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Spring 5-2022

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How Prospective Bias Shapes Children's Responses to Temporal Location Questions

Tige Anderson

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### **Abstract**

This study builds on McWilliams (et al., 2019) by analyzing temporal bias among children when making relative temporal judgments using recurring landmarks (e.g., birthday, holidays). Previous research has demonstrated that children display a prospective bias when making these judgments, meaning they tend to date things based on the future occurrence of the landmark (E.g, “it’s ten months until my birthday”) (McWilliams et al., 2019). Adults, by contrast, make relative judgments with landmarks based on the most proximate occurrence of the landmark. In other words, they do not prefer the future or the past (Merriwether et al., under review). Additionally, recent research suggests that, in legal settings, testimony that is consistent with the prospective bias is seen as less credible than when it follows adult patterns of temporal understanding. The present study aims to expand on this line of research by examining children’s open-ended explanations to these questions, in an effort to obtain a better understanding of how children think about relative judgments.

*Key Words:* Prospective bias, children, temporal reasoning, temporal locations

## **Introduction**

Children make relative temporal judgments with recurring landmarks (e.g., “Was it near Christmas?”) differently than adults due to a temporal bias known as prospective bias. Prospective bias specifically is a tendency for children to be future thinking and to make temporal judgments in relation to the future occurrence of a landmark. In contrast, adults make relative temporal judgments about recurring landmarks using the most proximate occurrence of the landmark, whether it just occurred or is forthcoming. Prior research has demonstrated children’s prospective bias using closed-ended responses to judgments with their birthday as the recurring landmark (i.e., “Was it near your birthday”). However, no research has expanded this beyond their birthday to look at other holidays. And more importantly, no study has examined how children explain these judgments. Therefore, it is unclear whether children’s future-oriented responses are simply guesses, a response bias, or an actual bias in their concept of relative judgments.

## **Literature Review**

### **Children’s Ability to Make Temporal Judgements**

Friedman (et al., 1995) was the first to expose temporal biases among children. Friedman’s research was concerned with how the accuracy of distance-based judgements changed over time and whether a child’s ability to make these judgements improved. Additionally, Friedman focused on how children’s ability to make distance judgements changes with development. Friedman’s first article includes three related studies.

The first study asked children to determine the distance between two occurrences. Seven hundred eighteen children in grades kindergarten to seventh grade were asked which was more recent their birthday or Christmas. The children were also asked how they came to their

conclusion. An example of this would be a response of “I know my birthday happened first because I do not remember Christmas decorations at my birthday party.” These responses were scored in one of three ways: correct, incorrect or not scored at all. For example, a child with the birthday of December first being asked on December tenth would either answer correctly by saying “my birthday happened more recently” or incorrectly by saying “Christmas happened more recently.” The child would not be scored at all if they had any inconsistencies in their response. When explaining how they knew the answer the child was then placed into one of 129 categories based on location, distance and order. Location is one’s ability to say when something happened. Distance is knowing how long ago something happened. Order is being able to place events in the order in which they occurred. The data showed that children were accurate in judging order when the event was at most two months away. After that, accuracy dwindled.

The second study had similar methodology except it took place six months later to see if anything skewed the responses to study one. The findings were the same as the first study. The final study took place when Christmas was in the near future. The methodology and findings were similar, except that it included an extra examination.

Several years later, Friedman (et al., 1998) studied temporal bias among 1,825 three to seven-year olds in three studies. The research done for the first two studies was an expansion whereas the final study was a replication.

The first study asked the children a question with the goal of recalling events and reporting which one was a shorter or longer time ago. This question was changed according to what the retrieval goal was, for example Christmas in relation to their birthday. This question was divided into two parts. The first, referred to as the retrieval question, asked “think about (first event description), and think about (second event description).” The goal of the retrieval

question was to get the children to think about an event. The second, referred to as the birthday question, asked about the recency of the child's birthday to a holiday. The data shows that the retrieval question was effective at getting children to think about the target date and a 52% accuracy showing that children cannot accurately determine how long ago a certain date was. The accuracy component was based on the child's ability to determine which event occurred more recently. The birthday question showed that children were able to determine the relative recency of their birthday in comparison to Christmas.

The second part of this research involved showing children stimulus cards, all of which had holiday information on them, and then being asked to place the cards on one side if they occurred longer ago and the opposing side if they occurred more recently. The data suggests that children can use spatial relations to describe time more accurately.

