on the conditional odds reported, there is also the suggestion that providing justifications for some time scales (e.g., season) is less challenging than providing justifications for other scales (e.g., day). For example, for recent events, more 4-year-olds provided justifications than did not provide justifications for the season judgment. The opposite was true for 4-year-olds for the day of week justifications.

For children who provided justifications for their temporal-scale judgment, for each age group, we averaged the percent of responses that fell into each of the categories described above (e.g., routine event, environmental cue). The resulting proportions are presented in Table 3, for both the recent and distant events. Note that the data for the 4-year-olds should be interpreted with caution, since few 4-year-olds provided justifications. In fact, for the day and month time-scales, we did not analyze the justifications provided by 4-year-olds because the sample of children who provided them was too small. Across event types (recent and distant) the majority of justifications made by both 6- and 8-year-olds for time of day were classified as those relating to a routine event (59% and 55%, respectively); the majority of justifications made by 4-year-olds were classified as those relating to an environmental cue (41%). For day of the week, the majority of justifications made by both groups of older children again fell into the category of routine events (6-year-olds: 86%; 8-year-olds: 56%). For month of the year, children used different justifications. A large proportion of 6-year-olds' justifications for month (39%) were categorized as those relating to a routine event, whereas the majority of 8-year-olds' justifications (47%) were categorized as relating to a holiday or calendar event. When asked to justify their responses for the season judgment, 4-, 6-, and 8-year-olds' justifications most often appealed to an environmental cue (79%, 78%, and 60%, respectively).

Relations between temporal-scale judgments and justifications—Next we examined the relation between children's accuracy on each temporal scale to the likelihood that they provided a justification for that response. Chi-square analysis was conducted for each temporal scale and type of event (recent or distant) for each age group. The possible outcomes were 0/0 (receiving a score of 0 on both the time scale judgment and justification), 0/1 (providing an inaccurate judgment response, but providing a justification), 1/0 (providing an accurate judgment response, but not providing a justification), and 1/1 (receiving a score of 1 on both the time scale judgment and justification). For recent events, the distribution of the number of children who were grouped into each possible outcome for time of day was not significantly different from chance for 4-year-olds, $\chi^2(3, N=17) = 4.41$, $p = .22$, approached significance for 6-year-olds, $\chi^2(3, N=27) = 6.63$, $p = .08$, and was significant for 8-year-olds, $\chi^2(3, N=26) = 44.46$, $p < .0001$. When examining only children who correctly judged the time of day of the recent event, only 42% of 4-year-olds provided a justification for their response. However, 80% of 6-year-olds and 95% of 8-year-olds who correctly judged the time of day of the event also justified their response. A similar outcome was seen for the analysis of time of day responses for distant events. Specifically, the distribution of the number of children who were grouped into each possible outcome was not significantly different from chance for 4-year-olds, $\chi^2(3, N=14) = 2.57$, $p = .46$, but was significant for both 6-year-olds, $\chi^2(3, N=24) = 33.33$, $p < .0001$, and 8-year-olds, $\chi^2(3, N=23) = 13.00$, $p < .005$. Whereas only 25% of 4-year-olds who correctly judged the time of day for the distant event also provided a justification, 82% of 6-year-olds and 72% of 8-year-olds did so.

For day of the week, for recent events, the distribution of the number of children who were grouped into each possible outcome was not significantly different from chance for 4-year-olds, $\chi^2(3, N=13) = 6.39$, $p = .09$, but was significant for 6-year-olds, $\chi^2(3, N=22) = 7.82$, $p < .05$, and 8-year-olds, $\chi^2(3, N=24) = 10.33$, $p < .02$. The proportion of children who provided both a correct response to the day of week judgment and a justification was only 25% for the 4-year-old group, but was 50% and 80% for the 6-year-old and 8-year-old group, respectively. It should be noted that for 6-year-olds, the majority of children in a particular outcome were those who did not provide an accurate judgment or a justification ($n = 11$). For 8-year-olds, the majority of children were those who provided both a judgment and a justification ($n = 12$). For the distant events, the distribution of the number of children who were grouped into each possible outcome was significantly different from chance for 4-

