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Abstract

This study examined how adults interpret children's relative temporal judgments about significant events. Previous research with children has shown that children have a "prospective bias," when making relative temporal judgments. The impact of this bias within the context of eyewitness testimony is currently unknown, as no prior research has examined how adults interpret relative temporal judgments (i.e., are they also forward thinking). The present study examined this question. Adult participants were provided with mock attorney-child interactions during which a child witness (either 8 or 17 years old) gave relative temporal judgments (i.e., *near*, *before*, *after*) to establish a timeline of when key events in the case occurred. Using the child's testimony participants gave an approximate timeframe of when they thought each key event happened. Overall, results do not suggest that adults have a prospective bias. Adults interpreted children's responses to indicate judgments in both backwards and forwards direction. Additionally, the findings suggest that adults have varying interpretations of the length of time indicated by the terms *before, after* and *near*. Participants in the *near* condition provided smaller timeframes than those in the *before* condition, and that the timeframes in the *after* condition did not differ significantly from the other two conditions. Finally, results revealed that jurors do not seem to think relative temporal judgments are influenced by age, as the age of the child did not significantly influence the length of the timeframe provided by the participants. The present findings provide important insight regarding how adults interpret children's temporal testimony. Future research should examine the extent to which this discrepancy impacts overall assessments of children's credibility.

Keywords: Temporal judgments, child abuse, sexual abuse

Adults' Interpretation of Children's Relative Temporal Judgments

In cases of child maltreatment children's allegations of wrongdoing can be the only

evidence of a crime (Lamb, Orbach, Hershkowitz, Esplin, & Horowitz, 2007). Due to this fact,

researchers have conducted countless studies to determine whether and under what

circumstances children can provide accurate accounts of the alleged maltreatment (Ceci &

Bruck, 1993, Lamb et al., 2007). To date the results have shown that children are at heightened

risk (as compared to adults) for false report and error when faced developmentally-insensitive

questions, including poor question types (e.g., forced choice questions, yes/no questions) or

suggestive or leading questions (Lamb et al., 2007). From this research arose structured forensic

interviewing protocols (e.g., NICHD, Ten Step Protocol), which have been shown to elicit

allegations in response to more desirable prompts (Orbach et al., 2000) and result in more

detailed reports from child witnesses (Sternberg et al., 2001).

Although research has made a positive impact regarding the ways to question child

witnesses, there is still much we need to learn. More recently, researchers have turned their

attention to children's ability to report forensically relevant details. Specifically, they focused on

what elements of a distressing event children are reliably able to understand and recall. Using

that information researchers and practitioners can work together to create developmentally-

appropriate strategies for targeting specific information. Additionally, recent research has begun

to assess how children's limitations and biases in specific areas impact adults' judgments of their

credibility (Clevland & Quas, 2016). While recent studies have focused on a variety of types of

forensically relevant details (e.g., clothing placement, children's ability to sequence actions

within an event), there has been little attention paid to children's ability to date their memories

(i.e., "when" an event took place). The limited research available suggests that young witnesses

struggle with temporally locating past events such that their immature temporal concepts and limited cognitive abilities result in biased and potentially problematic responding (McWilliams, Quas, & Lyon, 2019). However, before extracting these findings from laboratory studies and discussing the impact on witness credibility in an applied legal setting, one must carefully assess how children's limitations will affect the perceptions of their overall testimony. This is because the seriousness of children's restricted temporal understanding in an applied legal setting is only detrimental if it significantly clashes with mature conceptualization. In other words, problematic miscommunications and inconsistencies will only occur between a child witnesses and adult questioners (e.g., attorneys) and factfinders (e.g., jurors) if children and adults make and interpret temporal judgments differently. To date, there has been little research on how adults interpret children's temporal judgments. The proposed project aims to address this important question.

Children's Temporal Memory

The process of timing of a past event is quite complex. Research utilizing adult samples has demonstrated that when attempting to identify the timing or frequency of a repeated event, individuals make inferences utilizing a reconstructive process (Bradburn, 2000; Menon & Yorkston, 2000). For instance, imagine you had to pinpoint the last time you went to the beach. First, you would have to use your autobiographical memory to recall information about your last beach visit. Once you have remembered your beach visit, the second step is to evaluate that memory for temporally relevant information. Sometimes you are lucky and the memory is tied to a specific temporal concept or even an exact date (e.g., you went to the beach over Christmas), however, for most life events that is not the case. Instead, you need to use your knowledge about general temporal concepts, such as seasons, months, and days of the week, to draw inferences about your beach visit. You may recall that you were wearing shorts and a t-shirt and infer it was

warm (e.g., summer), perhaps you remember that you did not travel or take off work and you conclude the trip was probably over the weekend. The third and final step is to compare your memory against other memories for "summer weekends" and narrow down the options for a plausible timeframe.

Developmental research has demonstrated that young children can successfully accomplish the first step of this process; even two-year-olds can accurately recall and discuss autobiographical memories (Fivush & Nelson, 2006). Additionally, by the age of three children can recall specific incidents of a repeated event (Hudson, 1990). However, even though children are able to recall past experiences their reports are often limited. Adults typically have to prompt children to recall many details of the event, including time, in order to get the full account of what occurred (Fivush & Nelson, 2006), suggesting this type of information is either not easily available in children's memory or not information that children readily incorporate into their narratives. Additionally, not much is known about children's ability to engage in the cognitive processes needed for steps two and three, more specifically, the research only provides limited (and sometimes contradictory) guidance regarding what temporal knowledge young children possess and whether they are able to utilize that knowledge to draw accurate temporal inferences.

Children's Temporal Abilities

The simplest form of temporal ability is the mastery of general temporal concepts. Friedman (1991) found that during the preschool years (4-6 years old) children become more knowledgeable about different time scales (i.e. days of the week, months, and seasons). They often discover these conventional time constructs through early schooling and conversations with caregivers. At a surprisingly young age, children can use the learned information to identify current temporal locations (e.g., their current age; Friedman, 1992), and place common

landmarks (e.g., holidays) in traditional chronological order (Friedman, 1977). But, it is important to note that knowledge of rudimentary temporal concepts is only one element of temporal memory abilities (e.g., being able to identify the month of March is not the same as knowing a specific event occurred during the month of March).

