# The Role of Temporal Distance in Young Children's Future Event Representations and Reasoning

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Thesis submitted to the University of Ottawa in partial fulfillment of the requirements for the Ph.D. in Clinical Psychology.

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**Acknowledgements**

Not everyone gets to pursue their dreams, and to have been able to do so with the unwavering support of so many overwhelms me with gratitude.

It's difficult to find the words to properly thank my dissertation supervisor, Dr. Cristina Atance. Thank you for giving me the opportunity to pursue my dream career and creating a safe and supportive environment for me to grow my research skills. This process has had many ups and downs, and you were always there to celebrate my successes, and support me to overcome challenges. When you didn't know the answer to one of my questions, you put me in touch with someone who did, and even sought extra training opportunities for me. Your empathy and understanding of events in my personal life allowed me to show up as a whole person. I will never forget the time, support, care, and kindness you offered me, and I look forward to staying in touch with you in the future. I truly could not have asked for a better supervisor and mentor.

I have also been fortunate to work with remarkably supportive clinical supervisors. To Dr. Josée Fitzpatrick, thank you for helping me to see my strengths when I could not see them. You consistently modeled authenticity and genuineness, which encouraged me to be myself. Thank you to Dr. Nicola Wright for showing me how to bring our humanity into our work. The unmatched care, empathy and respect you have for everyone you work with has, and always will, inspire me. To Dr. Laura Hanson, thank you for being down to earth and encouraging me to pursue new areas of interest.

Thank you to my dissertation committee, Dr. Patricia Brosseau-Liard, Dr. Christopher Fennell, and Dr. Erin Maloney, for your comments and suggestions that greatly improved my dissertation. I am grateful for the time you gave from your very busy schedules to answer my questions.

I also want to thank the members of the Childhood Cognition and Learning Lab for their support and for making the long hours of recruitment and testing enjoyable. To Dr. Julian Caza, thank you for encouraging me to pursue this degree and offering instrumental help in doing so. Thank you to Joana Mukunzi, Madison MacLachlan, Patrice Yazdanyar, Maja Greenspon, Michela Rodriguez, Jane Archibald, Mohamed Ebeid, Ronan Sampson, and Fayth Kreisman for extensive help with recruitment, data collection, transcription and coding. This would not have been possible without the many hours you all dedicated. I would like to thank the University of Ottawa, The Natural Sciences and Engineering Research Council of Canada, and the Government of Ontario for funding support. Thank you to the children and families who contributed their time, and fascinating minds, to this research.

Throughout this process, colleagues have become lifelong friends. Thank you to Aimie-Lee, Alex and Gladys for being there to listen in my most challenging moments. You always reminded me to see the good in myself, and for that I am forever grateful.

To Mom and Dad, your support and encouragement have been endless since I decided to pursue this dream at 12 years old. Thank you for believing in me, listening to my worries, and cheering me on every step of the way. To my furry friends, thank you for always reminding me of what truly matters.

Finally, to my husband. You worked so hard, and made many sacrifices, so that I could complete these many years of school. Thank you for being my sounding board, putting up with numerous technological emergencies, and sharing in the many excitements and frustrations that came over the last six years. Your boundless love, encouragement, and humour supported me through the best, and most difficult, moments throughout this journey. Thank you from the bottom of my heart.

**Content of Dissertation and Contributions of Authors**

This dissertation is comprised of a multiple-article format including two articles. The research in both articles was approved by the University of Ottawa's Research Ethics Board. The first article, "Tomorrow vs. A Year from Now: Do Children Represent the Near and Distant Future Differently?" is published in the peer-reviewed journal *Journal of Experimental Child Psychology* (O'Brien, Rodriguez, Gallitto & Atance, 2024). The author of this dissertation, Bronwyn O'Brien, appears as the first author, with honours thesis student Michela Rodriguez, lab member Elena Gallitto, and dissertation supervisor Cristina M. Atance, as co-authors. Michela Rodriguez contributed to the methodological design, data collection, transcription, and coding. Elena Gallitto provided statistical consultation. The second article, "Who Feels Happier Right Now?: The Impact of Temporal Distance on Children's Judgements of Emotional Intensity" (O'Brien, Ebeid & Atance, 2024), is published in the peer-reviewed journal *British Journal of Developmental Psychology*. Bronwyn O'Brien appears as the first author, with honours thesis student Mohamed Ebeid, and dissertation supervisor Cristina M. Atance, as co-authors.  Mohamed Ebeid contributed to the methodological design, data collection and manuscript review.

For both articles, Bronwyn O'Brien's contributions included theoretical and methodological formulations, literature review, experimental research design, ethics application, data collection, data preparation, data analysis, transcription, coding, thesis proposal, manuscript preparation, and manuscript revision. Dr. Atance provided guidance, support and expertise at every stage of the development of the experimental research design, theoretical conceptualization, ethics application, data analysis, interpretation of findings, manuscript preparation and manuscript revision.

## Abstract

The current dissertation examines the effect of temporal distance on two aspects of children's thinking: 1) future event representations (Study 1), and 2) reasoning (Study 2). Study 1 includes a series of three experiments that sought to determine the effects of temporal distance, age, and event frequency on children's future event representations. Five- to 9-year-olds were asked to describe frequent (e.g., snack) and infrequent (e.g., party) events, with half of children imagining that these events would happen in the *near future* and the other half imagining that they would happen in the *distant future.* With several exceptions, effects of temporal distance were not detected, although event frequency (examined in Experiment 1) played an important role in children's event representations. Results suggested that young children may begin perceiving differences in temporal distance, but that this does not translate to their event representations (e.g., clarity, use of personal pronouns) until later in development.

Study 2 used a novel method to examine the impact of temporal distance on young children's reasoning, while addressing important methodological limitations of Study 1 (i.e., reliance on verbal skills and self-projection). Three to 6-year-olds were asked to judge which of two characters felt more "happy"/"sad" *right now*: one engaging in a pleasant/unpleasant activity *tomorrow* or another engaging in this same activity when they are *a year older*. Starting at age 4, children correctly judged which child was more "happy"/"sad" *right now*. However, 4- to 6-year-olds tended not to explain their judgments by referring to temporal distance, per se. Similarly to Study 1, results suggest that children are sensitive to temporal distance early in development - perhaps earlier than previously thought - but do not yet verbally express this understanding.

Taken together, this research contributes new insights to our understanding of the development of sensitivity to temporal distance in young children. Implications for theories about children's future thinking and future areas of research are discussed.

**Keywords:** cognitive development, episodic future thinking, event representation, reasoning, temporal distance.

# Chapter 1: General Introduction

Starting in childhood, humans spend a great deal of their lives outside of their present experience; mentally travelling in time and space, into the minds of others, and into the world of hypothetical possibilities. Mentally experiencing these "alternate" realities is called "mental travel" (Trope & Liberman, 2010). The capacity to travel mentally in time, in particular, or "mental time travel" (i.e., thinking about the past and future; Suddendorf & Corballis; 2007), has received a great deal of attention in many areas of psychology including cognitive neuroscience, developmental science, social psychology and comparative psychology (Michaelian et al., 2016a). In fact, thinking and reasoning about both the near, and distant, future is essential to adaptive functioning. Without this capacity, humans could not work towards important goals in the distant future (e.g., saving for retirement, completing a university degree, etc.) or simpler goals in the more immediate future, such as buying a birthday gift for a friend.

Between 3 and 5 years of age, children begin to think, and reason, about the future (Atance & Meltzoff, 2005). Indeed, two forms of future thinking are involved in these processes (see section "Forms of Future Thinking" for a more detailed description). First, episodic future thinking (EFT) allows children and adults to project themselves into future scenarios, and therefore, pre-experience the future with their senses (Atance & O'Neill, 2001). For example, children may pre-experience their upcoming birthday party by envisioning the taste of their birthday cake, and imagining how excited they will feel while opening gifts. Another form of future thinking is semantic in nature, allowing adults and children to construct future scenarios using their general knowledge of how events typically unfold. For example, children may be able to envision a future birthday party because they know that one typically eats cake, and opens presents at this type of event (Atance & O'Neill, 2001). Future thinking, and EFT more specifically, is a vital capacity in childhood, as it allows children to plan to fulfill future needs (e.g., Atance & Meltzoff, 2005; Caza & Atance, 2019; Mahy, 2016), save resources for the future (Atance, et al., 2017; Kamawar et al., 2019), practice for future events (Brinums et al., 2018), and delay gratification (Mischel & Ebbeson, 1970; Mischel & Baker, 1975).

**Temporal Distance and Future Thinking**

Importantly, however, not all future events are the same, as they differ in their relative temporal distance from the self "here and now" (e.g., whether the birthday party is going to take place tomorrow vs. a year from now). In fact, adults do not think about near and distant future events in the same way. In adulthood, near future events (e.g., tomorrow) tend to be thought of in a concrete and action-oriented manner, whereas distant future events (e.g., a year from now) are thought of in an abstract and goal-oriented fashion (Liberman & Trope, 2008). For example, imagine you are hosting a BBQ tomorrow evening. You have likely decided what food you will serve, bought the required ingredients, and perhaps begun marinating the salmon. However, when you first scheduled this BBQ a month ago, you probably had not started thinking about, nor preparing, these aspects of the dinner. Instead, you may have imagined yourself enjoying your friends' company and savoring the summer weather – in fact, this "higher-level" thinking may be what pushed you to plan the BBQ in the first place.

The fact that your event representations differ as a function of temporal distance is highly adaptive and has an impact on your reasoning and behaviour (e.g., planning, delay of gratification, saving, etc.). Indeed, imagine that the way in which you were representing these near and distant future events was reversed. For instance, imagine that you had begun marinating the salmon when the BBQ was still a month away. Or imagine that the night before the BBQ, you had not yet planned your meal, nor bought any ingredients. Instead, you were daydreaming about how much fun you would have with your friends in the beautiful summer weather. Needless to say, your BBQ would be less of a success in such instances.

Fortunately, these last examples do not reflect how humans tend to think about the near and distant future. Rather, as mentioned above, adults tend to think about the near future in a concrete and action-oriented manner, whereas distant future events are thought of in an abstract and goal-oriented fashion (e.g., Liberman & Trope, 1998; Trope & Liberman, 2010). Thinking about the near and distant future in these ways is vital for adaptive reasoning and behaviour, allowing us to prioritize tasks, set goals, plan, and engage in self control (Fujita & Roberts, 2010; Trope & Liberman, 2010).

Like adults, young children need to begin distinguishing between the near and distant future so that they can reason, prepare, plan, and behave adaptively with the future in mind. For example, if children fail to represent near future events (e.g., a presentation at school tomorrow) more concretely than distant ones, they may not engage in the necessary actions *now* to prepare for the event in question (e.g., practicing their speech the night before, instead of playing video games). Alternatively, if children were to represent distant events concretely (e.g., a presentation at school several months from now), they may get "stuck" focusing on this event, to the detriment of other tasks/events that they must prioritize and prepare (e.g., other school projects, household chores). As a result, children's ability to distinguish between the near and distant future, and represent these events differently, has implications not only for reasoning and behaviour, such as delay of gratification, planning, and self-control but, more broadly, for children's independence, autonomy, self-competence, and well-being.

**Dissertation Overview**

The current dissertation comprises two studies (i.e., four experiments) investigating whether, and at what age, children's future event representations and reasoning become sensitive to temporal distance. In other words, do children think, and reason, about the near and distant future differently, and at what age does this occur? In the General Introduction (i.e., Chapter 1), I begin with an overview of how humans engage in future thinking and the development of future thinking in childhood, including the development of future-oriented behaviour and reasoning (e.g., item-choice tasks, planning, saving, delay of gratification) and future event representation (e.g., verbal descriptions, scale ratings). Next, I outline current theories and relevant work on the effects of temporal distance on different aspects of adults' and children's future event representations and reasoning. Finally, I conclude with the objectives for this dissertation.

I then describe Study 1 (i.e., including three experiments; O'Brien et al., 2024), followed by Study 2 (i.e., including one experiment; O'Brien et al., under review), both presented in manuscript format. Study 1 (i.e., Chapter 2) includes three experiments that explore the effects of temporal distance on children's future event representations. We based our method on a paradigm initially used by cognitive psychologists to study the effect of temporal distance on adults' future event descriptions. In this design, verbal future event descriptions and scale ratings are used as a proxy for future event representations. Using a between-subjects design, these three experiments investigated whether 5- to 9-year-olds' near future event (e.g., tomorrow) descriptions (e.g., details, pronouns) and scale ratings (e.g., clarity) were more concrete than those of distant future events (e.g., next year), by examining numerous indicators of concrete event representation. Along with the effect of temporal distance, we investigated whether age and event frequency (i.e., whether the event occurs frequently or infrequently; Experiment 1) influence the concreteness of children's near and distant future event representations.

Study 2 (i.e., Chapter 3) used a novel methodology, that was less reliant on verbal skills and self-projection, to investigate whether younger children (i.e., 3- to 6-year-olds) consider temporal distance when reasoning about the intensity of another child's currently-felt emotions. To do so, we examined whether children understand that the emotional intensity of an event may differ depending on whether the event is to occur in the near or distant future (e.g., Agerström, et al., 2012; Burns et al., 2019). For example, do children understand that someone who will be engaging in an enjoyable event (e.g., "eating an ice cream cone") in the immediate future (e.g., "tomorrow") will feel happier *right now* than someone who will be engaging in the same event in the more distant future (e.g., "next year")? If so, this suggests that they are sensitive to temporal distance and consider it during reasoning. We also investigated whether event valence (i.e., happy vs. sad) and age play a role in this relation. I conclude this dissertation with a General Discussion (i.e., Chapter 4), including a general overview of the limitations, directions for future research, and applications of the main findings from the two studies.