year-olds, $\chi^2(3, N=14) = 12.29, p < .007$, and 6-year-olds, $\chi^2(3, N=21) = 11.95, p < .008$. However, for both of the younger age groups, the majority of children fell into the group who did not provide either an accurate day of week judgment or justification (4-year-olds: $n = 9$; 6-year-olds: $n = 12$). On the other hand, for 8-year-olds, the distribution of children who fell into each of the possible outcomes was significant, $\chi^2(3, N=26) = 8.15, p < .05$, and the majority of children were those who received a score of 1 on both the judgment and justification ($n = 11$). For the proportion of children who were accurate on the day of week judgment for the distant event, 25% of 4-year-olds, 67% of 6-year-olds, and 87% of 8-year-olds also provided a justification for their response.

For the month of year judgment and justifications, for recent events, the distribution of the number of children who were grouped into each possible outcome was significantly different from chance for 4-year-olds, $\chi^2(3, N=11) = 14.09, p < .003$. However, the majority of 4-year-olds ($n = 8$) were those who received a score of 0 for both the judgment and justification. The chi-square analysis was not significant for 6-year-olds, $\chi^2(3, N=23) = .83, p = .84$. For 8-year-olds, the chi-square analysis was significant, $\chi^2(3, N=28) = 15.71, p < .002$: 80% of children who correctly judged the month of year for the recent event also provided a justification. A similar outcome was obtained for the analysis of month of year responses for the distant events. The distribution of the number of children who were grouped into each possible outcome was significantly different from chance for 4-year-olds, $\chi^2(3, N=12) = 16.67, p < .0009$. However, the majority of 4-year-olds ($n = 9$) were those who received a score of 0 for both the judgment and justification. The chi-square analysis was not significant for 6-year-olds, $\chi^2(3, N=21) = 3.57, p = .31$. For 8-year-olds, the chi-square analysis was significant, $\chi^2(3, N=25) = 31.16, p < .0001$. Ninety-five percent of 8-year-olds who correctly judged the month of year for the recent event also provided a justification.

For season, for recent events, the distribution of the number of children who were grouped into each possible outcome for season (recent events) was not significantly different from chance for 4-year-olds, $\chi^2(3, N=21) = .52, p = .91$, but was significant for 6-year-olds, $\chi^2(3, N=30) = 16.13, p < .002$, and 8-year-olds, $\chi^2(3, N=29) = 35.14, p < .0001$. When examining only children who correctly judged the season of the recent event, only 40% of 4-year-olds provided a justification for their response. However, 77% of 6-year-olds and 84% of 8-year-olds who correctly judged the season of the event also provided a justification for their response. Similarly, for the distant events, the distribution was not significantly different from chance for 4-year-olds, $\chi^2(3, N=17) = 2.06, p = .56$, but was significant for 6-year-olds, $\chi^2(3, N=29) = 8.38, p < .04$, and 8-year-olds, $\chi^2(3, N=27) = 46.63, p < .0001$. Sixty percent of 4-year-olds, 74% of 6-year-olds, and 92% of 8-year-olds who accurately judged the season for the distant event also provided a justification.

In summary, the justifications provided for temporal judgments differed between preschool children and the two older child groups. Specifically, 4-year-olds did not provide as many justifications for their temporal-scale judgments, compared to older children. Further, unlike preschoolers, the two older age groups were likely to provide a meaningful justification when they were accurate in the temporal judgment for the majority of time scales.

Discussion

The purpose of the present study was to examine the development of memory for temporal information for personal past events in preschool- to school-aged children. Specifically, 4-year-olds, 6-year-olds and 8-year-olds were asked to judge the order of two personal events. In addition participants were asked to place personal past events on temporal scales (time of day, day of week, month and season), and provide justifications or explanations for their

responses. This study was novel because we used personal past events, as opposed to staged events, and because most temporal parameters associated with the events could be verified via a parent calendar, as opposed to relying on parents' retrospective judgments.