The final study combined the two earlier studies. The stimulus cards were shown and then various holidays were primed. The results were similar to study one with the addition of finding that priming has a large impact on a child's ability to recall which event took place first.

### **Children's Temporal Judgements in Legal Settings**

McWilliams (et al., 2019) discovered prospective bias. Her study asked whether maltreated children were capable of judging the location and order of significant events with respect to a recurring landmark event. Specifically, she asked 167 six to ten-year-old maltreated children whether their birthday was closer to the current day or their last court visit. The data suggests that landmark events make responses less precise than they would be otherwise.

McWilliams (et al., in prep) is studying prospective bias in more detail. McWilliams studied this by exploring the importance of dates in relation to children's most recent court visit. The dataset consisted of 168 participants who were seven to ten-year-old maltreated children.

Children were asked about the temporal location, relative temporal distance and order judgements in relation to the current time and their last court visit. The temporal judgements were based on the recurring landmarks of Halloween, Christmas and their birthday. It was found that children do indeed have a prospective bias that is not bound exclusively to their birthdays. The data also showed that if the target event occurred one month in the past 70% of children would still respond with “not near.”

Merriwether (et al., in prep) compiled two studies. The first study has the research goal of examining whether or not adults have a prospective bias or if they consider both the past and present equally when making temporal judgements. One hundred eighty-seven participants completed a questionnaire online through the website known as MTurk. The questionnaire asked adults to make relative temporal order and distance judgements about current time and past events. It was found that adults do not have a prospective bias and instead use the proximate occurrence of the landmark. This is in line with the current research since it shows that children most likely have more simplistic logic when making temporal judgements.

The second study has the research goal of determining if the prospective bias affected juror reasoning. The dataset used consisted of 221 participants who answered an online questionnaire using the MTurk website. The questionnaire used a child’s testimony which was manipulated to either have prospective bias or not have prospective bias. After reading, the participants were asked to decide and explain their reasoning for their decision. The data shows that participants who read the prospective bias example were more likely to render a guilty verdict.

The key findings from these research articles is that children have a prospective bias and adults do not. Prospective bias impacts how adults view children’s reliability. This relates to the

current research because of its focus on prospective bias. These studies are foundational for understanding how children and adults perceive. The previous research has made clear that juveniles have less maturity in temporal location abilities than adults. The logical next step in research is to investigate how children's responses are altered when making temporal judgements.

## **Methods**

### **Participants**

The current study features 168 seven to ten-year-old maltreated children. Participants were recruited from the Los Angeles County Dependency Court. The sample was equally split among sex (54% male, 46% female) and was racially diverse. The sample was 70% Latinx, 21% African American, 7% non-Hispanic Caucasian, 1% Indian and 1% Asian, which is representative of the population of the Los Angeles County Dependency Court. Consent for all children was given by the Presiding Judge of the Juvenile Court. Additionally, all participants provided written or verbal assent (depending on age). Children were ineligible if they were unable to communicate in English or if they were awaiting a court visit where they may testify. Because children were asked about their initial court visit in this research, children whose initial court visit had occurred more than three years ago were excluded, because that would have likely resulted in children being too young to remember the visit.

### **Procedure**

For recruitment, children were approached while in the shelter care area of a dependency court. Research assistants worked with court staff to identify eligible children, then approached the children and asked if they wanted to be part of a study which would include playing a game in a different room. After the children agreed, the research assistant escorted the child to a

private room in the shelter area of dependency court. First, the research assistant described the study to the child and obtained assent. Next, the research assistant administered the interview, which included rapport building through open-ended questions, temporal location questions, relative temporal judgments questions, and open-ended questions asking children to explain their responses. The children were then debriefed and received a small prize. Only the relative temporal judgments and the open-ended questions are discussed in this paper.

## **Materials**

### ***Closed-ended Judgments***

To determine how children would make relative temporal judgments about distance, the children were asked three yes/no questions: “Today is it near your birthday?” “Today is it near Halloween?” and “Today is it near Christmas?”

### ***Children’s Explanations***

Children were also asked to explain their closed-ended judgements. Immediately following the closed-ended question children were asked the open-ended prompt “You said today was near/not near your birthday/Halloween/Christmas, how do you know?” Because the study became long and repetitive for the children, children were only asked to explain two of their three closed-ended responses.