**What is Future Thinking?**

What is future thinking and how do humans construct a future event representation in their mind's eye, and reason about the future? Across the many subfields that have studied this concept (e.g., cognitive neuroscience, developmental science, social psychology, and comparative psychology; Michaelian, et. al., 2016a; Oettingen et al., 2018), many different terms have been used to describe future thinking, including *episodic future thinking, prospection, episodic simulation, projection, mental time travel into the future, episodic foresight, autobiographical planning,* and *future-oriented cognition* (Martin-Ordas, et. al., 2014; Szpunar, et al., 2014). Importantly, future thinking is a form of mental time travel (Suddendorf & Corballis; 2007), where mental time travel involves mentally re-experiencing our past (i.e., episodic memory) and pre-experiencing our future (i.e., episodic future thinking; EFT).

Indeed, we cannot project ourselves into the future without being able to revisit, and re-experience, our past. According to the *constructive episodic simulation hypothesis* (Schacter, et al., 2007), humans mentally construct, and reason about, future events by drawing on memories of previous, similar experiences. For example, to decide what to serve at your upcoming BBQ, you will likely think back to what you've enjoyed eating at previous BBQs. The same is true of predictions of the emotional content of future event representations. Consistent with the *memory hypothesis* of future thinking, our emotional predictions are derived from previous emotional experiences in similar situations (Morewedge et al., 2005). For example, you will likely imagine how excited you will feel to spend time with your friends at the upcoming BBQ based on previous experiences you have had dining with your friends. Therefore, memory plays an important role in future event representation and reasoning. In fact, thinking about the past and the future share common cognitive and neural mechanisms (Addis, et al., 2007; Buckner & Carroll, 2007; Szpunar, et al., 2007) and emerge at a similar point in cognitive development (Suddendorf, 2010; Quon & Atance, 2010).

***Forms of Future Thinking***

Drawn from work by Tulving (Tulving, 1972, 1984, 1985a; 1985b) on the memory system, Atance and O'Neill (2001) argue that future thinking can be episodic (i.e., personal details that are specifically located in time and space) as well as semantic (i.e., general facts). The semantic system involves retention and retrieval of facts (e.g., ketchup is red) and scripts of how events typically unfold (e.g., dinner comes before dessert**;** Tulving, 1972; 1985a; 1985b;

2001). Contrarily, the episodic memory system involves travelling back in time to re-experience personal memories in the mind's eye (e.g., recalling the taste of your BBQ food last week; Suddendorf et al., 2009; Tulving, 1984). According to Tulving (1985b, 2001), a distinct aspect of the episodic memory system is the requirement for *autonoetic consciousness*, which involves the consciousness of oneself as the "experiencer" of the memory, rather than the knowledge of general facts, as is the case with the semantic system. In other words, these two systems reflect our ability to "know" (i.e., semantic) vs. "remember" (i.e., episodic).

Therefore, like memory, future thinking involves semantic and episodic processes. In our current example, the scene of your future BBQ will include semantic (e.g., the steps to take to turn on the BBQ, the time at which guests will arrive) and episodic information (e.g., the smell of fresh corn and salmon). As illustrated in this example, researchers have argued that there is considerable overlap between episodic and semantic future thinking and that the two processes are interrelated (Martin-Ordas et al., 2014). Our future event representations are therefore made up of episodic and semantic details, extracted from memories of previous experiences.

Szpunar et al. (2014) proposed a taxonomy of future-oriented thought that describes different modes of future thinking in the aim of harmonizing the different terms used to describe future thinking across disciplines. These modes include "simulation" (i.e., construction of a detailed mental representation of the future), "prediction" (i.e., estimation of the likelihood of and/or one's reaction to a particular future outcome), "intention" (i.e., the mental act of setting a goal), and "planning" (i.e., the identification and organization of steps toward achieving a goal state)". In this taxonomy, Szpunar and colleagues (2014) conceptualize semantic and episodic future thinking as two ends of the same continuum and view these four modes of thinking as hybrids between semantic and episodic thinking.

The studies in this dissertation involve children 1) creating, and verbally describing mental *event representations* of personal events in the near and distant future, and rating various aspects (e.g., clarity) of the event representations (i.e., including “simulation” and “planning” in Szpunar’s (2014) taxonomy); and 2) considering temporal distance when *reasoning* about currently-felt emotions (i.e., including "prediction” in Szpunar’s (2014) taxonomy). Therefore, this dissertation focuses on children’s sensitivity to temporal distance during *future event representation* and *reasoning*, with both processes being interrelated (i.e., to reason/make a judgement about the future, we must first create a future event representation) and relying heavily on EFT. Although EFT is a main component of these studies, they also likely involve semantic future thinking, and the processes of simulation, planning, and prediction. Throughout this dissertation, I refer to these as “future event representation” and “reasoning”. In this case, the reasoning specifically pertains to reasoning about another’s currently-felt emotions in anticipation of a future event (i.e., Study 2).

**The Development of Episodic Future Thinking in Childhood**

Using behavioural and verbal tasks, researchers have discovered that EFT appears to emerge sometime between ages three and four (Atance & O’Neill, 2005). Importantly, EFT shows substantial development by the age of 5 (Busby & Suddendorf, 2005; Quon and Atance, 2010), and continues to develop through middle childhood, late childhood, and adolescence (Coughlin et al., 2014; Gott & Lah, 2014).

***Behavioural Methods***

Behavioural tasks, sometimes drawing on comparative methods (Premack, 2007; Raby et al., 2007), are often structured such that children must take action in the present in anticipation of a future need. In doing so, they are demonstrating that they are engaging in EFT through future-oriented behaviour. Tasks that measure abilities such as planning, saving, and delay of gratification are examples of this, as children must reason about a future need to make an adaptive choice in the present in anticipation of a future event. For example, in a study by Atance and colleagues (2017), children had to decide whether to use five marbles to play with a small marble run *now* or save their marbles to use with a more desirable marble run in *3 minutes*. In order to make the more adaptive choice (i.e., saving their marbles for the more desirable marble run), children had to project themselves into the future and imagine, for example, how disappointed they would feel if they did not have any marbles remaining for the more desirable marble run. Importantly, these abilities (i.e., planning, saving, delay of gratification) appear to emerge and improve between the ages of 3 and 5 (e.g., Atance and Meltzoff, 2005; Atance et. al., 2017; Barragan-Jason, et al., 2018; Hudson et al., 1995; Metcalf & Atance, 2011; Prencipe & Zelazo, 2005).

Many behavioural tasks have been inspired by Tulving's "Spoon test" (and by an earlier proposal by Suddendorf, 1994) in which a young girl places a spoon under her pillow at bedtime after having a dream the previous night in which she was not able to enjoy a delicious pudding because she did not have a spoon (Tulving, 2005). Therefore, she is taking an action in the present (i.e., putting a spoon under her pillow) to prepare for a future need (i.e., delicious pudding), consequently demonstrating EFT. Drawing on this work, several "item-choice tasks" have been designed in which children are presented with a problem and the item required to solve the problem is unavailable (e.g., puzzle board without puzzle pieces, Suddendorf & Busby, 2005). Children are then taken to a separate room and must select the appropriate item amongst a set of items to solve the problem, in anticipation of returning to the initial problem in the future. Overall, children begin selecting the correct item around the age of 4 which, again, has been taken to suggest that EFT emerges around this age (e.g., Scarf, et al., 2013; Suddendorf & Busby, 2005).

In one such experiment, Suddendorf and colleagues (2011) presented 3- and 4-year-olds with a locked bock containing stickers that required a key that was unfortunately missing. Children were then taken to a separate room and shown a variety of keys (including the correct one) from which to choose to unlock the box in anticipation of returning to the original room in the future. When immediately asked to solve the problem, 3- and 4-year-olds succeeded. However, only 4-year-olds were successful when they had to wait 15 minutes before choosing an item.

Using a slightly different approach, Atance and colleagues (2015) had 3- to 5-year-olds visit two rooms, where one room contained toys to play with, while the other did not. Children had to spend three minutes in each room and were therefore bored when in the room with no toys. After visiting each room twice, children were taken to another room and asked to place a box of toys in one of the rooms in anticipation of returning to the lab when they were one year older. The correct response is thus to place the box of toys in the empty room. Children were also asked memory questions (e.g., which room contained toys) to ensure that failures could not be attributed to memory difficulties. All age groups performed above chance on the memory questions, suggesting that memory was not a limiting factor. Four- and 5- year-olds correctly stated that they wanted to put the toys in the room with no toys, while 3-year-olds were not above chance on this question.

In another innovative item choice task, Moffett et al. (2018) followed a similar paradigm but instead asked 4- and 5-year-olds to generate the correct item (i.e., creating the item by drawing it) to bring back to the room, instead of choosing the correct item from a set of distractors. Results showed that 5-year-olds', but not 4-year-olds', performance improved across trials. This suggests that it may not be until 5 that children learn to use EFT to generate solutions to anticipated needs. Taken together, behavioural tasks suggest that EFT begins to emerge between 3 and 5 years of age, with substantial improvement occurring across this period of development.

***Verbal Methods***

A vast literature has explored how young children talk about the future (e.g., Quon & Atance, 2010; Busby & Suddendorf, 2005; Hayne, et al., 2011; Hudson, et al., 1995) as a proxy for understanding how they cognitively represent, and project themselves into, future events. Children as young as 2 years begin to talk about possible events in the future (Sachs, 1983). However, at this age future talk is primarily semantic, reflecting knowledge- and script-based observations as opposed to specific episodes. It is not until the ages of 3 to 5 that more episodic future talk emerges. For example, Busby and Suddendorf (2005) asked 3- to 5-year-olds to report events that happened, and were going to happen, "yesterday" and "tomorrow" and the accuracy of these events was rated by children's parents. The accuracy of children's reported future events increased with age, whereby 4- and 5-year–olds tended to generate accurate events overall (69% and 63%, respectively) whereas 3-year-olds did not (31%). Similarly, Quon and Atance (2010) asked 3- to 5-year-olds to describe specific future events (e.g., breakfast, restaurant, grocery shopping) and found that the response specificity (i.e., generating a specific – as opposed to a general - event representation in time and location) did not differ with age, but that 5-year-olds provided significantly more accurate future event descriptions than both 3- and 4-year-olds. On the other hand, Hayne and colleagues (2011) asked children aged 3 to 5 years to describe events (initially identified by parents) that would actually occur "later that day" and "tomorrow". For both time points, 5-year-olds tended to report more information than younger children. However, there was no difference in the accuracy of children's accounts or in the proportion of future-oriented information provided by any age group, suggesting that children as young as 3 years are capable of accurate future thinking. Therefore, episodic future thinking appears to emerge, and improve, between the ages of 3 and 5.

A program of research has also examined children's acquisition, and understanding, of temporal terms across development. Although young children produce temporal terms (e.g., "tomorrow" and "yesterday") around 2 to 3 years of age (Ames, 1946; Grant & Suddendorf, 2011; Dale & Fenson, 1996), they do not use them accurately until later in development. For example, Grant and Suddendorf (2011) asked parents of 3- to 5-year-olds to complete a questionnaire about their child's production, and accurate use, of a variety of temporal terms (e.g., "tomorrow", "next year", "soon", "minutes", "hours", etc.). The researchers concluded that words representing the present (e.g., "now", "today") and very general temporal terms (e.g., "later", "after", "when big") were produced, and used relatively accurately, by the majority of 3- to 5-year-olds. However, although terms describing specific time frames (e.g., "yesterday", "tomorrow") were produced from the age of 3, they were not used accurately by the majority of children until 4 or 5 years. Furthermore, very specific temporal duration terms (e.g., "months", "hours") appeared in children's vocabularies only later in the preschool years around age 5 and were inaccurately used even at this age.

Similarly, Tillman and colleagues (2017) examined 3- to 8-year-olds' understanding of the deictic status (i.e., whether an event occurs in the past vs. present vs. future), sequential order (e.g., "tomorrow" comes before "next week"), and remoteness (i.e., relative distance from the present) of time words by asking children to order temporal terms (e.g., "next week", "next year", "tomorrow", etc.) and events (e.g., "next birthday", dinner", "breakfast") on a timeline from the past (i.e., "when you were a baby") to the future (i.e., "when you'll be a grown up"). For their understanding of the deictic status of words, 3-year-olds performed at chance, while 4-year-olds performed above chance, and by the age of 7, children performed similarly to adults. Similarly, when assessing children's understanding of sequential order, 3-year-olds again performed at chance while 4-year-olds were above chance. However, it was not until 8-years-old that children's performance was adult-like. Finally, children were not able to accurately describe the remoteness of temporal terms until 5 years of age, and performance reached adult-like levels at age 8. Children also completed forced choice questions wherein they indicated which of two temporal terms would come first (e.g., "tomorrow" or "next week"). Performance was not above chance until the age of 4 and did not reach adult-like levels until age 7.

In another study, Tillman and Barner (2015) found that children can contrast and rank temporal duration words (e.g., second, minute, hour, day, week, month, year) by the age of 4 or 5 (i.e., an hour is longer than a minute), but that knowledge of the absolute duration of temporal terms emerges later in development. For example, by the age of 5, children were able to place temporal terms accurately along on a number line, but could not estimate the absolute duration of these words until they had acquired their formal definitions around ages 6 or 7. Therefore, although children begin episodically experiencing the future at age 3, it is not until middle childhood that a comprehensive understanding of the temporal terms used to describe the future emerges. In fact, research has found that children's understanding of the order and remoteness of some temporal terms (e.g., "Wednesday" is one day from "Tuesday") is still developing past the age of 9 (Friedman et al., 1995) and into adolescence (Friedman, 1986).