We found that 4-year-olds did not accurately judge the order of two distinct events from their past, but 6- and 8-year-olds did. When asked to place personal events on various time scales, we found age-related improvements across time-scales, with 8-year-olds' performance higher than 6-year-olds' performance, which in turn was higher than 4-year-olds' performance. However, patterns of performance differed based on the type of time scale judgment. No age differences were revealed for the time of day judgment (see Friedman, 1991, for similar findings). Yet, the two older age groups provided more justifications for their time of day judgments than the youngest age group. For the day of week time-scale, 8-year-olds were more accurate than 6-year-olds. Eight-year-olds also provided more justifications for their responses than the younger age groups. For month of the year, age-related improvements were seen across the age groups. Again, 8-year-olds provided more justifications for their responses than younger age groups. For the season time-scale, 4-year-old children were less accurate on their temporal judgments and provided fewer justifications for their responses than 8-year-old children.

The present data complement the existing literature on preschool to school-aged children's memory for temporal information using staged events. In the present study, 6- to 8-year-olds accurately judged the order of two unique personal events. This finding is consistent with data from Friedman's (1991) samples of first and second grade children. Our result from the primacy/recency task is inconsistent, however, with previous data with 4-year-old children. We found that this age group was not significantly different from chance, whereas past studies found that they did perform better than chance (Friedman, 1991; Experiments 2 and 3). This discrepancy may be due to differences across studies in the time from event to test, or time between the events used. For example, in the present study, on average, the two events were from the more distant past compared to the events in Friedman (1991). Further, the temporal distance ratio in Friedman (1991) was approximately 0.14, yet ranged from 0.42-0.49 in the present study. It is possible that this difference did not affect performance of older children, but impeded preschoolers for whom event ordering is more of a challenge.

The results from the individual temporal scale judgments are consistent with previous work and allow us to begin to chart a developmental trajectory of performance. Friedman et al. (2010) found that 8- to 12-year-old children were substantially accurate in their time-scale judgments, and further, they found no age-related differences in accuracy. The results of the present study, in combination with Friedman et al. (2010), suggest that the majority of developments in memory for the time-scales associated with personal past events occurs between preschool and the early school years. This is consistent with past work in which staged events were used to assess temporal memory.

It is surprising that there were few to no differences in accuracy of time-scale judgments for recent compared to distant events. It is logical to expect that memory for distant events would include less information than recent events because of forgetting that may occur with increasing time. However, as noted in Bauer et al. (2007), studies suggest that if a distant event is recalled, it is described in as much detail as a recent event (e.g., Fivush, Gray & Fromhoff, 1987; Van Abbema & Bauer, 2005). Thus, with the time range tested here, delay between the event and test may have had little effect on memory for the time-scales associated with the event.

Our analysis of the justifications or reasons young children used to judge the time-scales associated with personal past events is novel. The data inform our understanding of

children's *reconstruction* of time information, which is the most common method of recalling the times of past events in adults (Friedman, 1993; see Larsen, Thompson, & Hansen, 1996, for discussion). As noted by Friedman and Lyon (2005), reconstruction of the times of past events requires episodic memories that include temporally relevant information, general knowledge about time, and executive processes that allow for the effective use of these types of information. The categories that we used to classify children's justifications (relation to environmental cues, relation to routine events, and relation to holidays or calendar events) reflect temporally relevant information drawn from episodic memory. For example, a child who states that she knows that a science fair occurred in the winter because there was snow on the ground is using her episodic memory of an environmental cue associated with the event (snow) to constrain the time of the event to the appropriate season (winter). In the present research, the older children in particular were able to successfully recall and perhaps use this information. Yet even the youngest age group provided justifications that matched those of older children for certain time-scales (environmental cue for season judgment). Further, children who were correct on the time-scale judgments also more frequently provided meaningful justifications. Thus, children are able to provide temporally relevant information, and may use that information to reconstruct the times associated with past events. In addition, since older children provided a greater number of justifications than preschoolers, we may speculate that differences in recalling temporally relevant information from episodic memory may have contributed to age-related differences in remembering the times of personal past events.