Studies examining the development of temporal memory have demonstrated that young children do possess some ability to link autobiographical memories and time, suggesting at least a baseline understanding of temporal information within memories. For instance, they can produce narratives for memories when given a specific temporal location as a cue. Friedman (1992) demonstrated that when given yesterday, last summer, and last Christmas as cues, children as young as 4 years old were able to generate accurate memories (validated by parents) for that time. Although impressive and indicative of time-related mnemonic abilities, this study measured a slightly different process than what is typically required from a child witness. In this study, the children were asked to remember what they did on a salient date, not when a specific event occurred. It is possible that the later question is a more difficult task, as the event in question may have included a limited number of temporally salient elements at the time of encoding.

There is some evidence to suggest that children do possess some, albeit limited, ability to locate memories temporally. Specifically, when Friedman (1991) asked 4- , 6-, and 8-year-old children to determine when both recent (1 week prior) and distant (7 weeks prior) staged classroom events occurred, the 4-year-old children were able to produce the general time of day (e.g., morning) that the recent event occurred, but could provide no location information for the more distant event. The oldest children in the sample could provide temporal location (i.e., month and season) information regarding the distant event, but they erred on several concepts

(i.e., day, relative distance). Another study by Pathman, Larkina, Burch, and Bauer (2013) showed similar findings when examining the accuracy of 4- to 8-year-old children's judgments regarding the timing and order of two personal events. Results revealed a positive age trend for children's responses on each time scale (i.e., time of day, day of the week, month, and season); the 8-year-old children were more accurate and better able to justify their temporal judgments than 6-year-olds and 4-year-olds. Additionally, the 6-year-old children performed better than the 4-year--old children (Pathman et al., 2013). The justifications children gave mirrored the reconstructive process that is utilized by adults, however children's explanations showed patterns of immature understanding across the age groups. Taken together, the results of these studies suggest that by 4 years old, children have some ability to identify the temporal location of past events, however that ability is incomplete and continues to develop well into elementary school.

Strategies Used by Legal Professionals to Obtain Temporal Information

Given that the research on what children can do is still somewhat unclear and generally suggests young children struggle with making exact judgments about temporal location, many legal professionals resort to alternative strategies to attempt to extract temporal information from young witnesses (R. v. R.W., 2006; U.S. v. Tsinhnahijinnie, 1997). One strategy that is commonly recommended is to ask children to make relative temporal judgments in relation to a landmark event (i.e., a major holiday or salient point in the year) using temporal sequencing (e.g. *before*, *after*) or distance (e.g. *near*) terms (Ministry of Justice, 2011, p. 84; see also In the interest of K.A.W., 1986; Queensland Law Reform Commission, 2000). Developmental literature suggests that relative temporal concepts have their roots early in development and show up as connective terms in children's narratives as young as four years old (Fivush & Mandler, 1985). However, when language and memory research has examined children's

understanding of the terms *before*, *after*, and *near*, results demonstrate that although children spontaneously use these terms, they have difficulty using them accurately long after they first appear in their speech (Klemfuss, McWilliams, Olaguez, & Lyon, under review).

Even when children demonstrate accuracy regarding the meaning of relative temporal terms, relative temporal judgments using landmark events can still be problematic as they are more difficult than they initially appear. An obvious difficulty with these questions is that the terms utilized in some relative judgments are undefined. For instance, if you ask someone whether an event occurred *near* Halloween, what temporal distance constitutes *near* Halloween? Additionally, although at first glance it may appear that giving a child a landmark event to use as an anchor for their judgment may aid in their performance, if the landmark re-occurs (as is the case with major holidays), then this complicates the process. More specifically, unless a questioner specifies which occurrence of a landmark he is referring to, the event in question will have a different temporal relation to each occurrence of the landmark. For example, if the landmark is Halloween, and the time of the event in question is November, then at the time of the event Halloween has just passed. This means the event was quite *near* and just *after last* Halloween and not *near* but well *before next* Halloween. Thus, depending on which occurrence of the landmark the person is referring to, the response to a relative temporal judgment will be significantly different. It is rational to assume that people will make relative temporal judgments utilizing the closest occurrence of the event, so in the example above people would respond that November is *near* and *after* Halloween. However research examining 6- to 10-year-old maltreated children's relative temporal judgments found that children do not use this logic. Instead, McWilliams, Quas and Lyon (2019) found that children demonstrated a "prospective bias" when making relative temporal judgments such that they did not consider all possible

temporal relationships prior to making their judgment and preferentially answered using the future occurrence of a landmark. So, they would say that November is not *near* and *before* Halloween (McWilliams, et al., 2019). These results suggest, even when children understand what *before*, *after* and *near* mean, they may have biases that elicit responses that could appear illogical or incorrect to adults.

Adults' Perceptions of Child Witness Reports

Although developmental research suggests limitations and biases in children's temporal judgments, it is unclear whether these issues are problematic in real world settings. Unfortunately, the current recommendations for legal professionals promote the use of temporal questions that may highlight a prospective bias in children's temporal reasoning. However, for children's response pattern to be deemed "problematic" research must assess whether children's relative judgments differ from those adults would make and how those variations would influence assessments of children's credibility.