Indeed, verbal methods demonstrate that EFT continues to improve across middle childhood, late childhood, and adolescence (Coughlin et al., 2014; Gott & Lah, 2014). To illustrate, Coughlin and colleagues (2014) asked 5-year-olds, 7-year-olds, 9-year-olds, and adults to generate and describe events that would occur "one week" and "one year" in the future in response to a cue word (e.g., book, cake). Nine-year-olds generated future event descriptions that contained more episodic details than 7-year-olds. Similarly, Gott and Lah (2014) asked 8- to 10-year-olds and 14- to 16-year-olds to describe plausible, and personal, past and future events. Results showed that 14- to 16-year-olds provided more episodic details than 8- to 10-year-olds.

**Event Frequency.** Drawing on the verbal literature, it is possible that other factors, and perhaps aspects of the future events themselves, may impact children's event representations (Burns et al., 2021). One potential factor is event frequency (i.e., whether an event occurs frequently, such as brushing one's teeth, or infrequently, such as one's birthday). For example, irrespective of temporal distance, frequent events may be construed more concretely than infrequent events, perhaps because individuals possess more detailed and concrete information about frequent, as compared to infrequent, events. Although research in this area is limited, the related concept of "event familiarity" impacts adults' future event representations (Valiente et. al., 2021; Szpunar & McDermott, 2008) and children's past event representations (Hudson & Nelson, 1986). For instance, Valiente et. al (2021) found that adults described familiar events with more sensory and temporal detail than unfamiliar events. Similarly, adults may describe future events occurring in familiar locations more episodically than events occurring in unfamiliar locations (Szpunar & McDermott, 2008).

Developmental research has found the opposite trend, wherein 3- and 5-year-olds described past unfamiliar events with more episodic detail than past familiar events (Hudson &

Nelson, 1986). This is in line with Burns and colleagues' (2021) hypothesis that generic/repetitive (and presumably more frequent) events may be construed less concretely than infrequent events because individuals possess, and rely on, more script-like knowledge to describe frequent events. Consequently, this makes it difficult to imagine, and describe frequent events with a high degree of episodicity (and, hence, concreteness). Therefore, although more research is needed, event frequency may be an important factor impacting 3- to 5-year-olds event representations.

Taken together, verbal methods suggest that episodic future thinking emerges, and improves, between ages 3 and 5. Three-year-olds are able to generate future events, although their descriptions are not often accurate. Furthermore, 5-year-olds tend to describe future events accurately, but children's understanding of the multiple facets of temporal terms (e.g., remoteness, duration) improves into middle childhood and adolescence, and the episodicity of their future event descriptions continues to develop into adolescence. Therefore, verbal and behavioural tasks provide converging evidence that EFT begins to emerge around age four, with important improvements between ages 3 and 5, and continued improvements into late childhood and adolescence.

**The Effect of Temporal Distance on Future Event Representation**

Although, from a young age, children are thinking about the future, less is known about when children begin to think, and reason, about the near and distant future differently. Before reviewing the literature on the impact of temporal distance on children's future event representation and reasoning, I provide a description of the extensive adult literature in this area.

***The Effect of Temporal Distance on Adults' Future Event Representation***

Similar to the child literature, much of our knowledge about how adults engage in future event representation comes from work using verbal measures as indicators of how future events are cognitively represented. These studies have often asked adults to generate and describe a future event in response to a cue word (e.g., Addis, et al., 2008; D'Argembeau & Demblon, 2012; D'Argembeau, et al., 2011; Liberman, et al., 2002; Liberman & Trope, 1998; Levine et al., 2002). For example, adults might be given the word "birthday" and be asked to describe what will happen when they experience a birthday "tomorrow" or "next year". This work (D'Argembeau & Demblon, 2012; D'Argembeau et al., 2011; D'Argembeau & Van der Linden, 2004; Liberman & Trope, 1998; Liberman, et al., 2002; Trope & Liberman, 2003) suggests that adults represent the near and distant future differently and that temporal distance is therefore an important factor involved in future thinking.

Broadly, near and distant future events differ in their degree of "concreteness". Near future events tend to be represented concretely and distant events more abstractly, as indicated by a variety of indicators of concrete event representation. For example, D'Argembeau and colleagues (2011) and D'Argembeau and Van der Linden (2004) found that thinking about the distant future tends to relate to goal-oriented and abstract topics such as decision making, emotion regulation, and relationships, whereas thinking about the near future tends to include thoughts with more concrete themes, such as the completion of errands and leisure activities. Moreover, D'Argembeau and Van der Linden (2004) found that when imagining a near, as compared to distant, future event, adults tended to report a clearer sense of "pre-experiencing" the event, including a clearer sense of the location, actors present, and time of day, as well as more sensory and contextual details. D'Argembeau and Van der Linden (2004) have therefore argued that events in the near future may be easier to represent than those in the distant future, and that distant, as compared to near, future events may therefore feel more uncertain. Finally, near future events tend to be imagined from a "first-person" perspective, whereas distant future events tend to be represented from a "third person" perspective, or that of an observer, and are reported as less "clear" than near future events (D'Argembeau & Van der Linden, 2004).

**Construal Level Theory.** One theory that specifically pertains to the influence of temporal distance on the concreteness of future event representations is Construal Level Theory (CLT). According to CLT, when engaging in mental travel, the "psychological distance" (temporal, social, spatial, or hypothetical) of an event from the self, "here and now," affects adults' thinking by influencing how the event is cognitively construed or thought about. Temporally- (e.g., an event that will occur a long time from now), spatially- (e.g., an event that will occur in a place far away), socially- (e.g., an event that will occur to a stranger), or hypothetically- (e.g., an event that is unlikely to occur) distant events are construed at a "high level" – that is, they are thought of in an abstract, goal-oriented fashion, and focus on the central features of the event. For example, thinking about "having a snack" in the distant future leads one to focus on the higher-level feature "eating" or "eating something nutritious". In contrast, temporally- (e.g., an event that will occur soon), spatially- (e.g., an event that will occur in a nearby location), socially- (e.g., an event that will occur to oneself), or hypothetically- (e.g., an event that is definitely going to occur) near events lend themselves to a "low-level construal", in which thinking is more detailed, action-oriented, and concrete, with a tendency to focus on the peripheral or incidental features of the event (see Trope & Liberman, 2010 for a review). For instance, when envisioning a snack "tomorrow", one might instead focus on the lower-level features such as, "cutting carrots" or "washing fruit". Therefore, the CLT perspective corroborates D'Argembeau and colleagues' (2004; 2011) findings described above by showing that near future events tend to be represented with more concrete and incidental details, while distant future events tend to be more abstract and goal-oriented (Trope & Liberman, 2003). Although CLT uses the terms "low-level" and "high-level", I will use the terms "concrete" and "abstract" for consistency throughout this dissertation.

Liberman and Trope (1998) first explored CLT by asking adults to describe themselves engaging in seven activities that would occur either in the near, or distant, future. Using a between-subjects design, participants were asked to describe themselves "watching TV," for example, either "tomorrow" or "next year". Event descriptions were scored as corresponding to a high-level (e.g., goal focused) or low-level (e.g., activity focused) structure. Participants tended to use a more low-level structure to describe near future events and a more high-level structure to describe distant future events, therefore demonstrating a tendency to represent the near future concretely and the distant future abstractly. Participants then completed Vallacher and Wegner's (1989) Personal Agency Questionnaire in which they chose between an abstract and a concrete descriptor of either near, or distant, future activities. For instance, participants were asked to decide if the activity "tooth brushing" completed either tomorrow (i.e., near) or next year (i.e., distant) was better described as "preventing tooth decay" (i.e., abstract description) or "moving a toothbrush around one's mouth" (i.e., concrete description). Participants showed a tendency to endorse distant events as corresponding to abstract descriptors and near future events as corresponding to concrete descriptors.

**Concreteness of Language.** Researchers have also found that we tend to use more concrete language when describing temporally near events (e.g., describing the act of "keeping the house tidy" as "vacuuming"), and more abstract language when describing temporally distant events (e.g., describing the act of "keeping the house tidy" as "cleaning up"; Bhatia & Walasek, 2016; Joshi et al, 2016; Snefjella & Kuperman, 2015). For example, Snefjella and Kuperman analyzed the concreteness of millions of messages posted on social networking sites (e.g., Twitter, Facebook, etc.) and coded references to psychological distance in each message (e.g., "hours from now", "days from now", "tomorrow", "next year", etc.). The more psychologically near the message (i.e., the inclusion of more temporally proximal references), the more concrete the words used, thus illustrating the relationship between temporal distance and the concreteness of language.

**Emotional Intensity.** Finally, the emotional intensity of future event representations is a sensory detail that differs with temporal distance (e.g., Burns et al., 2019; Gilovich et al., 1993; Kanten & Teigen, 2008; Trope & Liberman, 2010; Peetz & Buehler, 2012; Tang, et al., 2019; Wilson & Gilbert, 2005; Van Boven et al., 2010). Therefore, near future event representations should be characterized by higher emotional intensity (i.e., more concrete) than distant future event representations. For example, Burns and colleagues (2019) found that adults felt happier in the present when a holiday (e.g., Christmas) subjectively felt like it was to occur in the more near, as compared to the more distant, future. Importantly, however, Agerström, Björklund, and Carlsson (2012) found that temporal distance influences the intensity of future emotions differently depending on the type of emotion being predicted. Specifically, what have been termed "low-level" emotions (i.e., emotions that are felt only from the individual's perspective, e.g., sadness, pleasure, etc.) are predicted to be more intense in the near, as compared to the distant, future. On the other hand, "high-level" emotions (i.e., emotions that can only be felt by taking the perspective of another person, e.g., shame, guilt, etc.) are anticipated to be more intense in the distant, as compared to the near, future.

***The Effect of Temporal Distance on Adults' Reasoning***

Given that adults represent the near future more concretely than the distant future, it makes sense that they would also reason about the near and distant future differently (e.g., Bruehlman-Senecal et all., 2015; Kivetz & Tyler, 2007; Nussbaum, et al., 2003; Spassova & Lee, 2013; Trope & Liberman, 2000). For example, reasoning about the distant, as opposed to near, future, tends to encourage adults to place higher value on goals than on the feasibility of their actions. Liberman and Trope (1998) asked adults to choose which lecture they would attend in the near or distant future, and varied the lectures on their desirability (i.e., how interesting the topic was) and feasibility (i.e., how convenient the time of the lecture was). When deciding which lecture to attend in the distant future, adults placed more weight on the desirability of the lecture. However, when making decisions about which lecture to attend in the near future, they placed more weight on the feasibility of the lecture. Similarly, Kivetz and Tyler (2007) found that adults focus more on their core values when planning for the distant future, whereas they place more emphasis on situational contingencies when making decisions for the near future. Interestingly, similar effects are observed when adults reason about the cause of another's behaviour. For example, adults tend to attribute another's distant future behaviour to more abstract personality variables, while near future behaviour tends to be attributed to concrete, situational causes (Agerström & Björklund, 2009; Pronin & Ross, 2006). Overall, these effects are likely due to differences in near and distant future thinking. Thinking about the distant future primes one to focus on goals (e.g., learning something new at the upcoming lecture), whereas thinking about the near future leads one to consider peripheral factors to the main event (e.g., deadlines that one must meet the week of the lecture), therefore impacting reasoning.

Furthermore, temporal distance influences adults' reasoning about their confidence in their abilities. For instance, Gilovich and colleagues (1993) found that university students expected to perform better on final exams on the first day of the semester (i.e., when the exam was in the distant future) as opposed to the day before the exam (i.e., when the exam was in the near future). Again, this may because thinking about the distant future causes one to focus on goals (i.e., getting a good grade on the exam), while thinking about the near future is more concrete, allowing you to consider extenuating circumstances (e.g., time constraints, other tasks you must completed before studying) that may impact your performance. Finally, the immediacy of negative consequences also appears to influence reasoning. Kim and Kim (2018) found that when future health risks were framed as occurring in the near, as opposed to distant, future, adults tended to report a greater intention to quit smoking, perhaps because they were representing the health risks more concretely.

In sum, thinking about the future is essential for adaptive functioning and wellbeing. However, adults do not think and reason about the near and distant future in the same way. The near future tends to be construed more concretely (i.e., more detail, clarity, certainty, ease, and emotional intensity) than the distant future, which places more emphasis on outcomes and goals. This has important implications for reasoning, including decision making, behavioural attributions, planning, predictions and intentions.

***The Effect of Temporal Distance on Children's Event Representations***

Is there any evidence that children represent events differently, and perhaps more concretely, as a function of temporal distance? Using a within-subjects design, Coughlin, Lyons, and Ghetti (2014) asked 5-, 7-, 9-year-olds, and adults to generate and describe events that would occur one week and one year in the future, as well as one week and one year in the past, in response to a cue word (e.g., book, cake). Participants were also asked to rate how clear the event looked in their mind, how easily the event came to mind, and the visual perspective of the event (i.e., first- or third-person perspective). The episodicity (i.e., personal details that are specifically located in time and space) of the future event descriptions, as well as the visual perspective from which they were imagined (i.e., first vs third person) did not differ as a function of temporal distance (i.e., near vs distant). However, all age groups rated near events as easier to think of than distant events. Starting at age 9, participants rated distant future events as less clear than near future events.

Similarly, Wang and colleagues (2014) asked 7- to 10-year-olds to generate and describe one event that would occur "soon" (i.e., near future) and another that would occur when the child was "a grown up" (i.e., distant future). Seven- to 10-year-olds described near future events using more specific details (i.e., episodic information directly relevant to the central event, including happenings or the unfolding of the story, characters, place, time, perceptual experiences, emotions, and thoughts) than distant future events. These results suggest that it is not the amount of detail, per se, but rather the type of detail that differs between near and distant future event representations - a finding that is consistent with the adult literature reviewed above (e.g., D'Argembeau et al., 2011).

Children also tend to represent the near future with more personal pronouns than the distant future. Chernyak and colleagues (2017) asked 3- to 5-year-olds to generate events that they would do in the near (e.g., "right after this game") and the distant (e.g., "when you're a grown up") future. Children in the near future condition used more personal pronouns (i.e., "I" and "we") to describe events than children in the distant future condition. The authors interpreted this to mean that near, as compared to distant, future event representations involve increased self-projection, which is considered a more "concrete" representation of the event (D'Argembeau & Van der Linden, 2004).