Further work is needed to determine the extent to which developmental differences in the other components necessary for reconstruction (general knowledge of time, and executive processes that can search for and integrate relevant information) contributed to the age-related improvements in time-scale judgment accuracy reported here. We know, for example, that knowledge of conventional time patterns is positively correlated with memory for the times of personal past events in middle childhood (Friedman et al., 2010). Future work should examine the contributions of the different aspects of reconstruction to age-related differences in memory for the temporal information associated with personal past events in younger children. Further, it should be noted that, children may have used reconstruction processes to recall temporal information, even if they did not provide a verbal justification for their response. Although we cannot definitely conclude whether reconstruction processes were used, our findings suggest that younger children may not be as aware of (or provide explanations related to) their own reconstruction processes. Further work relating to metamemory of temporal information would be informative (see Friedman, 2007).

The present data are consistent with past work on children's temporal reconstruction. For example, Friedman (1991) asked preschool to third grade children to make temporal scale judgments and provide an explanation for their judgments. The target event, an in-class demonstration that occurred after recess in which an experimenter showed a video of children playing during recess, provided several contextual cues that the children could use to help make their temporal judgments (e.g., remembering that the event was associated with recess could help to signal the season based on what children in the videotape were wearing, or day of week could be constrained by remembering that it was an in-class demonstration and thus occurred on a weekday). First grade and third grade children, but not preschool children, provided at least one logical constraint for the majority of time scales (time of day, day of week, and season). This resembles our finding that 4-year-old children provided fewer justifications than older children. In summary, there is evidence that older school-aged children provide temporally relevant explanations for their judgments of when events occurred, and may use this information to help make their time judgments.

Whereas the present research revealed substantial competence with the temporal characteristics of personal past events, there is evidence that even older school-aged children do not always recall temporally relevant information. Friedman and Lyon (2005) examined temporal-reconstructive abilities in children age 4 to 13. Children participated in an in-class demonstration that included the planting of temporal cues that could be used to reconstruct the time of an event. For example, a staged demonstration included placing leaves in a “mystery box”; the leaves could be used to reconstruct the time of year the event occurred. Children were tested 4 months after the event and asked to recall the planted temporal cues. Although older children recalled more cues than younger children, recall of the temporal cues was poor for all children. Further analysis of the relation between remembering temporal cues and temporal judgment accuracy revealed significant, but weak, correlations for only the month time-scale. Thus for the staged events, there was not strong evidence for the relation between memory for temporally relevant cues and accuracy on temporal judgments.

One possible reason for the inconsistency between the data reported in the present study and that reported previously is that for personal past events in our study, children who provided temporally related justifications or explanations for their responses were likely to provide accurate responses. As noted by Friedman and Lyon (2005) when discussing the need for further studies using events in the home and outside school, personal past events may “provide contextual information that is more temporally differentiated...” Thus it is possible that the present study's conclusions are more readily applied to life outside the laboratory.

It should be noted, however, that we cannot be certain that children who provided temporally relevant justifications or explanations actually used those justifications to reconstruct the time of the events. Since justification reports were obtained after children made their time-scale judgments, and since these are subjective reports, we cannot be sure of the mental processes in which children engaged. Yet there is some evidence that children used temporally relevant contextual information to reconstruct the times of past events. For example, there were cases in which relying on reconstruction led to inaccurate temporal judgments. This is illustrated by a 6-year-old's recollection of a friend's birthday party in which she went to a roller-skating rink. She stated that the event occurred on a Saturday because she recalled that she did not go to school that day. This inference is logical and, normally, would lead to an accurate approximation of the day of the event. However, as revealed by her mother's calendar, the child did not go to school the day the event occurred (Tuesday) because of inclement weather. Thus, this child relied on temporally relevant episodic memory to reconstruct the time of the event. A break in the “typical routine,” however, led to an inaccurate temporal judgment. Further studies in which children's justifications and strategies are examined could give insight into the development of temporal reconstruction processes.