The current literature does not provide much guidance as to whether adults have different interpretations of relative temporal concepts (i.e., *before*, *after*, and *near*) compared to children. However, there is literature to suggest the consequence of miscommunications and perceived errors when children testify. A study conducted by Goodman, Golding, and Haith (1984) revealed that jurors (i.e., adults) view children as less credible than adults when testifying as a witness, suggesting that inconsistencies and errors may be met with skepticism by jurors. In this study, the jurors were asked to rate the witness credibility for a 30-, 10-, and 6-year-old witness. The results showed that jurors rated the credibility of 6-year-old lower than that of 10-year-olds, and 10-year-olds were rated lower than 30-year-olds. The findings for these statements showed that the jurors made more negative comments regarding the child witnesses (i.e., 10- and 6-year-

old) compared to the adult witness. The jurors made negative comments about the child witness in regards to their perception and memory (Goodman et al., 1984). Leippe and Romanczyk (1989) demonstrated similar results, such that mock jurors were less likely to deliver guilty verdicts when the eyewitness was a child (as compared to an adult) and they reported that they perceived the child witness to be less credible than the adult witness. However adults' negative biases about children's testimony do not automatically guarantee they will reject the child's memory; if the child's testimony sounds mature and is consistent with mature conceptualizations then the ratings of child witnesses increase (Leippe & Romanczyk, 1989).

Temporal structure use and questioning regarding the child witness. Research has been conducted in order to see how mock jurors interpret temporal aspects of children's testimony. Mugno, Klemfuss, and Lyon (2016) examined attorneys' temporal structure use and how it affects jurors' perceptions of the child's credibility. The study showed that when the attorneys used temporal structure it helped the jurors create a more accurate timeline of events, which increased their perceptions of the child's credibility (Mugno et al., 2016). Cleveland and Quas (2016) also examined how adults perceived children's temporal testimony. The results of this study showed that adults tended to rate the child lower on the credibility scale when the child was uncertain about the number of occurrences of the alleged abuse and the time frame of these instances (Cleveland & Quas, 2016). Thus, one can conclude that a coherent and consistent timeline of events bolsters children's credibility in the eyes of factfinders. However, this literature mostly examined children's "correct" responding as compared to vague or uncertain responding. No study has examined whether adults interpret children's responses taking into account developmental limitations, or whether the information they hear is interpreted using mature understanding.

The Present Study

Currently, there is a dearth of research examining how adults interpret children's testimony regarding temporal information. To date only two studies have examined adults' perceptions of children's temporal testimony (Cleveland & Quas, 2016; Mugno et al., 2016). However, neither of these studies examine how adults specifically interpret children's temporal testimony. Furthermore, the previous work has done little to examine how adult's temporal concepts differ from children's. The purpose of the present study is to provide further information about how adults interpret relative temporal judgments and whether their interpretations possess the same biases as those observed in McWilliams, et al. (2019).

Participants read twelve excerpts depicting a child's (either 8 or 17 years old) testimony in a case of alleged sexual abuse. In each excerpt the attorney asked the child to make a relative temporal judgment (using *before*, *after*, or *near*) regarding a key event in the case (e.g., when the abuse first began, when she disclosed) in relation to a specific date. Following each excerpt, participants were asked to give a timeframe for when they believed (based on the testimony) the key event may have occurred. Participants' responses to each excerpt were then analyzed to determine their conceptualization for each relative temporal term.

The current literature provides little guidance regarding how adults would conceptualize testimony regarding relative temporal concepts. Our examination is exploratory and we do not have a priori predictions regarding the length of time that adults will include in their perception of children's *before*, *after*, and *near* temporal judgments. We believe it is possible that all terms will encapsulate generally the same length of time and will only differ in direction of the judgment. More specifically, we believe that adults' judgments about *before* will reflect a timeframe that is prior to the target event and their *after* judgments will reflect a timeframe that

is subsequent to the target event. We believe that adults will reflect both forward and backward

thinking in their judgments (i.e., not have a prospective bias), therefore *near* judgments will

include times both prior to and subsequent to the target event.

Child's age was varied in order to determine whether participants show developmental

sensitivity regarding children's ability to locate events. Previous research has yet to examine

whether adults are sensitive to the difficult nature of timing past events, so again our analyses are

exploratory. If adults do show sensitivity, we expected to see that the timeframes for the younger

witness may be larger (i.e., including more potential dates) than those for the older witness.

Method

Participants

We recruited 149 participants (63% males, 83% white, $M_{age} = 35.61$) for the present

study through an online posting located on Amazon MTurk. None of the participants that

participated in the study were eliminated. The posting listed a brief explanation of the study, the

eligibility requirements, and the compensation for participation. The eligibility requirements

stated that the participants were required to be over 18 years old and be able to read and respond

in fluent English. The participants were provided with a consent form that included information

about the purpose of the study, the procedure of the study, potential risks or discomforts, and

other pertinent information that would help the participants decide to consent to being a

participant in the study. All procedures and materials were approved by The City University of

New York Human Research Protection Program.

Materials

Demographic questionnaire (Appendix A). Participants were given a twelve question

demographic questionnaire that collected information about participants' sex, age, native

language, ethnicity, occupation, education, and income. Additionally, participants were asked about how often they interacted with children and if they had any children. Participants were given multiple choice options to report their sex, income, interactions with children, and how often they see their children. The demographic information collected regarding the participants' age, ethnicity, and occupation was gathered through open response style questions. The information regarding the participants' native language, education level, and whether the participant had children was acquired by a combination of multiple choice and open response questions.

Case information (Appendix B). All participants were provided with a brief description of an allegation of child sexual abuse. The description included: the victim's name, victim's age (based on experimental condition), the defendant's name, the defendant' age, the child's relationship to alleged perpetrator, a description of child's initial disclosure, and the specific charges against the defendant. Participants were then told that they would be reading excerpts from the trial testimony in this case. They were instructed that they would need to decide when key events in the case most likely took place based on excerpts of testimony provided.