### ***Demographic Information***

Children’s demographic information was filled out at the time of testing by the research assistant by asking the children their name, gender, race/ethnicity and birthday. This information was then verified post-session by using court records at the dependency court.

## **Coding**

### ***Prospective Bias Coding***

One-month landmark groups were created based on children's pattern of responding in relation to the amount of time between the target event (i.e., current time) and the recurring landmark (i.e., birthday, Halloween, Christmas). For example, if a child making a relative judgment about the current time (target event) relative to Halloween (recurring landmark) was tested in March, that child would fall into the seven-month group because March to October is seven months. These groups allowed for graphing based on the percentage of children who responded "near." This allowed for examination of the prospective bias.

Prospective bias is demonstrated by children in the nine, ten and 11-month groups who responded with "not near." This reflects the prospective bias because it indicates that children are considering the future distant occurrence of the event (i.e., 9-11 months in the future) and not the recent past occurrence of the event (i.e., 1-3 months in the past).

No prospective bias is demonstrated by children in the nine, ten and 11-month groups who responded with "near." This does not reflect prospective bias because it indicates that children are considering the recent past occurrence of the event which is 1-3 months in the past. This pattern of responding is what is seen in adult participants (Merriwether et al., in preparation).

### ***Children's Explanation Coding***

Coding for children's open-ended explanations for their relative temporal judgements was a three-part process (see Table 1 for full breakdown and examples of each code). First, children's responses were categorized as substantive or non-substantive. Substantive explanations were explanations that indicated the children understood the questions and were able to answer them in a logical fashion. Non-substantive explanations, on the other hand, were those that demonstrated that children could not or did not want to provide any useful

information. Next, Substantive explanations were further broken down into those that used temporal concepts, which we called Temporal Substantive explanations, and those that did not, which we called Non-Temporal Substantive explanations. Temporal Substantive explanations were those in which children included conventional temporal information or any temporal concepts as a means of describing the temporal relationship. Non-Temporal Substantive explanations were characterized by logical explanations that did not use temporal concepts in order to describe their reasoning.

Finally, children's Temporal Substantive explanations were examined for how they rationalized their response. The rationalization types included *forward* language, backward language, gist language, and temporal cutoff language. *Forward* language explanations included an explanation that was clearly future-oriented. Backward language explanations included those in which children explained the relation in reference to the previous occurrence of the landmark. Gist language explanations were any explanations that included simple language to explain the relation, and were often the children simply restating the question. Finally, temporal cutoff explanations included references to temporal boundaries as the reason why a temporal relation existed. These codes were not mutually exclusive, therefore some responses included multiple types of explanations. Two coders independently coded 20% of the sample and reached a high level of interrater reliability with of  $\kappa > .80$  for all codes. All dependent variables using these codes reflect the percentage of responses across all open-ended relative explanations that include each type of code.

## **Results**

### **Prospective Bias in Children's Closed-Ended Judgments**

Overall, 98% ( $n = 198$ ) of children's closed-ended relative temporal judgments (i.e., "near"/ "not near") were forward looking. Across the three holidays, 99% percent ( $n = 66$ ) of children's birthday judgments were consistent with a prospective bias, 96% ( $n = 69$ ) of children's Halloween judgments were consistent with a prospective bias, and 100% ( $n = 63$ ) of the children's Christmas judgments were consistent with a prospective bias. Additionally, every child gave at least two judgments that were consistent with a prospective bias.

Of the judgments that were not forward looking, of which there were only four, each was from a different child. The first child to reflect a non-prospective bias response was an eight year old who was asked whether or not their birthday was near. This eight-year-old's birthday is on February 24th and they were asked this question on March 21st. The rest of the children who did not reflect forward looking in their closed-ended response answered whether or not Halloween was near. The first response was from an eight-year-old who responded to the question the day after Halloween. The next response was from another eight-year-old who responded 13 days after Halloween. Finally, a nine-year-old responded to the question 29 days after Halloween. All of the responses which did not reflect a prospective bias (i.e., children considered the past occurrence) fell within a month from the target date.