In conclusion, the present study adds to the small literature on children's memory for when past events occurred. It is the first study to systematically examine temporal memory, of which accuracy could be verified, of personal past events in preschool to school-aged children. As discussed by Friedman et al. (2010), the use of naturally occurring events may generalize more readily to childhood testimony compared to staged events. This work, then, has implications for legal settings in which children are asked to provide information about the times of past events. In addition, this research has implications for the literature on autobiographical memory development. As discussed by Fivush (2010), in order to create an autobiography or life story, personal events must be linked or organized on a personal time line (e.g., Habermas & Bluck, 2000; McAdams, 2001). Recent work has suggested that it is not until middle childhood to adolescence that this narrative story emerges and increases (e.g., Habermas & Bluck, 2000; Hamermas & de Silveira, 2008; Reese, Yan, Jack, & Hayne,

2010). Being able to order unique personal events and being able to relate past events to conventional time-scales (both assessed in the present research), are basic building blocks for autobiographical memory and can lead to the creation of a life story.

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Appendix A

Time of day judgment: For time of day, four units were possible, morning (6 am – noon), afternoon (noon – 6 pm), evening (6 pm – midnight), and night (midnight – 6 am). The child could indicate time of day either by giving a clock time or a part of the day. If the child gave a clock time, it was translated into a part of a day.

Season judgment: The actual season of an event was inferred by the month that the event was recorded on the parent's calendar. The children who participated in this study lived in Minneapolis, MN, where season features may overlap or not conform to a conventional division based on calendar months. For this reason, four months were coded as one season, with the month at the boundary between seasons counted in two seasons. Specifically, December, January, February, and March were coded as winter; *March*, April, May, and June as spring; *June*, July, August, and September as summer; and *September*, October, November, and December as fall.

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Figure 1. Primacy/recency task average scores. The dotted line indicates the level of responding that would be expected by chance.

Figure 2. Temporal scale judgment task average of total scores. Recent and distant events are averaged for the figure.

Table 1
Temporal scale judgment task

Time scale	Recognition question
Time of day	Do you remember what time of day it was on the clock or like morning, afternoon, evening or night?
Day of week	Do you remember what day of the week it was, like Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday?
Month	Do you remember what month it was, like January, February, March, April, May, June, July, August, September, October, November, December?
Season	Do you remember what season it was, like spring, summer, fall, or winter?

Table 2
The proportion of children (averaged across recent and distant events) who answered correctly for each temporal scale judgment

	Age Group		
	4-year-olds	6-year-olds	8-year-olds
Time of Day	.66	.74	.82
Day of Week	.33	.29	.57
Month of Year	.11	.33	.73
Season	.52	.70	.88

Table 3
The proportion of children in each age group whose justification response was classified into each category

Temporal Scale	Justification Category	4-year-olds		6-year-olds		8-year-olds	
		Recent Event (n = 8)	Distant Event (n = 8)	Recent Event (n = 7)	Distant Event (n = 20)	Recent Event (n = 21)	Distant Event (n = 17)
Time of Day	Environmental Cue	.25	.57	.30	.24	.26	.29
	Routine Event	.38	0.0	.55	.62	.56	.53
	Calendar Event	0.0	.29	0.0	0.0	0.0	0.0
	Other	.38	.14	.15	.14	.19	.18
Day of Week	Environmental Cue	0.0	0.0	0.0	.14	0.0	0.0
	Routine Event	.33	0.0	1.0	.71	.38	.73
	Calendar Event	0.0	.33	0.0	.14	.15	.20
	Other	.67	.67	0.0	0.0	.46	.07
Month	Environmental Cue	.50	0.0	.27	.50	.19	.28
	Routine Event	0.0	0.0	0.0	0.0	.24	.11
	Calendar Event	0.0	0.0	.27	.25	.38	.56
	Other	.50	1.0	.45	.25	.19	.06
Season	Environmental Cue	.75	.82	.71	.84	.52	.68
	Routine Event	.13	0.0	0.0	0.0	0.0	.08
	Calendar Event	.13	.09	.24	.11	.39	.24
	Other	0.0	0.0	.05	.05	.09	0.0