Attorney-child excerpts (Appendix B). Participants were given twelve attorney-child excerpts. The excerpts were created by adapting language from transcripts of child witness testimony in cases of alleged child sexual assault tried in Maricopa County, AZ between the years of 2005-2016. Researchers used a "search and find" function to locate sequential terms *before, after, near* in children's testimony. Researchers then identified instances in the transcripts in which child witnesses made relative temporal judgments. Once a sample of these excerpts was collected, two researchers worked together to adapt the original testimony to fit the details of the present case. All attempts were made to preserve children's language and attorney question

structure. The resulting twelve attorney-child excerpts each briefly described a key event in the case including a relative temporal judgments regarding when that event took place (e.g., "Attorney: So you said that the defendant moved into to your house [*near/before/after*] the 4th of July? Child: Yes."). Excerpt length ranged between 1 conversation turn (i.e. question-answer pair) and 5 conversational turns. Participants were randomly assigned to 1 of 3 "relative judgment" conditions whereby all attorney-child excerpts included one relative sequencing term: *before* (e.g., "So you said that the defendant moved into to your house *before* the 4th of July?"), *after* (e.g., "So you said that the defendant moved into to your house *after* the 4th of July?", *near* (e.g., "So you said that the defendant moved into to your house *near* the 4th of July?)". Each attorney-child excerpt was presented one at a time and participants were required to provide an estimated timeframe (month, day for the beginning and end of the temporal window) for when they believe the event may have occurred. Administration of attorney-child excerpts was randomized to account for the influence of order on participants' responses.

Dependent Variables

   Timeframes. For each of the twelve time questions, participants provided a start date (i.e., month & day) and end date (i.e., month & day). These dates served as "boundaries" for calculating the timeframe. Using a time wizard function on SPSS, an absolute numerical value was calculated for the amount days that fell between the given "start" and "end" date. This value is referred to throughout the paper as a "timeframe." After the timeframes were calculated, they were manually checked by the first author to ensure that they were accurate and reflected the most direct relation between the two dates (e.g., The distance between a December 31 and January 1 was equal to 1 day rather than 364 days).

Procedure

A recruitment flyer (Appendix C) was posted on Amazon MTurk that provided a brief overview of the study and the eligibility requirements to be a participant. If the participant met the requirements (e.g. over 18 years old and English-speaking) they were provided a link to the survey on Amazon MTurk. The participants were given an informed consent form (Appendix D) to read over before deciding whether or not to participate in the study. If the participants gave consent, they began the survey by filling out the demographic questions section. Once those questions were completed, the participants were given a brief summary of the charges brought against the defendant. The participants were then randomly assigned to the attorney-child scripts that contained different temporal terms. The attorney-child scripts consisted of *near, before,* and *after* sections. Each participant was only shown scripts for one of the terms, *near, before* or *after,* to complete the task of determining a timeframe based on each script that they read. Following this section the participants completed a timeline of the events listed in the excerpts, as an attention check (all participants passed). Once this section was completed, the participants were asked to enter the MTurk code that was generated at the end of the survey and input it into the MTurk link in order to be granted compensation for completing the survey.

Results

Preliminary analyses

We conducted preliminary analyses to assess if there were any extraneous effects due to demographic variables. First, we examined whether our experimental conditions significantly varied by gender, education, income, or experience with children. No significant group differences emerged. Next, we conducted a General Linear Model (GLM) on the dependent variable (i.e., average timeframe) with gender, education, income, and experience with children

entered as fixed factors and age entered as a continuous covariate. Again, no significant effects emerged.

Conceptualization of Relative Temporal Terms

Our first aim was to determine how adult participants interpreted child testimony regarding relative temporal judgments by relative temporal term (i.e., *before, after, near*), and whether perceptions varied as a function of witness age (Table 1). To accomplish our goal we conducted a general linear model (GLM) on participants' mean timeframe scores across questions with condition (*before, after, near*) and child age (8 years old, 17 years old) entered as between subjects factors. Results revealed a main effect of condition (F (2, 148) = 7.44, p = .001, $\eta\rho^2$ = .09). Post hoc pairwise comparisons using Tukey's HSD tests revealed that participants in the *near* condition (M = 17.42, SD = 11.19) provided a significantly smaller timeframe than those in the *before* condition (M = 35.45, SD = 35.35). Interestingly, timeframes given by participants in the *after* condition (M = 26.11, SD = 17.1) did not significantly differ from participants in either of the other temporal term conditions. The age of the child witness did not significantly influence the length of participants' timeframes. Although participants in the older witness condition did provide slightly wider ranges than those in the younger witness conditions, that difference did not reach statistical significance.

Relative perceptions as a function of the calendar. Although there were no a priori hypotheses regarding the length of timeframe, the trend of *after* judgments being slightly smaller and more similar to *near* judgments was a bit surprising. Thus, we conducted exploratory post hoc analyses to further examine potential sources of variability in participants' judgments. More specifically, we investigated participants' average judgments of *before*, *after*, and *near* across the calendar year. We believed it could be possible that judgments made close to the calendar

boundary (i.e., December/January transition) could be different from other judgments. More specifically, the closer the key event was to this border, the smaller the timeframe could be. If this were true, then in the *after* condition, excerpts describing events at the end of the year (e.g., "It happened *after* Christmas") would result in smaller timeframes than those made at other time points. Similarly, in the *before* condition excerpts about events the beginning of the year (e.g., "It happened *before* New Year's") would be smaller than *before* judgments at other time points.

To examine this we created mean timeframes scores for questions about the first quarter (Q1: January-March), second quarter (Q2: April-May), third quarter (Q3: July-September) and fourth quarter of the year (Q4: October- December; see Table 2 for *M* and SD). We conducted four univariate GLMs on each mean score with condition (*before, after, near*) with child age (8 years old, 17 years old) entered as between subject factors. Results revealed significant condition effects for judgments made about Q1 (F (2, 148) = 6.53, p = .002, $\eta \rho^2$ = .08), Q2 (F (2, 148) = 6.43, p = .002, $\eta \rho^2$ = .08), and Q3 dates (F (2, 148) = 6.62, p = .002, $\eta \rho^2$ = .09). Post hoc pairwise comparisons using Tukey's HSD tests revealed that participants in the *near* condition (Q1: M = 14.57, SD = 2.98, Q2: M = 7.02, SD = 3.13, Q3: M = 16.53, SD = 4.24,) provided significantly narrower timeframes than those in the *before* condition (Q1: M = 27.50, SD = 2.82, Q2: M = 31.81, SD = 2.97, Q3: M = 36.60, SD = 4.02) and in the *after* condition (Q1: M = 26.64, SD = 2.72, Q2: M = 27.99, SD = 2.86, Q3: M = 32.46, SD = 3.87). But, for judgments made in the first three quarters of the year, participants' timeframes did not significantly differ across the *before* and *after* conditions, nor by child witness age.