### *The Effect of Temporal Distance on Children's Reasoning*

Although sparsely researched, preliminary work has examined the effect of temporal distance on children's reasoning. Specifically, children have been shown to experience more emotional intensity in the present when envisioning events occurring in the near, as opposed to the distant, future. Burns and colleagues (2019) asked participants aged 4-5, 6-7, 9-10, 14-18 years, and adults to rate how they felt *right now* when thinking about Easter break, Christmas holiday, and Halloween when these holidays were two weeks away. Children also rated how far away each holiday felt subjectively on a Likert-type scale. Starting at age 6, temporal distance was negatively correlated with current emotional intensity. In other words, subjectively more distant future events were rated as less emotionally intense than subjectively more proximal future events.

In sum, temporal distance appears to begin influencing different aspects of young children's event representations with near events being overall more concrete than distant events. However, much remains unknown about the impact of temporal distance on young children's future event representations and reasoning.

## Current Dissertation Objectives

The current dissertation involves two Studies (four experiments) aimed at investigating the effect of temporal distance on young children's future event representations (Study 1) and reasoning (Study 2). To do so, I examine the effect of temporal distance on a comprehensive list of verbal aspects and scale ratings of 5- to 9-year-olds' future event descriptions (i.e., Study 1). Furthermore, I investigate 3- to 6-year-olds' ability to consider temporal distance when reasoning about another child's currently-felt emotions (i.e., Study 2). This dissertation makes several important, and novel contributions to the study of future thinking, and its development in childhood, as described next.

***Chapter 2: Study 1***

Study 1 comprised three experiments, all with the objective of examining whether, and how, temporal distance, age, and event frequency (Experiment 1) influence the concreteness of 5- to 9-year-olds' future event representations via their verbal event descriptions and scale ratings (i.e., indicators of concreteness). The indicators of concreteness focused on the hypothesis that near future event descriptions would, overall, be more concrete than distant future event descriptions.

Study 1 makes several novel contributions to the field. First, previous research paradigms in this area (e.g., Coughlin et al., 2014; Wang et al., 2014) were not specifically designed to examine the impact of temporal distance on children's future event representations. Therefore, we modeled the experiments in this study after Liberman and Trope's (1998) foundational paradigm, that was specifically designed to test for effects of temporal distance. We also examined a comprehensive list of indicators of concrete event representation drawn from the child and adult literature. To our knowledge, this approach has not been undertaken with children. Moreover, we anchored Study 1 in a specific theoretical framework, CLT, to guide interpretations. This has the potential to contribute to the CLT literature more broadly, as it is the first study, to our knowledge, to examine temporal distance from a CLT perspective in children. Finally, we aimed to clarify the role of event frequency (i.e., whether an event occurs frequently, such as brushing one's teeth, or infrequently, such as one's birthday) in children's future event representations, as this has not been previously examined.

### *Chapter 3: Study 2*

Study 1 was limited by its reliance on children's verbal output and self-projection capacities. Therefore, Study 2 (i.e., that includes one experiment) employed a novel paradigm that relied less on verbal skills and self-projection to examine the effects of temporal distance on children's reasoning. This was accomplished via participants' ratings of another child's currently-felt emotions. Emotions are not only a promising means to access temporal distance effects, but also play an important role in adaptive future-oriented behaviour, such as planning and self-control (see Schmeichel & Inzlicht, 2013, for a review). To our knowledge, this novel approach, and paradigm, has not been used with adults or children.

Specifically, Study 2 focused on examining whether, and at what age, 3- to 6-year-olds become sensitive to temporal distance and consider it when reasoning about another child's currently-felt emotions. We hypothesized that, at age 4, children would be able to correctly reason about another child's currently felt emotions as a function of temporal distance at a level significantly above chance. However, we predicted that children would only be able to correctly verbally explain their reasoning at age 5 or 6. A secondary exploratory goal was to examine the role of event valence in the relationship between temporal distance and emotional intensity by presenting children with both "happy" and "sad" activities. Event valence appears to be an important factor in adults' future event representations and reasoning (D'Argembeau & Van der Linden, 2004; Agerström et al. 2014) but has not been examined in children.

#### *Implications*

Temporal distance plays a fundamental role in adults', and possibly children's, future thinking. Indeed, the ability to represent and reason differently about the near and distant future is vital for adaptive behaviour, including planning, delay of gratification and self-control. Recall the hypothetical situation outlined earlier in the Introduction in which you had begun marinating your salmon for an upcoming BBQ a month early, or in which a child fails to practice for a school presentation, instead playing video games. These less than adaptive future-oriented behaviours could be the result of insufficiently differentiating between the near and distant future during event representation and reasoning. Therefore, understanding whether, and at what stage in development, children begin to represent and reason about the near and distant future differently has important implications for their future-oriented behaviour, mental health and well-being, and independence.

Despite the importance of the impact of temporal distance on children's future thinking, this concept remains understudied to date. The current dissertation will contribute to our understanding of the effects of temporal distance on children's future event representation and reasoning and provide insight into when in development these effects emerge. Furthermore, this work may help us to understand the factors that interfere with adaptive future thinking in children. Therefore, the current dissertation has the potential to inform interventions to support children's future event representation and reasoning.

# Chapter 2: Tomorrow vs. A Year from Now: Do Children Represent the Near and Distant Future Differently?

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This manuscript was published in the journal *Journal of Experimental Child Psychology* in 2024

https://doi.org/10.1016/j.jecp.2024.105878

Minor changes were made to the published manuscript to address committee comments.

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We thank Maja Greenspon and Jane Archibald for help with data collection, video transcription and coding. Thanks to Dr. Patricia Brosseau-Liard, Dr. Veronika Huta and Dr. Simon Beaudry for statistical consultation. Thank you to the children and parents who participated.

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Anonymous data supporting these findings are openly available on OSF: https://osf.io/69n4e/?view_only=d2a899299a6b4d75810d0d4b18b9c9c1

**Abstract**

Adults represent the near future more concretely and vividly than the distant future, with important implications for future-oriented behavior (e.g., planning and self control). Although children are adept at describing future events around age 5, we know little about how temporal distance (i.e., "near" vs "distant") affects their future event representations. In a series of three experiments, we sought to determine the effects of temporal distance, age, and event frequency on children's future event representations. Five- to 9-year-olds were asked to describe frequent (e.g., snack) and infrequent (e.g., party) events, with half of children imagining that these events would happen in the *near future* and the other half imagining that they would happen in the *distant future*. We investigated the effect of temporal distance on numerous event representation indicators (e.g., clarity, details, pronouns), all theoretically grounded in previous literature. Although children perceived near events as closer in time than distant events (Experiments 2 and 2b) and temporal distance impacted the clarity of event representations (Experiment 2), most indicators were not impacted by temporal distance. In contrast, event frequency (examined in Experiment 1) played an important role in children's event representations, with infrequent events being described more concretely than frequent events. Results suggest that young children may begin perceiving differences in temporal distance, but that this does not translate to their event representations (e.g., clarity, pronouns) until later in development. Implications for children's future thinking and future research are discussed.

**Keywords:** cognitive development, episodic future thinking, event representation, temporal distance.

# Tomorrow vs. A Year from Now: Do Children Represent the Near and Distant Future Differently?

Not only do humans think about the future frequently, but we do so in a way that accounts for the temporal distance between the present and the future event in question. For example, imagine you are hosting a BBQ tomorrow evening. You have likely decided what food to serve, bought the required ingredients, and perhaps begun marinating the salmon. However, when you first scheduled this BBQ a month ago, you probably had not started thinking about, nor preparing, these aspects of the dinner. Instead, you may have imagined yourself enjoying your friends' company and savoring the summer weather. More broadly, the fact that our event representations differ as a function of temporal distance is highly adaptive. Indeed, marinating the salmon a month before the BBQ or, alternately, failing to have planned your meal, or bought any ingredients the night before, would be problematic. Fortunately, these last examples do not generally reflect how temporal distance affects our behavior. Rather, adults tend to think about the near future (e.g., tomorrow) in a concrete and action-oriented manner, whereas distant future events (e.g., a year from now) are thought of in an abstract and goal-oriented fashion (e.g., Trope & Liberman, 2010). Thinking about the near and distant future in these ways is vital for adaptive future-oriented behavior, allowing us to prioritize tasks, plan ahead, and engage in self control (Trope & Liberman, 2010).

Although the capacity to pre-experience future events (sometimes referred to as "episodic future thinking") emerges between 3 and 5 years of age (Atance & Meltzoff, 2005), we know little about whether children represent near and distant future events (i.e., termed "future event representation") differently. Yet, like adults, even young children need to begin distinguishing between the near and distant future so that they can prepare, plan, and behave adaptively with the future in mind. For example, if children fail to represent near future events (e.g., a presentation at school tomorrow) more concretely than distant ones, they may not engage in the necessary actions *now* to prepare for them (e.g., practicing their speech the night before instead of playing video games). Alternatively, if children represent distant events concretely (e.g., a presentation at school several months from now), they may get "stuck" focusing on this event, to the detriment of other tasks/events that must be prioritized (e.g., other school projects, household chores).

Children's ability to distinguish between the near and distant future, and represent these events differently, has implications not only for future oriented behaviors such as delay of gratification, planning, and goal attainment but, more broadly, for children's independence, autonomy, self-competence and well being. In a series of three experiments, we explore whether, and how, temporal distance influences young children's future event representations, as reflected by their verbal descriptions of events that they are asked to imagine in either the near or distant future.

***Effects of Temporal Distance on Adults' Future Event Representations***

One account that directly pertains to the influence of temporal distance on people's event representations is Construal Level Theory (CLT; Liberman & Trope, 1998; 2008; 2014; Trope & Liberman, 2010). According to CLT, the "temporal distance" of an event from the self, "here and now," affects adults' thinking by influencing how the event is cognitively construed, or thought about. Temporally distant events are construed at a "high level"; that is, they are thought of in an abstract, goal-oriented fashion with a focus on the central features of the event. For example, thinking about next month's BBQ leads one to focus on the higher-level features of "spending time with friends" or "kicking off the summer." In contrast, temporally-near events lend themselves to a "low-level construal," in which thinking is more detailed, action-oriented, and concrete, with a tendency to focus on the peripheral or incidental features of the event (Trope & Liberman, 2010). For instance, when envisioning tomorrow's BBQ, one might focus on lower-level features such as "making a grocery list" or "washing lettuce."

In the first of a series of experiments examining the influence of temporal distance on future-oriented thought, Liberman and Trope (1998) asked adults to describe themselves engaging in activities that would occur either in the near, or distant, future. Using a between-subjects design, participants were asked to describe themselves "watching TV," for example, either "tomorrow" or "next year". Event descriptions were scored as corresponding to a high-level (e.g., goal focused) or low-level (e.g., activity focused) structure. Participants used a more low-level structure to describe near future events and a more high-level structure to describe distant future events, therefore demonstrating a tendency to represent the near future concretely and the distant future abstractly. Participants then completed Vallacher and Wegner's (1989) Personal Agency Questionnaire in which they chose between an abstract and a concrete descriptor of either near, or distant, future activities. For instance, participants were asked to decide if the activity "tooth brushing" completed either tomorrow (i.e., near) or next year (i.e., distant) was better described as "preventing tooth decay" (i.e., abstract description) or "moving a toothbrush around one's mouth" (i.e., concrete description). Participants tended to endorse distant events as corresponding to abstract descriptors and near future events as corresponding to concrete descriptors.

Similarly, adults use more concrete language when describing temporally near events (e.g., describing the act of "keeping the house tidy" as "vacuuming"), and more abstract language when describing temporally distant events (e.g., describing the act of "keeping the house tidy" as "cleaning up"; Bhatia & Walasek, 2016; Snefjella & Kuperman, 2015). Finally, D'Argembeau and Van der Linden (2004) found that when imagining a near, as compared to distant, future event, adults report a stronger sense of "pre-experiencing" the event, including a clearer sense of location, actors present, time of day, sensory and contextual details, as well as more visual clarity. Accordingly, the authors argue that events in the near future may be easier to represent than those in the distant future, and that distant, as compared to near, future events may therefore feel more uncertain.

***Effects of Temporal Distance on Children's Future Event Representations***

Children's ability to think about the future begins to emerge around 3 years of age, shows substantial development by the age of 5 (Busby & Suddendorf, 2005), and continues to develop through middle childhood, late childhood, and adolescence (Coughlin et al., 2014; Gott & Lah, 2014). However, is there evidence that children represent future events differently as a function of temporal distance? Using a within-subjects design, Coughlin et al. (2014) asked 5-year-olds, 7-year-olds, 9-year-olds, and adults to generate and describe events that would occur one week and one year in the future in response to a cue word (e.g., book, cake). Participants were also asked to rate how clear the event looked in their mind, how easily the event came to mind, and the visual perspective of the event (i.e., first- or third-person). The episodicity of future event descriptions and the visual perspective from which they were imagined did not differ as a function of temporal distance. However, all children rated near events as easier to think of than distant events and, starting at age nine, children rated near events as clearer than distant ones. Using a similar paradigm, Wang and colleagues (2014) found that 7- to 10-year-olds represented near future events with more episodicity than distant future events. However, this difference from Coughlin and colleagues (2014) may have been due to their distant future time point being much further away (i.e., being "a grown up" vs "next year"). Finally, using a between-subjects design, Chernyak and colleagues (2017) found that 3- to 5-year-olds used more personal pronouns to describe events occurring in the near vs distant future. In sum, as with adults, several aspects of young children's future event representations appear to be influenced by temporal distance.