### **Prospective Bias in Children's Explanations for Their Judgments**

Children's responses to the close-ended questions demonstrated that the majority of children were future-oriented in their responses and many reflected a prospective bias. Next, we examined how children made these judgments and whether their tendency to conceptualize these questions relative to the future was clear in their explanations. First, we examined whether children's open-ended responses to the relative temporal judgments provided any substantive information. We found that 10% of children's responses ( $n = 21$ ) were non-substantive, meaning

they were unable to answer the open-ended question. Given that these children were not able to explain their own reasoning and it is unclear whether they were just guessing, we removed them from the sample. Next, we examined whether children's responses included temporal information. Approximately 11% ( $n = 23$ ) of children gave Non-Temporal Substantive explanations. While these explanations demonstrated that children understood the question and were able to answer it, they did not provide much information about children's actual temporal understanding. Because of this, we also removed these explanations from the sample for all subsequent analyses. Seventy-nine percent ( $n = 158$ ) of the responses were Temporal Substantive explanations. Therefore, it can be concluded that the majority of children's responses (90%) are not guesses, but rather clear, rational, and thoughtful explanations that include temporal information (79%).

Next, within the Temporal Substantive explanations ( $n = 158$ ), we explored how often children provided each rationalization type to describe their judgments. We found that the majority of explanations included *Forward* language (74%,  $n = 117$ ). The next most popular category was *Gist* language (24%,  $n = 38$ ), followed by *Backward* language (15%,  $n = 24$ ) and *Temporal cutoff* language (14%,  $n = 22$ ). The majority of responses reflected children's tendency to be forward thinking, and explain the relation by the distance between the current time and the future occurrence.

However, to determine if prospective bias is truly evident, it is important to examine not only how children explain relative judgments, but how they explain the concepts of "near" and "not near" specifically. Thus, we explored the distribution of children's explanation types across near and not near responses (see Figure 1). Overall, children answered "not near" to 81% ( $n = 128$ ) of the relative temporal judgments and "near" to 18% ( $n = 30$ ) of the judgments. Fisher

exact tests were conducted to examine children's distribution of explanation types and found that only children's backward responses significantly varied by response type ( $p < .05$ ).

Specifically, children used backward language to explain "not near" responses at a significantly higher rate (96%,  $n = 23$ ) than they did near (4%,  $n = 1$ ). In fact, only one child used backward language to explain a "near" response, all other backward language was to describe why an event was "not near." For all other response types, children used the explanations type to explain both near and not near responses at a rate similar to the overall distribution of near and not near responses.

### **Discussion**

As demonstrated through previous research, children have been found to have a prospective bias when making relative temporal judgements. This bias causes them to prefer future landmarks when making judgements. This is a legal problem when evaluating children's statements because it makes it harder to determine whether or not their response is credible. Previous research has shown that adults do not have a prospective bias (Merriwether et al., under review). Previous research has also shown that children who do display a prospective bias in their response are actually seen as less credible to mock jurors (Merriwether et al., under review). Despite knowing children possess the bias and that it is problematic in legal settings, we still are unsure why children have these biases. We are also unsure whether or not they find the question difficult and simply guess as a result. We do not know if they are using any temporal concepts to answer these questions. Another unknown is if they are future orientated for a logical reason. Finally, we are unsure if explaining the reasoning behind these temporal biases will alleviate the credibility problem. The present study aimed to answer these questions.

The data showed that most children do have a prospective bias for landmark events outside of their birthday such as Halloween and Christmas. Children's responses were also analyzed and this showed that most children do not guess but instead use temporal concepts to answer these questions. Despite this however, prospective bias is still present in their explanations. Seventy nine percent of children's explanations used *forward* language meaning that most children show understanding of an event by explaining when the future occurrence of an event occurs. Some children in the dataset mentioned the previous event which suggests that children do understand that the past did happen. This makes it unclear as to why a prospective bias is evident in most of the responses. It is possible that children are future oriented simply because of the term "near." This is evident from how all but one child used backwards language to explain a "not near" relationship. This implies that if an event has passed it is no longer seen as near to this set of children.

Future research needs to explore whether using a different term, such as "far," would affect the children's responses. This is shown from how only one child used backwards language to describe a "not near" relationship. Future research also needs to explore when children lose their prospective bias. We know from Merriwether et al (under review) that adults do not have a prospective bias and we know from this dataset that children up to the age of 10 do have a prospective bias. Finally, future research needs to explore what temporal concept is causing prospective bias. This may help with increasing children's perceived credibility.