For Q4 judgments (i.e., judgments that are close to the end of the year), a significant effect of condition also emerged, (F (2, 148) = 7.55, p = .001, $\eta \rho^2$ = .10), however post hoc pairwise comparisons revealed a different pattern. Participants in the *near* (M = 15.96, SD = 3.97) and

after conditions provided significantly narrower timeframes than participants in the *before*

condition (*M* = 35.87, SD = 3.79). In other words, the *after* condition timeframe for these

judgments was smaller than it had been for judgments made earlier in the year. This pattern

suggests that adults are using the calendar boundary (i.e., December/January transition) as a cut-

off for *after* judgments in the last quarter of the year (i.e., October-December).

Directionality

Our final aim was to assess the direction of adults' temporal judgments. Literature

examining children's relative temporal judgments has demonstrated a prospective bias whereby

children tend to be forward looking. We conducted exploratory descriptive analyses to examine

whether our data suggest any evidence of a similar bias in adults' responses. We assessed the

start dates participants provided for *before* and *after* judgments (because these concepts are

unidirectional) and the start and end dates given for *near* judgments (because of the lack of

directional specificity in the term).

We categorized the dates participants provided as either "prior to" or "subsequent to" the

temporal information within each excerpt. For instance, if the excerpt indicated that the key

event occurred "*near* June 12" a start date of June 1 would be coded as "prior to" to "June 12."

On the other hand, a start date of June 14 would be coded as "subsequent to" the target of "June

12." [1]If participants' interpretations of the prompts were consistent with traditional concepts of

before and *after*, responses in the *before* condition should include only "prior to" start dates and

responses in the *after* condition would include only "subsequent to" start dates. If adults do not

have the same prospective bias as children, then the responses in the *near* condition should

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[1] Start dates that fell exactly on the target date were not observed in the *before* condition, and
were coded as "subsequent to" in the *after* condition and the *near* condition. End dates that were
the exact target date were coded as "prior to" in the *near* condition.

include both past and present dates (i.e., give start dates that are "prior to" and end dates that are "subsequent to"). If the adults do suffer from a prospective bias, then the *near* condition will give "subsequent to" dates for both the start and the end date.

Consistent with our predictions, participants in the *before* condition (*n* = 50) used "prior to" start dates for the majority of their judgments. Ninety-six percent of participants gave start dates that were "prior" to the target event in all 12 questions and 4% did so in response to 11 out of the 12 prompts. Surprisingly, in the *after* condition (*n* = 56) participants were a bit more variable in their directionality, with some participants deviating from the expected "subsequent to" start date. Although all participants gave at least one "subsequent to" start date, only 48% did so to all 12 prompts.

In the *near* condition (*n* = 48), all but one of the participants provided a "prior to" start date to at least one prompt and 94% of participants gave "prior to" start dates for at least 10 of the 12 questions suggesting that adults do not have a prospective bias. However, surprisingly, responses were variable on whether participants conceptualized *near* as including dates after the target date. For end dates, all participants gave at least one end date that was "subsequent to" the target event but zero participants gave 12 judgments with an end date that was "subsequent to". Sixty-percent of participants gave "subsequent to" end dates to over half of the prompts (ranging from 6-9 out of 12 prompts), the remaining 30% only gave "subsequent to" end dates to five or fewer prompts (ranging from 2-5 out of 12), which may indicate many treated *near* judgments similarly to *before* judgments.

These results suggest that adults do not have the same prospective bias as children in that they do not preferentially interpret temporal judgments in a forward direction. All participants included past dates in their *before* judgments and the majority also did so with *near* judgments.

Surprisingly, participants differed regarding their willingness to include future dates within their timeframes, with a surprising number of participants including some past dates in their *after* judgments and many treating *near* prompts similarly to *before* prompts.

Discussion

The criminal justice system often has to use only child witness testimony to communicate wrong doing in cases of child maltreatment (i.e., sexual abuse). Research has shown that relying on child witness statements can be difficult because children often provide reports that are less detailed and more prone to suggestion than adults (Ceci & Bruck, 1993). Additionally, research examining how jurors perceive child eyewitness testimony (i.e., whether or not they are credible witnesses) reveals that jurors typically view children's testimony to be less credible than adults' testimony (Goodman et al., 1984). Therefore, when children are attempting to recall forensically relevant details in their case, any source of confusion or error based on developmental limitations can be costly.

Currently, there is not a significant amount of research examining how jurors perceive children's testimony about chronology and time. The two studies that do exist both support the theory that jurors find testimony about the timeline of events to be important in assessing witness testimony (Clevland & Quas, 2016; Mugno et al., 2016). Additionally, Clevland and Quas (2016) found that when children were uncertain about the timing of events, jurors rated their overall testimony less credible than when temporal errors were not present. However, not all temporal responses are clearly "right" or "wrong," some are relative. Previous research has demonstrated that for certain relative judgments, children have a prospective bias. Based on these findings, the authors concluded that the children's bias may result in misinterpretations and miscommunications in legal settings (McWilliams, et al., 2019). However, no research has

examined what adults' assumptions are regarding relative temporal judgments, and whether they would conflict with children's prospective bias.