However, none of these studies were specifically designed to address the impact of temporal distance on children's event representations leading to several design limitations. For example, this research has largely employed a within-subjects design which has important strengths (e.g., accounting for between-subjects variability in event descriptions and use of rating scales) but may weaken the effect of a distance manipulation. This is because thinking about near or distant future events primes individuals to the corresponding level of construal (e.g., Gilead et al., 2019; Liberman & Forster, 2009). For example, first imagining events in the near future may subsequently impact representations of distant future events, and vice versa. Perhaps most importantly, previous research did not present children with the same events to describe in the near and distant future leading to potential differences in such factors as event valence, arousal, frequency, and novelty. Therefore, it is difficult to determine whether any distance effects obtained were due to temporal distance, specifically, or to the events, themselves, that children chose to describe.

***Current Study***

We report three experiments that investigate the influence of temporal distance, age, and event frequency (Experiment 1) on children's future event representations. We used a between-subjects design in which all children were presented with the same events across temporal distance conditions. This allowed for a direct comparison between near and distant future event representations, thus preventing a "diffusion" of the distance manipulation. Although we anchored our design, findings, and interpretation on CLT, we also drew on the literature described earlier that uses a broad array of indicators to determine the impact of temporal distance on people's event representations. In line with CLT, all indicators focused on examining the hypothesis that events in the near future are represented more concretely than those in the distant future. We hypothesized that this trend would increase with age given that children's future thinking continues to develop throughout early to middle childhood.

We pre-registered each of our experiments here: https://osf.io/69n4e/?view_only=d2a899299a6b4d75810d0d4b18b9c9c1. Although some of our dependent variables differ from those preregistered, our hypotheses largely follow those pre-registered and deviations are explained in the updated preregistration. Testing for Experiment 1 occurred in person, while Experiments 2 and 2b occurred online via Zoom due to COVID-19.

**Experiment 1**

We examined the impact of temporal distance, event frequency and age on 5- to 7-year-olds' future event representations. We varied event frequency (i.e., whether an event occurs frequently, such as playing with toys, or infrequently, such as going to a restaurant) given that previous work (e.g., Burns et al., 2021) has suggested that event type (e.g., frequency, intensity, novelty) may impact future event representations. Moreover, a related concept, "event familiarity", impacts adults' future event representations (Valiente et. al., 2021; Szpunar, 2008) and children's past event representations (Hudson & Nelson, 1986). Drawing on this literature, we hypothesized that, irrespective of temporal distance, frequent events would be described more concretely than infrequent events because individuals possess more detailed and specific information about the former. We chose the 5–7-year age range because this age group has a good understanding of the future (e.g., Atance & Meltzoff, 2005, Busby & Suddendorf, 2005) and thus might be sensitive to temporal distance effects.

We asked children to describe themselves participating in a set of six familiar activities/events (see Table 1) either in the near (i.e., "soon") or distant (i.e., "a long time from now") future. We chose these more general temporal terms because young children's use of them is more accurate than their use of specific temporal terms (e.g., tomorrow; Grant & Suddendorf, 2011). To examine the impact of event frequency on event representation, half of the events were considered frequent and the other half infrequent in the lives of young children. In contrast to previous developmental work, we examined a highly comprehensive list of indicators of concrete event representation pulled from the adult and developmental literatures, and argued to be affected by temporal distance: (1) number of "information units" (Trope & Liberman, 2010); (2) "concreteness" of information units (e.g., "eating an apple" is more concrete than "having an apple"; Bhatia & Walasek, 2016); (3) number of uncertainty terms (D'Argembeau & Van der Linden, 2004; O'Neill & Atance, 2000); (4) number of personal pronouns (Chernyak et al., 2017; Liberman & Trope, 2008); (5) clarity of the event representation (Coughlin et al., 2014); (6) ease of imagining (Coughlin et al., 2014); and (7) whether the event was represented in a concrete or abstract fashion (Liberman & Trope, 1998; see Table 2 for a description of all indicators and associated hypotheses).

**Table 1**

*Experiment 1 Events*

| Frequent | Infrequent |
|---|---|
| Play with toys | Go to a birthday party |
| Have a snack | Go swimming |
| Have a bath | Go to a restaurant |

**Table 2**

*Event Representation Indicators and Related Hypotheses for Experiments 1, 2 and 2b*

| Indicator | Measurement | How it indicates "concreteness" | Hypothesis |
|---|---|---|---|
| Experiments 1, 2 and 2b | | | |
| Event Description | | | |
| Mean number of information units* | Number of verbs, nouns, and adjectives | Associated with more details | Near/frequent events will contain more information units than distant/infrequent events |
| Mean concreteness of information units* | Concreteness ratings of the nouns, verbs, and adjectives from the English Lexicon Project | Associated with more concrete language | Near/frequent events will contain more concrete information units than distant/infrequent events |
| Mean number of pronouns* | Number of references to "I" and "we" | Associated with increased self-projection into the future event | Near/frequent events will contain more pronouns than distant/infrequent events |
| Mean number of uncertainty terms* | Number of uncertainty terms (e.g., maybe, could, possibly) | Associated with less uncertainty | Near/frequent events will contain fewer uncertainty terms than distant/infrequent events |
| Scales | | | |
| Clarity (1 – 6)* | Clarity Scale | Associated with a clearer mental image | Near/frequent events will be rated as clearer than distant/infrequent events |
| Ease (0 – 1)* | Ease of Thinking Scale | Associated with more ease of imagining | Near/frequent events will be rated as easier to imagine than distant/infrequent events |
| Concrete vs abstract (0 – 1)* | Event Descriptor Task | Associated with concrete descriptions of the event | Near/frequent events will be endorsed as corresponding to the concrete event descriptor more often than distant/infrequent events |

| Experiments 2 and 2b | | | |
|---|---|---|---|
| Subjective Distance (1 – 10) * | Subjective Distance Scale | Associated with decreased subjective temporal distance | Near events will be rated as subjectively closer in time than distant events |
| Emotional Intensity (1 – 6)* | Emotion Scale | Associated with increased emotional intensity | Near events will be rated as more emotionally intense than distant events |

* To calculate the mean score for all indicators, we added children's scores for each of the events they completed and then divided by this total. In Experiment 1, a separate mean score was calculated for the frequent and infrequent events. For Experiments 2 and 2b a total mean score for all events completed was calculated.

***Method***

**Participants.** Participants were 95 typically-developing English speaking 5- to 7-year-olds tested between February and August 2019 at a local science museum laboratory ($n$ = 38) or university laboratory ($n$ = 54). Three participants were excluded for not understanding the task, and the final sample therefore included 92 5- ($n$ =28; range = 60 – 71 months), 6- ($n$ =33; range = 72 – 83 months), and 7- ($n$ =31; 84 – 98 months) year-olds. Notably, three 8-year-olds who had recently turned eight (i.e., within three months) were included in the analyses as 7-year-olds. The near-future condition ($n$ =45) included 24 males and 21 females (14 5-year-olds; 17 6-years-olds; 14 7-year-olds), whereas the distant-future condition ($n$ =47) included 16 males and 31 females (14 5-year-olds; 16 6-years-olds; 17 7-year-olds). Age in months did not differ between temporal distance conditions, $t$ (90) = -.27. $p$ =.39.

Fifty-seven percent of children were identified as White, 13% as mixed ethnicity, 7% as Asian, and 3% as Arab/West Asian (20% provided no information). Sixty percent of mothers (13% provided no information) and 60% of fathers (16% provided no information) reported attaining a college or university degree or higher. The total household income was over $80,000 for 72% of families (16% provided no information). Children were compensated with a small sticker or toy. Notably, two 5-year-olds and one 7-year-old completed only five events as they requested to end the task early. We accounted for this here and throughout all experiments, by only including the number of "completed events" in the mean score calculation.

**Power Analyses.** A recent meta-analysis found an overall medium sized effect of psychological distance (i.e., including temporal distance) on adults' construal-level (Soderberg et al., 2015). A priori power analyses using G*Power 3.1.9.4 (Faul et al., 2009) determined a sample size of 85 was required to detect a medium sized effect (i.e., $f^2 = .15$) of all predictors, as opposed to any one individual predictor, and interactions using linear mixed model regressions.[1]

**Materials**

***Road (see Figure 1 in Friedman, 2000; Appendix A).*** During the introductory task, a drawing of a long road was used to represent "soon" and "a long time from now".

***Clarity Scale (see Figure 1 in Coughlin, et al., 2014; Appendix A).*** The Clarity Scale is a Likert-type scale that contains six identical smiley faces, each with a "thought bubble" containing an image that increases in clarity across the scale. Mean clarity scores were calculated for the frequent events by adding the clarity scores for all the completed frequent events and dividing by this total and ranged from 1 (very unclear) to 6 (perfectly clear). The same process was followed for the infrequent events.

***Ease of Thinking Scale (adapted from Coughlin et al., 2014; Appendix A).*** We used a dichotomous scale asking children to rate whether it was "easy" or "hard" to imagine each event. Mean scores were calculated using the same method as the clarity scale, with scores ranging from 0 (hard) to 1 (easy).

[1] Due to an oversight, in Experiments 1, 2 and 2b of Study 1, we calculated the sample size required to detect an effect of the sum of all of the predictors, but then interpreted the effect of individual predictors. As a result, we may have been underpowered to detect effects of individual predictors.

***Event Descriptor Task (adapted from Vallacher & Wegner, 1989; Appendix A).*** The Event Descriptor Task was created for this experiment by adapting Vallacher and Wegner's (1989) questionnaire for children. Liberman and Trope (1998) found significant effects of temporal distance on adults' future event representations (though using different events than we used here) using this scale. In Vallacher and Wegner's scale, adults must decide whether an event (i.e., brushing teeth) is better described with an abstract (i.e., preventing tooth decay) or concrete (i.e., moving a toothbrush around one's mouth) event descriptor. We similarly presented children with both an abstract and concrete descriptor for each event using puppets and asked children to indicate which descriptor corresponded with their event representation (see Table 3). Mean scores were calculated using the same method as the clarity scale. Scores ranged from 0 (*abstract*) to 1 (*concrete*).

**Table 3**

*Abstract and Concrete Descriptors in the "Event Descriptor Task" in Experiments 1, 2 and 2b*

| Event | Concrete Descriptor | Abstract Descriptor |
|---|---|---|
| Experiment 1 | | |
| Playing with toys | Setting up your toys | Having fun with your toys |
| Having a snack | Putting food in your mouth | Giving your body energy |
| Having a bath | Scrubbing your body with soap | Getting yourself squeaky clean |
| Going to a birthday party | Picking out a present to give to your friend | Celebrating with your family and friends |
| Going swimming | Splashing in the water | Becoming a better swimmer |
| Going to a restaurant | Looking at the menu | Having a meal with your family |
| Experiment 2 | | |
| Having a snack | Putting food in your mouth | Giving your body energy |
| Having screen time | Looking at your screen | |

| | | |
|---|---|---|
| | | Watching something interesting |
| Reading a book with your mom/dad | Turning the pages | Learning something new |
| Making a drawing | Putting your crayon on the paper | Making a picture |
| Experiment 2b | | |
| Having a playdate | Picking out what games to play | Being with your friend |
| Going to a birthday party | Choosing a present | Celebrating with your friend |
| Going to the park | Walking over there | Spending time outside |
| Going to your favourite restaurant | Choosing what food to order | Having your food |

**Procedure.** Children were randomly assigned to either the near or distant future condition. After obtaining informed consent and assent, children completed the 20–25-minute experiment in a quiet testing room in a laboratory at a local science museum or in our university laboratory. Testing procedures did not differ between both locations. To begin, children were introduced to Friedman's (2000) road. Children were told that activities on the nearest part of the road would happen "soon" and activities on the furthest part of the road would happen "a long time from now" (see Appendix A for training and question wording). Children were then given examples of activities that would happen "soon" (e.g., having dinner tonight) and "a long time from now" (e.g., "going for a bike ride" if testing occurred during the winter). Children were asked to place these example activities on the appropriate part of the road to check their understanding. Errors were corrected before continuing.

Children were then asked to imagine and describe themselves participating in each of the events listed in Table 1 either "soon" or "a long time from now". Specifically, children were told "Let's talk about [having a snack]. Let's imagine that you're going to have a snack [soon]/[a long time from now]. Can you tell me what's going to happen?" Children were prompted twice to provide additional detail, although we ultimately chose to only examine their first elicited response before additional prompting, as described below. Events were counterbalanced to control for order effects. If children did not understand the question, it was repeated and, if their understanding remained unclear, they were prompted (i.e., "What are you going to do?").

Children then completed the "Clarity Scale", "Ease of Thinking Scale" and the "Event Descriptor Task" in this order. This same procedure was repeated for all six events. The Ease of Thinking Scale and Event Descriptor Task were introduced partway though data collection, so 6 of 92 participants did not complete them.

**Scoring Event Narratives.** Responses were video recorded and transcribed before coding. We scored the first response given by the child before they were prompted to provide additional detail, to ensure that all responses were elicited by the same prompt. We calculated the mean number of main verbs, nouns, and adjectives (i.e., information units) for the infrequent and frequent events. For the number of main verbs, we did not count auxiliary verbs (i.e., helping verbs that provide tense to the main verb), as we were interested in examining the verbs providing the most meaning to the event representation. We then retrieved the concreteness rating for the information units (i.e., verbs, nouns, and adjectives) from the English Lexicon Project database (Balota et al., 2007; a database containing ratings of various phonological and lexical characteristics of 40,000 words across 1200 participants at six universities). Concreteness ratings of words range from 1 to 5, with a higher score indicating a more concrete word. The mean concreteness score for the frequent and infrequent events (i.e., verbs, nouns, and adjectives, combined, in one mean concreteness score) was calculated for all participants across all completed events. Additionally, the mean number of pronouns (i.e., "I" and "we") and uncertainty terms (e.g., “maybe”, “probably”) were calculated for each participant across all completed events for the infrequent and frequent events.