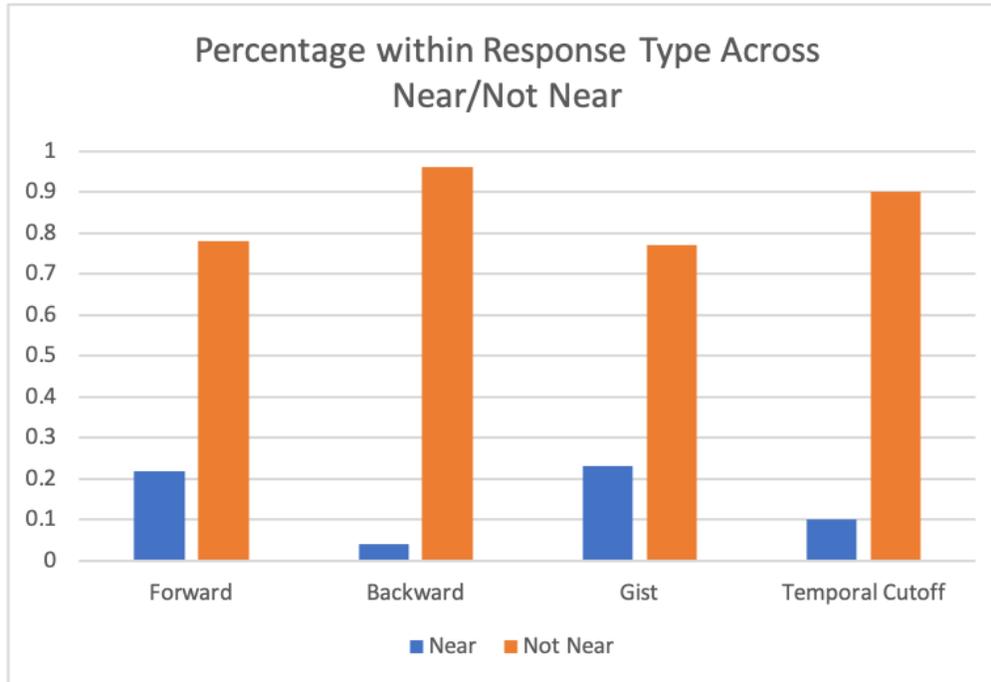
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| Category                 | Sub-Category                | Example  |
|--------------------------|-----------------------------|--|
| Non-Substantive          |                             |  |
|                          | Irrelevant/Unclear Response | Because I only came here one time (mm-hmm), and I never came again |
|                          | Limited Temporal Response   | Because my birthday  |
|                          | I Don't Know                | I don't know   |
| Non-Temporal Substantive |                             |  |
|                          | Metacognitive Deficit       | Because I know when it's my birthday                               |
|                          | Someone Told Me             | Because my dad told me   |
|                          | Celebration Information     | Cause I didn't see any Christmas decorations                       |
|                          | Calendar Use                | Because I saw it on the calendar                                   |
| Temporal Substantive     |                             |  |
| Gist                     |                             |  |
|                          | Close in Time/Near          | Because December and October are kind of close to each other       |
|                          | Far/Not Near/Long           | Because January and July are not really close months               |
| Forward                  |                             |  |
|                          | Before                      | Because it 250 something days before Christmas                     |
|                          | After                       | Because after December is January                                  |
|                          | Infront/Behind Description  | Because Halloween is in front of my birthday                       |
|                          | Takes Longer                | Because it'll take longer, about like [three second                |

|                 |                             |   |
|-----------------|-----------------------------|---|
|                 |                             | pause] four months until it's Christmas   |
|                 | Has Not Passed/Coming Up    | Because it had, the month of March hadn't, didn't pass yet  |
|                 | Listing Forward             | Because it's almost April and after March it's April and February. January, February, March, April, that's how I know |
|                 | Amount of Temporal Units    | Because it's like three or four months away from my birthday on November 20th   |
| Backwards       |                             |   |
|                 | Has Passed/Already Happened | Because my birthday already passed and when I went to court   |
|                 | Listing Backward            | No child provided a listing backward response   |
| Temporal Cutoff |                             |   |
|                 | Temporal Location           | Because Christmas is at the end of the month  |
|                 | Temporal Boundaries         | Because it was in another month   |

(Table One)



(Figure One)