The current study examined how adults interpret children's temporal judgments. This was assessed by having participants read child testimony of 12 key events that either used *near, before,* and *after* prompts to create a timeframe of when they thought the events occurred. We did not have any ad hoc hypotheses regarding whether the length of time would differ across temporal term condition, but the results showed that the temporal term *near* was conceptualized as a more "exact" judgment than *before*. Initially, the results showed that *after* was not significantly different from either of the other two terms. However, upon closer examination, this seems to be due to the *after* judgments differing depending on the time of the year. More specifically, when participants heard *after* responses about excerpts in the fourth quarter of the year (i.e., Q4) their interpretation was narrower than for all other times in the year. This means for the first three quarters of the year, the terms *before* and *after* were conceptualized similarly, however at the end of the year, the participants used the calendar boundary (i.e., December/January transition) as a cut off for their judgment, which is similar to patterns found by McWilliams, et al. (2019). Interestingly, we did not see the same pattern for the *before* judgments at the beginning of the year. This could mean that participants did not use the beginning of the year as the same boundary and are more likely to think of the past as cyclical. Another possibility is that the dates that were used to did not make for a "clear" calendar boundary. Since the mean window of participants was around 30 days, the judgments in January would have been the most sensitive to the calendar boundary influence. However, the only January date present in our excerpts was January 1st, which requires moving across the boundary

to include any dates. The next closest date was in February, which allowed for the typical

window to be used without hitting up against the "boundary".

The directionality results showed that a majority of participants picked a "start date" that

was "prior to" the date listed in the 12 prompts in the *before* condition, which is consistent with a

mature conceptualization of *before*. Interestingly in the *after* condition, participants provided

responses that were not entirely consistent with the definition of the word *after*. Participants did

provide "subsequent to" start dates for many of the 12 prompts, which is consistent with mature

understanding; however a surprising number of participants included start dates that were "prior

to" the date indicated in the excerpts, which suggests that they included some *before* dates. Upon

closer examination of the individual response patterns (i.e., by both participant and by question),

there was no clear pattern to explain these responses. It was not driven by a specific excerpt or a

certain participant. Therefore, we are not clear what these answers reflect. Future research is

needed to replicate this finding and determine what factors may be driving this interpretation.

In the *near* condition, many participants included "prior to" and "subsequent to" dates in

their timeframes. Due to the inclusion of past dates in their responses, this suggests that adults do

not only consider future events when interpreting *near*. This means they could find children's

responses to relative *near* questions confusing or lacking credibility. For example, if a child

indicates in her testimony that a particular event that has been previously proven to have

occurred in early November is not *near* Halloween, jurors may begin to question her report. In

contrast to a prospective bias, an unexpected number of participants in the *near* condition gave

"subsequent to" dates in their timeframes, which indicated that they interpreted *near* similarly to

how one would typically interpret *before*. As with the *after* responses, this pattern did not appear

to be the product of a particular participant or excerpt. Future research is needed to replicate and

untangle this pattern of responding.

Limitations and Future Directions

There were limitations present in this study. One limitation was that the study was

offered online, which precludes us from knowing how focused the participants were and if they

were paying attention when they participated in the survey. It is possible that some of the

unexpected directional findings were due to typos or careless error that may not occur during an

in person study. An additional limitation present in the study was that there was no check to see

if the participants recalled the child's age. This could account for the lack of statistical difference

between the age conditions, as the participants may not have attended to the child's age. Another

limitation that was present in this study was that there was no check in place to determine if the

participants knew the "landmark" dates that were present in the excerpt, however almost all dates

that were chosen were logical. An additional limitation was that some of the "landmark" dates

chosen could potentially be problematic for the participant to determine. For example a

"landmark" date chosen was Thanksgiving and this holiday changes yearly, so the participant

would have to know the exact date that it occurs for that year. Another significant limitation was

that the participants made multiple temporal judgments at once, which could mean that

judgments were made relative to each other. For instance, if a participant received two excerpts

in chronological order (e.g., one about January 1st followed by one about February 14), then they

may have adjusted their time boundaries to account for previous answers. Methodological

attempts were made to alleviate this risk (i.e., randomization of excerpts, *before, after,* and *near*

judgments were made between subjects rather than within), but it may have played a role.

Although the present study provides important information regarding adults' interpretation of children's relative temporal judgments, it is only the first step. The present results provide us with information about how jurors interpret *before, after,* and *near* responses, but it does not tell us anything about how jurors will perceive testimony that deviates from their expectations. This key question is the next step. Future research needs to assess how jurors rate children's credibility when their relative temporal responses are consistent with a prospective bias versus when they are consistent with the interpretations observed in the present study. Future research should also attempt to replicate the findings of the calendar boundary, in order to determine if this is really how adults interpret these timeframes or if the results obtained in this study were due to methods that we chose. For example instead of picking a start date and end date (e.g., with month and day option) the participant could use a slider function (e.g., from zero to the amount of days they think appropriate for that timeframe) in order to determine timeframe length. Another area that future research should focus on is an attempt to create developmentally appropriate strategies for obtaining temporal information from children. These strategies should be sensitive to children's temporal concepts (e.g., location, sequence, distance, duration). The temporal elements that are encoded by young children should also be examined, in order to create developmentally appropriate strategies.