A reliability coder who was blind to temporal distance condition then coded 100% of responses. Intraclass correlations were .98 for the mean number of information units, .95 for uncertainty terms, and .99 for pronouns. Discrepancies between coders were resolved by calculating the mean score of the two coders.

**Statistical Analyses.** A series of mixed linear multiple regressions with temporal distance (between-subjects; distant = 0 vs near = 1), age in months (between-subjects), event frequency (within-subjects; frequent = 1 vs infrequent = 2), and temporal distance X age were run for each of our dependent variables (see Table 2) in R version 4.2.0 (R Core Team, 2022) using the “lme4” (Bates et al., 2015) and “lmerTest” (Kuznetsova et al., 2017) packages. All data were evaluated for outliers, normality, independence of residuals, linearity, homoscedasticity, and multicollinearity. The only assumption violated was the presence of outliers. Thirteen outliers (i.e., 5 for Uncertainty Terms, 4 for Pronouns, and 4 for Information Units) with z-scores greater than +/- 3.29 were winsorized to the closest non-outlier score (Tukey, 1962). Because of our large number of analyses, a Bonferroni corrected alpha level of .007 was used to evaluate each of the seven mixed linear multiple regressions (.05/7).[2]

### *Results*

**Preliminary Analyses.** Sex, ethnicity, testing location, and trial order did not influence our dependent variables and were not considered further.

[2] Due to an oversight, we did not take the Bonferroni correction into account for our power analyses in Study 1. If we had accounted for this, we would have required a larger sample in Experiment 1 (i.e., 125 children), and Experiments 2 and 2b (i.e., 116 children) to detect the desired effects. Notably, however, temporal distance effects were not close to being statistically significant in the current sample. Therefore, it is unlikely that a larger sample would have made for statistically significant effects of temporal distance.

**Main Analyses.** None of our dependent variables (see Table 4 for descriptive statistics) were significantly affected by temporal distance, age in months, nor their interaction. However, contrary to hypotheses, infrequent events contained significantly more information units, more concrete information units, and more pronouns than frequent events (see Table 5 for significant models).

**Table 4**

*Descriptive Statistics for Experiments 1, 2 and 2b Collapsed Across Age, Temporal Distance, and Frequency*

| **Experiment 1** | | | | |
|---|---|---|---|---|
| Indicator | Mean | *SD* | Range | |
| | | | Minimum | Maximum |
| Information Units | 2.01 | 1.47 | .17 | 7.02 |
| Concreteness of Information Units | 2.22 | .57 | .4 | 3.51 |
| Pronouns | .55 | .46 | 0 | 2.19 |
| Uncertainty Terms | .14 | .27 | 0 | 1.09 |
| Clarity Scale (1–6) | 4.86 | 1.29 | 1 | 6 |
| Ease of Thinking Scale (0-1) | .73 | .28 | 0 | 1 |
| Event Descriptor Task (0–1) | .39 | .19 | 0 | .67 |
| **Experiment 2** | | | | |
| Indicator | Mean | *SD* | Range | |
| | | | Minimum | Maximum |
| Information Units | 2.59 | 1.73 | .50 | 7.67 |
| Concreteness of Information Units | 2.73 | .42 | 1.83 | 3.66 |
| Pronouns | 2.00 | 1.63 | 0 | 7.30 |
| Uncertainty Terms | .55 | .91 | 0 | 4.10 |
| Clarity Scale (1–6) | 4.66 | .87 | 2.25 | 6.00 |
| Event Descriptor Task (0-1) | .40 | .30 | 0 | 1 |
| Subjective Distance Scale (1–10) | 3.47 | 1.65 | .75 | 8 |
| Emotion Scale (1–6) | 3.96 | 1.30 | 1 | 6 |
| **Experiment 2b** | | | | |
| Indicator | Mean | *SD* | Range | |
| | | | Minimum | Maximum |
| Information Units | 5.31 | 2.72 | .92 | 12.17 |
| Concreteness of Information Units | 2.93 | .33 | 2.34 | 3.50 |
| Pronouns | 4.31 | 2.30 | .25 | 10.50 |
| Uncertainty Terms | 1.33 | 2.10 | 0 | 7.50 |
| Clarity Scale (1-6) | 4.75 | .81 | 2.25 | 6.00 |
| Event Descriptor Task (0-1) | .25 | .21 | 0 | .75 |
| Subjective Distance Scale (1-10) | 5.00 | 1.98 | 1.33 | 10 |

| | | | | |
|---|---|---|---|---|
| Emotion Scale (1-6) | 4.69 | .86 | 2.25 | 6 |

Note: Higher values for all dependent variables, except "Subjective Distance Scale" and "Uncertainty Terms", indicate increased concreteness. Higher values on the "Subjective Distance Scale" indicate increased subjective distance and higher values on the "Uncertainty Terms" indicate less concreteness.

**Table 5**

*Significant Models in Experiment 1*

| Dependent Variable | Predictor | | | | |
|---|---|---|---|---|---|
| | | *β* | *SE* | *p* | 97.5% CI for *β* |
| Number of Information Units | TD | .02 | .09 | .82 | [-.16, .20] |
| | Age | .18 | .09 | .06 | [-0.002, .36] |
| | Frequency | .26 | .04 | <.001 | [-.19, .34] |
| | TD X Age | -.04 | .09 | .65 | [-.23, .14] |
| Concreteness of Information Units | TD | .03 | .09 | .76 | [-.14, .29] |
| | Age | .03 | .09 | .74 | [-.14, .20] |
| | Frequency | .28 | .05 | <.001 | [.18, .39] |
| | TD X Age | .03 | .09 | .74 | [-.14, .20] |
| Pronouns | | | | | |
| | TD | -.04 | .09 | .70 | [-.22, .15] |
| | Age | .24 | .09 | .01 | [.05, .43] |
| | Frequency | .13 | .04 | .001 | [.05, .21] |
| | TD X Age | -.05 | .09 | .63 | [-.23, .14] |

Note: TD indicates Temporal Distance

***Discussion***

Experiment 1 investigated the impact of temporal distance, age, and event frequency on 5- to 7-year-olds' future event representations. Whereas we did not detect effects of temporal distance or age, we detected a significant effect of event frequency on the mean number of information units, concreteness of information units, and pronouns. Although these results were contrary to our hypothesis, they are in line with recent work by Burns and colleagues (2021) who argue that generic/repetitive (and presumably more frequent) events may be difficult to envision and describe in detail due to their script-like nature. Interestingly, this suggests that children may have an easier time imagining and describing themselves in events that occur less, rather than more, frequently - something we explore further in Experiment 2b. However, we did not directly check event frequency with children or parents; a point we address in Experiments 2 and 2b.

Also contrary to hypotheses, temporal distance did not influence any of the dependent variables examined, at any age. This is surprising given its robust effect on adults' event representations (Soderberg et al., 2015). Although temporal distance may simply not have affected the future event representations of children between ages 5 and 7 years, it is important to first rule out the possibility that young children were not sensitive to our temporal distance manipulation. More specifically, events in the near condition may not have felt *subjectively closer* in time than events in the distant condition. In fact, subjective distance itself may be an important indicator of children's sensitivity to temporal distance. That is, children may first need to perceive the difference in temporal distance between near and distant future events (i.e., near events are closer in time than distant events) before temporal distance impacts their event representations (e.g., clarity, verbal descriptions). It is also possible that the temporal terms we used (i.e., "soon" vs. "a long time from now") minimized effects of distance because they are somewhat subjective terms that children may interpret differently. We address this and other relevant design issues in Experiment 2. Finally, children provided relatively short event descriptions with little detail (see Table 4) which may also have limited our ability to detect effects of temporal distance, which we address in Experiment 2b.

**Experiment 2**

Although Experiment 1 suggests that temporal distance may not yet influence 5- to 7-year-olds' future event representations, several limitations in our methodology need to be addressed. First, we included Burns and colleagues' (2019) subjective distance scale to determine whether children in the "near future" condition will indeed perceive events as occurring sooner than children in the "distant future" condition. Second, we explored another fundamental aspect of event representations: emotional intensity. This indicator has been examined in the adult literature with the finding that increased emotional intensity reflects a more concrete event representation (Agerström et al., 2012; Trope & Liberman, 2010). Moreover, Burns and colleagues (2019) found that, starting at age six, temporal distance was negatively correlated with emotional intensity. That is, events that felt subjectively more distant were rated as less emotionally intense than events that felt subjectively closer in time. Third, we included 8- and 9-year-olds to address the possibility that 5- to 7-year-olds are too young for temporal distance to impact their future event representations. We also presented the near and distant future conditions using the temporal labels "tomorrow" vs "a year from now" instead of "soon" vs "a long time from now" to map on to the terms Liberman and Trope (1998) used with adults and to render the temporal labels more objective.

Other small adaptations were made to our protocol to make it more developmentally appropriate for this age group. For example, we provided children a sample event to help familiarize them with the structure of the task. Moreover, because ease of thinking and clarity were correlated in Experiment 1 ($r = .33$, $p < .05$), we opted not to examine ease of thinking in Experiment 2. Finally, we focused on isolating the effect of temporal distance on event representations by only asking children about frequent events (see Table 6). This decision was in large part due to severe COVID-19 restrictions in our area which meant that children could not engage in infrequent events (e.g., birthday parties) and may have had difficulty imagining them. Our hypotheses were identical to those in Experiment 1 (see Table 2).

**Table 6**

*Events in Experiments 2 and 2b*

| Experiment 2 | Experiment 2b |
|---|---|
| Having a snack | Going to a birthday party |
| Having screen time | Going to your favorite restaurant |
| Reading a book with mom/dad | Going to the park |
| Making a drawing | Having a playdate |

### *Method*

**Participants.** Participants were 107 English speaking, typically-developing 5- to 9-year-olds tested online via Zoom between August 2021 and June 2022. Two participants were excluded for not speaking English fluently, one participant for providing past event descriptions, one participant for being too distracted to complete the task, and one participant due to experimenter error. Two 10-year-olds who recently turned 10 were included in the study as 9-year-olds. The final sample included 102 5- ($n$ =19; range = 61 to 70 months), 6- ($n$ =21; range = 72 to 83 months), 7- ($n$ =21; range = 85 to 95 months), 8- ($n$ =19; range = 96 to 107 months), and 9- ($n$ =22; range = 108 to 125 months) year-olds. The near-future condition ($n$ =51) included 24 males and 27 females (8 5-year-olds; 13 6-years-olds; 11 7-year-olds; 10 8-year-olds; 9 9-year-olds), and the distant-future condition ($n$ =51) included 26 males and 25 females (11 5-year-olds; 8 6-year-olds; 10 7-year-olds; 9 8-year-olds; 13 9-year-olds). Age in months did not differ between temporal distance conditions, $t$ (100) =.43, $p$ =.67.

Fifty-seven percent of children were identified as White, 8% as mixed ethnicity, 5% as Asian, 2% as Black, and 1% as Hispanic (25% provided no information). Seventy-two percent of mothers (26% provided no information) and 65% of fathers (27% provided no information) reported attaining a college or university degree or higher. The total household income was over $80,000 for 63% of families (27% provided no information). Children were compensated with a

10$ gift card to a bookstore. One 5-year-old only completed three events as they requested to end the task early.

**Power Analyses.** The required sample size for Experiment 2 was calculated using the same rationale as in Experiment 1. A sample size of 77 was required to detect a medium sized effect (i.e., $f^2$=.15) of temporal distance, age in months, and temporal distance X age in months on our variables of interest using multiple linear regression. We aimed to collect 20 participants in each age group (i.e., total of 100 participants), given that the effect size of temporal distance is likely weaker in this population.

**Materials.** Materials were identical to those in Experiment 1 (but presented online via Zoom due to COVID-19) and the subjective distance and emotion scales were added. Measures were presented using the share screen feature and participants responded verbally. For all scales, a number was associated with each response option and children indicated their responses by verbally stating the number that corresponded to their choice.

***Subjective Distance Scale (see supplemental materials in Burns et al., 2019; Appendix A):*** The subjective distance scale is a 10-point Likert Type scale, represented as a ruler, used to ask participants how far away each event representation felt in their minds. Mean scores were calculated using the same method as the scales in Experiment 1 and ranged from 1 (*really soon*) to 10 (*really long time from now*).

***Emotion Scale (adapted from Burns et al., 2019; Appendix A):*** The emotion scale is a 6-point Likert Type scale (i.e., with each point represented by a happy face of increasing happiness) with which participants indicated how intensely happy they expected they would feel during each future event representation. Mean scores were calculated using the same method as the scales in Experiment 1 and ranged from 1 (*not sad, not happy, just normal*) to 6 (*very, very happy*).

**Procedure.** The procedure was identical to Experiment 1 with small adaptations as outlined earlier (see Appendix A for procedure). Participants were introduced to the 15 to 20-minute task using a sample future event description (i.e., "swimming") given by the researcher that included an equal number of concrete and abstract event descriptions [i.e., "I'm going to drive to the pool (*concrete*), put on my swimsuit (*concrete*), play in the water (*abstract*), and get some exercise (*abstract*)!"]. Children were subsequently presented with each event individually and asked to imagine and describe themselves participating in each event either "tomorrow" (i.e., near) or "a year from now" (i.e., distant). Events were counterbalanced to control for order effects. Children then completed the "Clarity Scale", "Event Descriptor Task", "Subjective Distance Scale" and "Emotion Scale", in that order. Finally, participants indicated whether, and how much, they thought COVID-19 influenced their responses and were asked to rate the frequency with which they engaged in each event (see section "Cross-Experiment Comparison between Experiments 2 and 2b").

**Scoring Event Narratives.** Event narratives were scored using the same method as in Experiment 1. A reliability coder (i.e., blind to temporal distance condition) coded 50% of responses. Intraclass correlations were .99 for the mean number of information units, .99 for uncertainty terms, and .99 for pronouns. The primary coder's codes were used for final analyses.