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Table 1

Mean days included in timeframe by condition and witness age

	Before	After	Near
	M (SD)	*M* (SD)	*M* (SD)
8-year-old witness	29.90 (15.85)	27.47 (15.75)	15.06 (9.44)
17-year-old witness	42.52 (49.99)	25.02 (18.30)	19.79 (12.66)

Table 2

Mean days included in timeframe for each question by condition

	Before M (SD)	After M (SD)	Near M (SD)
Q1: January- March			
January 1	30.66(54.53)	31.00(20.13)	11.09(8.17)
February 14	24.64(18.84)	22.15(24.65)	15.42(11.52)
March 17	27.20(21.03)	26.76(25.18)	17.20(12.31)
Overall Q1	27.50(26.64)	26.64(19.05)	14.57(9.79)
Q2: April- June			
May 5	17.28(22.16)	17.28(18.40)	9.91(11.15)
May 15	33.74(34.95)	33.76(28.25)	20.42(16.11)
June 12	44.40(47.54)	32.93(31.28)	20.71(17.67)
Overall Q2	31.81(28.68)	27.99(18.37)	17.01(11.77)
Q3: July-September			
July 4	37.44(42.03)	30.50(27.25)	14.58(14.68)
August 11	35.76(43.22)	34.43(25.48)	18.49(13.32)
Overall Q3	36.60(39.78)	32.46(25.03)	16.53(12.85)
Q4: (October- December)			
October 31	46.10(48.35)	26.89(20.03)	20.64(14.09)
Thanksgiving (11/15-11/30)	42.82(64.42)	21.39(13.97)	22.04(31.33)
December 25	37.48(53.54)	26.83(35.41)	18.82(13.68)
Christmas	47.90(70.00)	24.30(21.90)	17.84(13.31)
Overall Q4	34.86(42.50)	19.88(13.42)	15.87(12.39)
TOTAL	**35.45 (35.35)**	**26.11 (17.10)**	**17.26 (11.19)**

Appendix A

DEMOGRAPHIC QUESTIONNAIRE

The following questions are on your own demographics

1. Name: _____

2. Birthday: _____

3. Your age: _____

4. Your sex: Male_____   Female_____   Other _____

5. Is English your first language? Yes   No

6. If not, how many years have you been speaking English? _____

7. What is your ethnicity? _____

8. What is your occupation? _____ Or retired ___ Or student ____

9. What is your highest level of completed education?
    a. High school diploma or equivalency (GED) _____
    b. College _____
    c. Graduate Degree _____
    d. Other (please specify) _____

10. What is your total household income? (please choose only one):
    a. Student _____
    b. Less than $25,000 _____
    c. $25,000 to $34,999_____
    d. $35,000 to $49,999_____
    e. $50,000 to $74,999_____
    f. $75,000 to $99,999_____
    g. $100,000 to $149,999_____
    h. $150,000 or more_____

11. In the past 1 year, how many interactions would you say you have had with 6- to 12-year-old children (please choose only one):
    a. Daily _____
    b. Weekly_____
    c. Monthly_____
    d. 2-11 times per year _____
    e. 1 time per year ____
    f. Less than 1 time per year ____

12. Do you have any children? Yes   No
    a. If yes, how many children do you have? _____
    b. How often do you see your children?
        i. Daily _____
        ii. Weekly_____
        iii. Monthly_____
        iv. 2-11 times per year _____
        v. 1 time per year ____
        vi. Less than 1 time per year ____

Appendix B

Case information and 12 attorney-child excerpts

INSTRUCTIONS: The following are excerpts from a mock trial transcript representing the case

of New York v. Williams (2017). The allegations are as follows:

Isabella Johnson [age 8/age 17] accused the defendant, Michael Williams (age 41), of several

counts of Predatory sexual assault against a child (a class A-II felony in the state of New York).

The child reported that Michael Williams touched her in a sexual manner on several occasions

while she was under his care. The defendant was the live-in boyfriend of Isabella's mother and

had access to the child for approximately one year. The allegation came to light when the child

disclosed several incidents to her mother and father (who are estranged, but share custody of

Isabella).

Based on the child's testimony you will need to decide when each event most likely took place.

For each questions, use the excerpt of the testimony provided to determine an approximate time

window that you feel the event could have taken place.

Attorney: When was the first time you met Michael Williams?

Child: I don't remember the exact day, but it was [near/before/after] the end of school.

Attorney: And when did school end?

Child: May 15.

What timeframe is reasonable for "when" the child first met the defendant?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format.

Attorney: Your mom told you that she was dating Michael, correct?

Child: I think they started dating [near/before/after] my birthday.

Attorney: When is your birthday?

Child: My birthday is June 12, that was the birthday I turned [7/16]. Now I am [8/17].

What timeframe is reasonable for "when" the defendant and the mother started dating?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month format.

Attorney: So you said that the defendant moved into to your house [near/before/after] the 4ᵗʰ of July?

Child: Yes.

What timeframe is reasonable for "when" the defendant moved into the house?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month format.

Attorney: Was the defendant nice?

Child: Yes, Michael was really nice and he bought me stuff.

Attorney: He bought you stuff?

Child: Yes.

Attorney: What was one thing that Michael bought you that you liked?

Child: One time we were at the mall and he got me a tablet so I could play games. My mom had said it was too expensive, but he got one for me. It was awesome.

Attorney: When was that?

Child: I don't know, it was [near/before/after] school starting.

Attorney: And your school starts in August?

Child: It started August 11.

What timeframe is reasonable for "when" the defendant bought the tablet?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format.

Attorney: Now, Isabella, when was the first time Michael touched you in a way you didn't

like?

Child: I don't remember.

Attorney: Was it [near/before/after] a holiday?

Child: Halloween. It was near Halloween.

What timeframe is reasonable for "when" the abuse began?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format.

Attorney: Did Michael touch you more than once?

Child: Yes, it was more than one time. It was a lot of times.

Attorney: How come you didn't tell anyone?

Child: Because he always told me not to tell.

Attorney: Do you remember a specific time he told you not to tell?

Child: One time he told me that if anyone found out what we were doing that he would

have to move out and then no one would be there to take care of my mom anymore.

Attorney: Do you remember when Michael say that to you?

Child: It was sometime [near/before/after] Thanksgiving, I don't know the exact day

though.

What timeframe is reasonable for "when" the defendant said this?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format.

Attorney: Ok, Isabella, when was the last time Michael touched you?

Child: The last time Michael touched me was [near/before/after] Christmas.

What timeframe is reasonable for "when" the abuse ended?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format.

Attorney: How come that was the last time?

Child: Because I told my mom what he was doing.

Attorney: Now, you said that you told your mom, when do you think you told her, was it

[near/before/after} Christmas?