**Statistical Analyses.** Data cleaning followed the same procedure as Experiment 1. A series of linear multiple regressions with temporal distance (distant = 0 vs near = 1), age in months and temporal distance X age in months as predictors were run for each dependent variable in SPSS version 28. We ran linear multiple regressions, as opposed to the mixed linear multiple regressions run in Experiment 1, because we no longer had the within-subjects predictor of event frequency. Main effects were entered in Block 1 and the interaction term in Block 2. Before running these main analyses, we determined whether children perceived distant events as further in time than near events by running t-tests with temporal distance (i.e., near vs distant) as the independent variable and children's ratings on the subjective distance scale as the dependent variable. As a result of our large number of analyses, a Bonferroni corrected alpha level of .007 was used to evaluate each of the seven analyses.

***Results***

**Preliminary Analyses.** Neither sex nor trial order influenced our dependent variables and were therefore not considered further. Whether children thought about COVID-19 during the experiment influenced the concreteness of information units, $t\,(94) = 2.26$, $p = .03$, wherein children who endorsed thinking about COVID-19 used more concrete information units ($M = 2.91$, $SE = .08$) than children who did not endorse thinking about COVID-19 ($M = 2.68$, $SE = .05$). Whether children thought about COVID-19 was therefore controlled for in the corresponding regression.

**Main Analyses.** Children rated distant events ($M = 4.05$, $SE = .24$) as feeling further away in time on the subjective distance scale than near events ($M = 2.88$, $SE = 1.87$), $t\,(100) = 3.84$, $p < .001$. Although we did not obtain a main effect of temporal distance, nor age, on clarity ratings, a significant interaction between temporal distance and age in months was found. Simple slopes analyses revealed that age had no impact on clarity ratings in the near condition ($\beta = -.13$, $SE = .01$, $p = .35$), but did in the distant condition ($\beta = -.60$, $SE = .01$, $p < .001$). There are two ways to interpret this finding: (1) as age increased, children rated distant events as increasingly less clear, and (2) as age decreased, children rated distant events as increasingly more clear (see

Figure 1). We further explored this interaction by performing a median-split on age in months (i.e., “younger” = under 91 months and 15 days vs. “older” = over 91 months and 15 days) and running an exploratory independent samples t-test with age group (younger vs. older) as the independent variable and mean clarity rating as the dependent variable. Older children rated near events (*M* = 4.58, *SD* =.60) as more clear than distant events (*M* = 4.09, *SD* = .78), *t* (51) =-2.56, *p* =.01, whereas younger children rated distant events (*M* = 5.36, *SD* =.71) as more clear than near events (*M* = 4.79, *SD* = .86), *t* (47) = 2.53, *p* =.01.

No other dependent variables were predicted by temporal distance or the interaction between temporal distance and age. Age in months positively predicted the number of information units, the concreteness of information units, and the number of pronouns used (see Table 4 for descriptive statistics and Table 7 for significant models).

**Figure 1**

*Interaction Between Age in Months and Temporal Distance as a Predictor of Clarity Ratings*

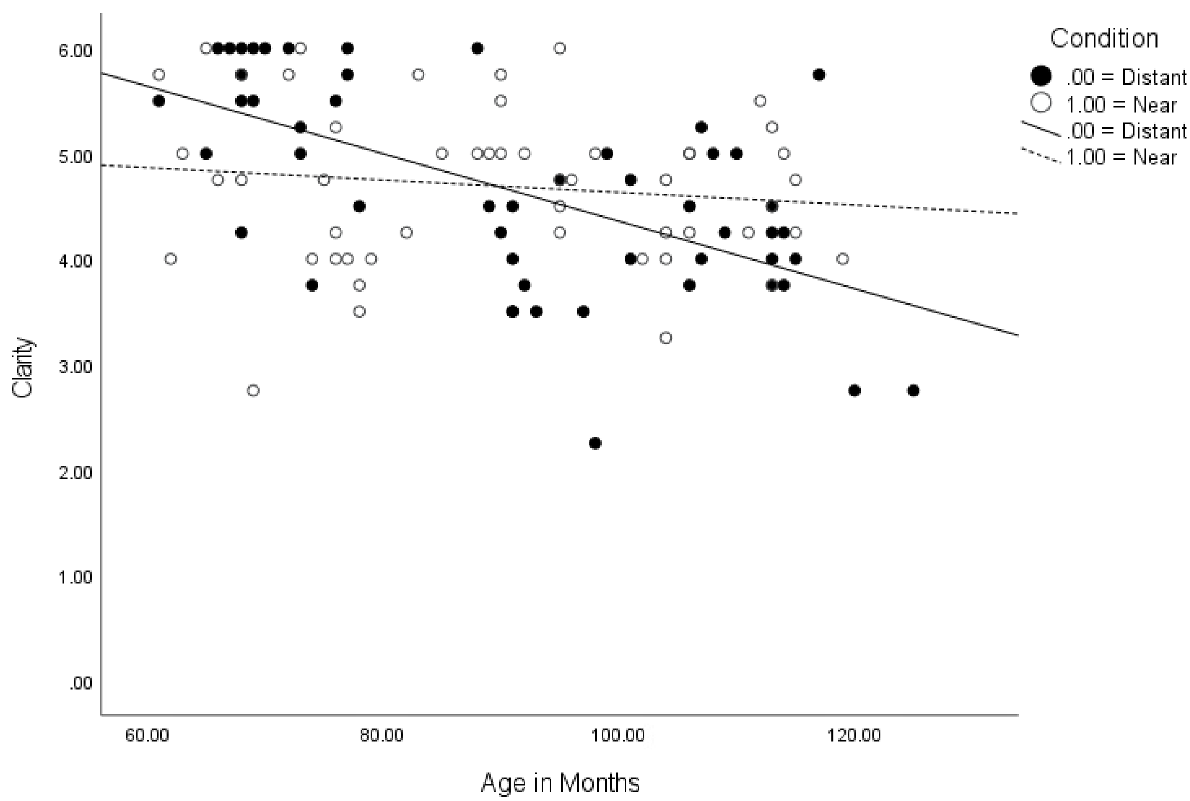

**Table 7**

*Significant Models in Experiment 2*

| Dependent Variable | | Predictor | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | *β* | B(*SE*) | *t* | $R2_{adj}$ | $\Delta R^2$ | *F* | *Part r* |
| Information Units | Model 1 | | | | | .09 | .11 | 6.26* | |
| | | TD | .04 | .15(.33) | .46 | | | | .04 |
| | | Age | .33 | .03(.01) | 3.53** | | | | .33 |
| | Model 2 | | | | | .09 | .002 | 4.22 | |
| | | TD | .05 | .15(.33) | .47 | | | | .05 |
| | | Age | .34 | .03(.01) | 3.54** | | | | .34 |
| | | TD X Age | -.05 | -.01(.02) | -.47 | | | | -.05 |
| Concreteness of Information Units | Model 1 | | | | | .04 | .05 | 5.13 | |
| | | COVID | -.23 | -.23(.10) | -2.26 | | | | -.23 |
| | Model 2 | | | | | .11 | .09 | 5.03* | |
| | | COVID | -.20 | -.20(.10) | -2.04 | | | | -.20 |
| | | TD | -.02 | -.02(.08) | -.20 | | | | -.02 |
| | | Age | .30 | .01(.002) | 3.07* | | | | .30 |
| | Model 3 | | | | | .12 | .02 | 4.33* | |
| | | COVID | -.20 | -.20(.10) | -2.02 | | | | -.19 |
| | | TD | -.02 | -.02(.08) | -.24 | | | | -.02 |
| | | Age | .29 | .01 (.002) | 2.94* | | | | .28 |
| | | TD X Age | .14 | .01(.01) | 1.44 | | | | .14 |
| Pronouns | Model 1 | | | | | .10 | .12 | 6.86* | |
| | | TD | .12 | .37(.31) | 1.22 | | | | .12 |
| | | Age | .33 | .03(.01) | 3.55** | | | | .33 |
| | Model 2 | | | | | .12 | .02 | 5.50* | |
| | | TD | .12 | .39(.30) | 1.27 | | | | .12 |
| | | Age | .35 | .03(.01) | 3.69** | | | | .35 |
| | | TD X Age | -.15 | -.03(.02) | -1.60 | | | | -.15 |
| Clarity | Model 1 | | | | | .15 | .17 | 9.92** | |
| | | TD | .01 | .02(.16) | .15 | | | | .01 |
| | | Age | -.41 | -.02(.01) | -4.44** | | | | -.41 |
| | Model 2 | | | | | .21 | .07 | 10.16** | |
| | | TD | .02 | .04(.15) | .24 | | | | .02 |

| | | | | |
|---|---|---|---|---|
| Age | -.39 | -.02(.004) | -4.36** | -.39 |
| TD X Age | -.27 | -.03(.01) | -3.01* | -.27 |

Note: TD indicates Temporal Distance. Part r = partial correlation
* $p$ <.007
**$p$ <.001

***Discussion***

Experiment 2 focused on isolating the effect of temporal distance on 5-to 9-year-olds' future event representations by asking children to describe only frequent events. Children perceived near events as closer in time than distant events, but this did not translate into their event representations, as we did not, overall, detect effects of temporal distance. However, temporal distance influenced the clarity of children's event representations differently as a function of age. In line with our hypotheses and previous research (e.g., Coughlin et al., 2014; Wang et al., 2014), older children represented the distant future with less clarity than the near future. However, younger children showed the opposite trend, representing the distant future with more clarity than the near future. This unexpected finding is further discussed in the General Discussion.

Similar to Experiment 1, children provided relatively short event descriptions with little detail (see Table 4), which may have compromised our ability to detect effects of temporal distance. These sparser event descriptions may have been because we asked children to describe frequent events that may predominantly rely on more general, script-based knowledge (Burns et al., 2021; Hudson & Nelson, 1986). When describing such frequent events (e.g., snack) children might find it difficult to move beyond established scripts (e.g., sitting at the table, washing hands) to provide many details (e.g., color of the fruits, emotions). Due to the many restrictions in place during the COVID-19 pandemic, we were limited in the events we could ask children about. Accordingly, once restrictions in our region were mostly lifted (summer 2022), we ran one final experiment in which we asked children about more novel, infrequent events.

## Experiment 2B

Experiment 2b replicated Experiment 2, but instead asked 8- and 9-year-olds to describe *infrequent* events. Infrequent events may be more novel, and rely less on scripts, therefore leading to more detailed event descriptions (Burns et al., 2021) and, importantly, an increased possibility of detecting temporal distance effects. We focused on 8- and 9-year-olds because their event representations are more likely to be influenced by temporal distance than those of younger children (e.g., Coughlin et al., 2014; Wang et al., 2014). As in Experiment 2, we hypothesized that near event representations would be more concrete than distant event representations.

### *Method*

**Participants.** Participants were 42 English speaking, typically developing 8- and 9-year-olds tested online via Zoom between June and November 2022. One participant was excluded for describing past events and one 7-year-old was included in the analysis as an 8-year-old. The final sample included 41 8- ($n$ =21; range = 87 to 108 months) and 9- ($n$ =20; range = 109 to 116) year olds. The near future condition ($n$ =18) included 7 males, 10 females and 1 non-binary child (10 8-year-olds; 8 9-year-olds), whereas the distant future condition ($n$ =23) included 11 males, 11 females and 1 non-binary child (11 8-year-olds; 12 9-year-olds). Age in months did not differ between temporal distance conditions, $t$ (39) = -.33, $p$ = .37.

Fifty-five percent of children were identified as White, 9% as Asian, % as Black, 2.5% as Indian, 3% as Indigenous, and 3% as mixed ethnicity (26% provided no information). Sixty-eight percent of mothers (28% provided no information) and 61% of fathers (31% provided no information) reported attaining a college or university degree or higher. The total household income was over $80,000 for 62% of families (31% provided no information). Children were compensated with a 10$ gift card to a bookstore. Two 9-year-olds and one 8-year-old only completed three events, as they requested to end the task early.

**Procedure.** The procedure, power analyses, materials, event scoring, data cleaning and statistical analyses were identical to Experiment 2, except children described engaging in infrequent events (see Table 6) either "tomorrow" (i.e., near) or "a year from now" (i.e., distant). A reliability coder coded 50% of the data. Intraclass correlations were .99 for the mean number of information units, uncertainty terms, and pronouns. The primary coder's codes were used for final analyses.

***Results***

**Preliminary Analyses.** Trial order influenced the number of pronouns used, $F$ (1, 40) = 5.04, $p$ = .03. Sex, $F$ (1, 40) = 5.49, $p$ = .02, and ethnicity, $F$ (1, 30) = 4.77, $p$ = .04, significantly predicted clarity ratings. Therefore, these were controlled for in the corresponding analyses. Whether children thought about COVID-19 during the experiment did not influence any variables examined.

**Main Analyses.** Similar to Experiment 2, distant events felt significantly further away in time ($M$ = 5.45, $SE$ = .39) than near events ($M$ = 4.42, $SE$ = .48) on the Subjective Distance Scale, $t$ (39) = 1.70, $p$ =.04. However, temporal distance had no significant effect on other aspects of children's future event descriptions. Similar to Experiment 2, age positively predicted the number of information units and pronouns (see Table 4 for descriptive statistics and Table 8 for significant models).