Child: [near/before/after], it was [near/before/after] Christmas.

 What timeframe is reasonable for "when" the child told her mother about the abuse?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format

Attorney: Was there a time when you told your dad what happened?

Child: It was [near/before/after] New Year's.

What timeframe is reasonable for "when" the child told the father about the abuse?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month

format

Attorney: So Isabella, was there a time when you saw your dad yell at Michael?

Child: Yes. He yelled at him for what he did to me.

Attorney: Ok, and when was it that your dad yelled at the defendant about what he had

done to you?

Child: It was [near/before/after] Valentine's Day.

What timeframe is reasonable for "when" the father confronted the defendant?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month format

Attorney: At some point Michael and your mom broke up, correct?

Child: Yes.

Attorney: And did Michael move out of your house?

Child: Yes. He moved out [near/before/after] St. Patrick's Day.

What timeframe is reasonable for "when" the mother broke up with the defendant?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month format

Attorney: Isabella, at some point you went and talked to the police about what Michael had done to you, correct?

Child: Yes, I went to see the police [near/before/after] Cinco de Mayo to tell them what had happened to me. The police station had decorations for a party.

What timeframe is reasonable for "when" the child talked to the police?

Place Boxes for Participant to freely determine "time window" in: Day Month to Day Month format.

Appendix C

Recruitment Text for Amazon MTurk

Study Title: *Adult Perceptions of Children's Temporal Judgments*

The Child Study Lab is seeking participants **18 years of age or older and English-speaking** for a study on juror perceptions of children's testimony. This study involves a 30-minute session where you will be asked to read excerpts of a child's testimony and make judgments about when you think key elements of the case occurred. After the case-relevant portion of the study is complete, you will be asked to complete a demographic questionnaire. Our goal is to gain a better understanding of how adults perceive children's testimony about time. Participants will be compensated $6.75 for participation. To sign up, please follow the link or contact a research team member at meghan.manginelli@jjay.cuny.edu.

This study has been approved by The City University of New York Research Ethics Board

Appendix D

Participant Consent Form

THE CITY UNIVERSITY OF NEW YORK

John Jay College of Criminal Justice

Psychology Department

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title of Research Study: Adult's Perception of Children's Temporal Judgments

Principal Investigator: Meghan Manginelli, B.A.

Faculty Advisor: Kelly McWilliams, PhD

You are being asked to participate in a research study because you are an English-speaking adult above the age of 18.

<u>Purpose</u>:

The purpose of this research study is to examine adults' perception of children's answers to attorneys' questions about time.

<u>Procedures:</u>

If you volunteer to participate in this research study, we will ask you to do the following:

- Read approximately 12 question-answer pairs from transcript of a child's testimony in a hypothetical case of alleged child sexual abuse.

- Based on the information given in the question-answer pairs you will attempt to determine an approximate time window for the key events in the case.

- After making judgments for all 12 "key events" you will put the events on a timeline depicting the entire sequence of events.

- You will be asked your perceptions of the child in this case as well as child witnesses generally.

- Finally, you will fill out a demographic questionnaire.

Time Commitment:

Your participation in this research study is expected to last for a total of thirty minutes.

Potential Risks or Discomforts:

- It may be important for some individuals to note that you will be reading several simulated attorney-child interactions regarding mock allegations of child sexual abuse. This could potentially cause psychological distress for some people. All explicit information has been removed from the interactions and case descriptions, however if the topic of child sexual abuse is particularly upsetting for you or you have heightened sensitivity to this subject matter you may want to terminate your participation.

Potential Benefits:

- There are no direct benefits for participation.

Alternatives to Participation:

For all participants, participation is voluntary.

Participants can skip any question they do not wish to answer.

Participants may terminate their participation at any time.

Payment for Participation:

Participants will be compensated $6.75 through the Amazon MTURK system upon completion of the study. Although participation is voluntary, and participants can skip questions they do not wish to answer. Compensation will only be given to completed surveys (i.e., 90% of answers provided).

New Information:

You will be notified about any new information regarding this study that may affect your

willingness to participate in a timely manner.

Confidentiality:

- We will make our best efforts to maintain the confidentiality of any information that is

  collected during this research study that could identify you. We will disclose this

  information only with your permission or as required by law.

- The research team will have access to the identifying information: Amazon MTurk

  Worker ID and your IP address.

- Identifying codes will be created to link with identifying information with participant

  responses.

- All identifying codes will be stored in a secure location, separate from participant

  responses.

- All responses will be storage electronically. The data will be housed on a secure server

  behind multiple locked doors.

- The research team, authorized CUNY staff, and government agencies that oversee this

  type of research may have access to research data and records in order to monitor the

  research. Research records provided to authorized, non-CUNY individuals will not

  contain identifiable information about you. Publications and/or presentations that result

  from this study will not identify you by name.

Participants' Rights:

- Your participation in this research study is entirely **voluntary**. If you decide not to

  participate, there will be no penalty to you.

- You can decide to withdraw your consent and stop participating in the research at any time, without any penalty.

Questions, Comments or Concerns:

If you have any questions, comments or concerns about the research, you can talk to one of the following researchers:

Kelly McWilliams, PhD

(212) 237-6241

kmcwilliams@jjay.cuny.edu

Meghan Manginelli, B.A.

(212) 237-6241

meghan.manginelli@jjay.cuny.edu

If you have questions about your rights as a research participant, or you have comments or concerns that you would like to discuss with someone other than the researchers, please call the CUNY Research Compliance Administrator at 646-664-8918 or email HRPP@cuny.edu.

Alternately, you can write to:

CUNY Office of the Vice Chancellor for Research

Attn: Research Compliance Administrator

205 East 42nd Street

New York, NY 10017

IMPORTANT: You may NOT consent to participate in this study if you are under the age of 18.

If agree to participate in this research study, **please hit "continue" to go onto the next screen**.

If you do not wish to agree to participate, please exit this screen and terminate the study.