**Table 8**

*Significant Models in Experiment 2b*

| Dependent Variable | Predictor |
| --- | --- |

| | | | β | B(*SE*) | *t* | $R2_{adj}$ | $\Delta R^2$ | *F* | *Part r* |
|---|---|---|---|---|---|---|---|---|---|
| Information Units | Model 1 | | | | | .17 | .21 | 5.04 | |
| | | TD | -.17 | -.90(.78) | -1.15 | | | | -.17 |
| | | Age | .44 | .19(.06) | 3.02* | | | | .44 |
| | Model 2 | | | | | .18 | .03 | 3.82 | |
| | | TD | -.17 | -.92(.78) | -1.18 | | | | -.17 |
| | | Age | .48 | .21(.07) | 3.22* | | | | .46 |
| | | TD X Age | .17 | .16(.14) | 1.14 | | | | .16 |
| Pronouns | Model 1 | | | | | .09 | .11 | 5.04 | |
| | | Trial Order | .34 | 1.54(.67) | 2.25 | | | | .34 |
| | Model 2 | | | | | .26 | .20 | 5.64* | |
| | | Trial Order | .26 | 1.17(.63) | 1.85 | | | | .25 |
| | | TD | -.22 | -1.00(.63) | -1.61 | | | | -.22 |
| | | Age | .41 | .15(.05) | 2.95* | | | | .40 |
| | Model 3 | | | | | .28 | .04 | 4.85* | |
| | | Trial Order | .28 | 1.26 (.63) | 2.01 | | | | .27 |
| | | TD | -.22 | -1.03(.62) | -1.66 | | | | -.22 |
| | | Age | .46 | .17(.05) | 3.24** | | | | .44 |
| | | TD X Age | .20 | .16(.11) | 1.43 | | | | .19 |

Note: TD indicates Temporal Distance. Part r = partial correlation
* $p < .007$
** $p < .001$

***Discussion***

We replicated Experiment 2 to determine whether temporal distance impacted children's representations of infrequent future events. Yet, despite these older (i.e., 8- and 9-year-old) children providing more detail in their event descriptions than our 5- to 9-year-old sample in Experiment 2 (see Table 4), we detected no effect of temporal distance on their future event descriptions. Importantly, as in Experiment 2, children perceived events in the distant future to feel subjectively further away than events in the near future.

**Cross-Experiment Comparison between Experiments 2 and 2b**

To further explore whether children represent infrequent events more concretely than frequent events, as was the case in Experiment 1, we directly compared our dependent variables from Experiments 2 and 2b, while restricting the analyses to 8- and 9-year-olds (i.e., the common ages across both experiments). We ran a series of exploratory independent samples *t*-tests with Experiment (i.e., 2 vs 2b) as the independent variable and each of our indicators as the dependent variable (see Table 9). Due to our large number of analyses, a Bonferroni corrected alpha level of 0.006 was used (0.05/8) to reduce spurious results.

Overall, as in Experiment 1, children represented infrequent events more concretely (i.e., more information units, pronouns, emotional intensity) than frequent events. In contrast, infrequent events were also rated as more abstract on the event descriptor task and as feeling subjectively further away in time than frequent events (a finding we return to in the General Discussion). Importantly, however, children also indicated that infrequent events were significantly more emotionally intense/positive than frequent events. As such, it is possible that the differences between Experiments 2 and 2b were not driven by differences in event frequency, but by differences in emotion (i.e., positive events being represented more concretely than less positive events; D'Argembeau & Van Der Linden, 2004). Therefore, we re-ran our analyses while controlling for children's mean emotional intensity ratings. The overall trends of our results did not change when controlling for emotional intensity ratings, suggesting that event frequency was likely driving differences between event representations in Experiments 2 vs. 2b, and not emotional intensity. Moreover, at the end of their respective sessions, children in Experiments 2 and 2b were asked to rate the frequency with which they engaged in each event on a scale from 1 (once a day) to 7 (not at all). Children's ratings in Experiment 2 (i.e., events intended to be frequent; $M = 1.95$, $SD = .55$) were significantly lower than those in Experiment 2b (i.e., events intended to be infrequent; $M = 3.99$, $SD =.57$), thus corresponding to what we had intended with respect to event frequency. Nonetheless, given that the reliability of developmental tasks is often not tested (Brosseau-Liard, 2022), and we did not confirm the reliability of our emotional intensity scale, the emotional intensity scale used in the current studies may not have been a reliable measure of emotional intensity. Therefore, it is possible that emotional intensity (i.e., and not event frequency), or perhaps another confounding variable entirely (e.g., event length, event novelty), could still be responsible for differences found between the events of Experiment 2 and 2b. Furthermore, these cross-experiment analyses should be interpreted cautiously given that the data comes from two different samples (though both were tested online using the exact same procedure).

**Table 9**

*Differences Between Dependent Variables in Experiments 2 & 2b*

| Dependent Variable | Mean (SD) Experiment 2 (*N* = 41) | Mean (SD) Experiment 2b (*N* = 41) | *t(df)* |
|---|---|---|---|
| Number of Information Units | 3.03(1.66) | 5.31(2.72) | -4.59(66.23)** |
| Concreteness of Information Units | 2.85(.41) | 2.93(.33) | -.88(80) |
| Pronouns | 2.50(1.78) | 4.31(2.30) | -3.98(80)** |
| Uncertainty Terms | .72(1.02) | 1.34(2.10) | -1.68(57.83) |
| Clarity Scale | 4.30(.75) | 4.75(.80) | -2.57(80) |
| Event Descriptor Task | .43(.27) | .25(.21) | 3.23(74.98)** |
| Emotion | 3.71(1.14) | 4.69(.86) | -4.34(80)** |
| Distance | 3.16(1.39) | 5.00(1.98) | -4.86(80)** |

Note. Only the data of the 8- and 9-year-olds are included.
**$p < .001$

**General Discussion**

The current study comprised three experiments examining whether temporal distance influences children's future event representations. We used a comprehensive number of indicators drawn from previous research as well as a between-subjects design that required all children to describe the same events across the near and distant future. We did this to better target the unique effect of temporal distance on children's future event representations – this, as opposed to other aspects of the specific events children chose to describe. Although temporal distance and age interacted to predict children's event clarity ratings in Experiment 2, overall, we found little evidence of 5- to 9-year-olds' event representations being impacted by temporal distance. We did, however, find consistent effects of event frequency on children's event representations. We discuss the implications of these findings first, followed by our findings related to temporal distance, and close with our study's limitations and conclusions.

### *Event Frequency*

In Experiment 1, infrequent events were represented more concretely than frequent events. Furthermore, although these findings must be interpreted with caution, as described above (i.e., see "Cross-Experiment Comparison between Experiments 2 and 2b"), 8- and 9-year-olds tended to describe infrequent events in Experiment 2b more concretely than the frequent events in Experiment 2. Although these findings are contrary to our initial hypotheses, they are consistent with recent arguments that children may rely more on scripts when describing frequent, as compared to infrequent, events (Burns et al., 2021). Interestingly, however, infrequent events in Experiment 2b were also rated as feeling subjectively further away in time, and more abstract on the event descriptor task, than frequent events in Experiment 2. Although this contradicts the idea that infrequent events are represented more concretely than frequent events, it may be that, regardless of temporal distance, infrequent events feel further away in time simply because they do not occur frequently (and, hence, will generally occur further away in time). Thus, although children in the near future condition in Experiment 2b were told to imagine the events as happening tomorrow, perhaps they were unable to ignore that infrequent events do not occur often and, for this reason, feel further away. Indeed, children may have difficulty separating "frequency" from "temporal distance" when envisioning infrequent events.

Our findings regarding event frequency are intriguing given that this is the first study, to our knowledge, to investigate the impact of event frequency on *future* event representations in children. Therefore, an important contribution of this work is the finding that the relationship between temporal distance and event representation in children may be significantly impacted by the frequency of the imagined event. Furthermore, other aspects of events (e.g., salience, novelty, length) may also affect this relationship. Given that research on the role of event frequency in adults' event representations is limited and results are mixed (e.g., Anderson, 2012; Szpunar & McDermott, 2008), understanding the role of event frequency in future event representation has important implications for theories in this area, including CLT. In fact, to our knowledge, CLT has not considered the role of event frequency in adult's event representations. Future work could replicate the current method with adults, while controlling for confounding variables as highlighted above, to investigate whether the relationship between temporal distance and future event representation is impacted by the frequency of the event being represented.

***Temporal Distance***

As noted earlier, our various event representation indicators were generally not impacted by temporal distance. However, in Experiment 2, temporal distance influenced the clarity of children's event representations differently as a function of age. Older children represented the distant future with less clarity than the near future whereas, unexpectedly, younger children represented the distant future with more clarity than the near future. We are unsure of why this was the case; perhaps younger children had difficulty using the clarity scale, although results from Coughlin and colleagues (2014) do not support this possibility. Further research is thus needed to understand younger children's clarity ratings.

Importantly, however, distant events were rated as feeling subjectively further away in time than near events in Experiments 2 and 2b. This suggests that children perceived the difference between the near and distant future, but this did not translate into their event descriptions or scale ratings. Therefore, another contribution of our study is that, although children perceived the near future as sooner than the distant future, they represented near and distant future events similarly. Temporal distance effects may not emerge, or be detectable with current methods, until later in development (Coughlin et al., 2014; Wang et al., 2014).

It is possible that as children age and develop more independence and autonomy, they begin to more intensely experience the effects of temporal distance on their own behavior (e.g., when to begin planning for an event), and consequently become more sensitive to its effects in their thinking and event representation. Furthermore, children's understanding of the order and remoteness of some temporal terms (e.g., "Wednesday" is one day from "Tuesday") is still developing past the age of 9 (Friedman et al., 1995) and into adolescence (Friedman, 1986), and episodic future thinking continues to develop through middle childhood and adolescence (Abram et al., 2014; Gott & Lah, 2013). These developments may in turn render children more sensitive to temporal distance manipulations (Burns et al., 2021).

Although previous developmental work (Chernyak et al., 2017; Coughlin et al., 2014; Wang et al., 2014) has uncovered effects of temporal distance on children's event representations, this may be because children had more choice over the events they described. When children freely select their own events, they may choose ones that are more personal and salient, and perhaps events they know are going to occur in the future. Bernstein and Bohn

(2010) found that personally important events were described with more imagery and sensory detail (i.e., more concretely) than cued events in adults. Such self-generated and personally salient events may be easier for children to project themselves into, and imagine, in an episodic manner. In fact, although we used a substantially different coding scheme, children in our study provided shorter event descriptions than those in previous similar studies (e.g., Burns et al., 2021; Wang et al., 2014). Despite addressing this issue in Experiment 2b by asking children to describe infrequent (and potentially more salient/personal) events, we still selected these events for them. Although this may have limited our ability to detect an effect of temporal distance, it was a design "trade-off" that allowed us to examine the exact same events across conditions to better isolate temporal distance and to closely align with previous work with adults (e.g., Liberman & Trope, 1998). Nonetheless, future research could hold events constant across distance conditions, while also asking children about events that they know are going to occur (e.g., upcoming holidays or school events; something that we were limited in doing due to the COVID-19 pandemic). Distance could then be manipulated by testing children at different intervals to the event (e.g., Burns et al., 2019).

***Limitations***

An important limitation of research in this area, including the current study, is its reliance on verbal skills. We sought to address this by including scales (e.g., clarity), though we recognize that these were still anchored on children's verbal event descriptions. Developing measures that rely less on verbal skills may be better suited to uncovering differences between near and distant future event representations in children. For example, forced-choice paradigms may allow children to construct future event representations with fewer demands on their verbal abilities. Another method that has been utilized in developmental research is asking children to draw their responses instead of expressing them verbally (Moffett et. al., 2018). Future work could ask children to draw their near and distant future event representations and score the number of concrete details in their drawings. However, this approach would be limited by children's still-developing drawing ability. Another limitation is that event frequency may have been confounded by other factors, such as event length, emotional intensity, and excitement. Specifically, infrequent events were generally longer lasting, more emotionally intense, and more exciting, than frequent events. To understand the effect of event frequency, future work should ask children to describe frequent vs. infrequent events that are equal in length and level of emotional intensity/excitement they generate.

Finally, data collection for Experiments 2 and 2b occurred throughout the COVID-19 pandemic, influencing the events that we could ask children about. This likely impacted how children, themselves, envisioned events in their personal futures. Nonetheless, the results that we obtained with respect to frequency and to children's subjective perceptions of distance held across our different experiments, thereby giving us more confidence in our findings.

***Conclusion***

By holding events constant across temporal distance conditions and examining a comprehensive list of indicators theorized to be impacted by temporal distance, the current study adds to the literature by highlighting the potential importance of event frequency on the relationship between temporal distance and future event representation. Furthermore, young children perceived the difference between the near and distant future (i.e., subjective distance ratings), but this did not translate into their verbal descriptions or the phenomenological characteristics of their representations (e.g., clarity). Future work should consider using methods that rely less on children's verbal skills, and also increase event salience, to better understand the role of temporal distance in children's future event representations.

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## Appendix A: Scales Description and Wording

### Road (used in Experiment 1; adapted from Figure 1 in Friedman, 2000)

Scale Description: During the introductory task in Experiment 1, a drawing of a long road was used to represent "soon" and "a long time from now". We used an adapted version of Friedman's (2000) road. This is a hand drawn image of a road in which one end of the road is very close, and the other end is very far away, extending into the horizon. The road we used was identical to Friedman's (2000) road, except we removed the numbers written on it.

Task wording: Children followed two different introductory procedures depending on the season during which testing occurred. The two procedures were identical apart from the example activities used to illustrate "a long time from now". If testing occurred between November 2nd and April 30th, the example activities were activities that children would do in the summer (i.e., go to the splashpad and go for a bike ride). If testing occurred between May 1st and November 1st, the example activities were activities that children would do in the winter (i.e., build a snowman and go sledding). Here, we give an example of the introduction procedure when testing occurred between November 2nd and April 30th:

*"Here is a picture of a long road. Let's imagine that we are standing right here (Experimenter points to closest point on the road) looking down the long road. Some things on the road are really close to us, and that means they are going to happen soon. These are things like going back to your home after this game (Experimenter places a picture of a house on the near part of the road) and having dinner tonight (Experimenter places a picture of dinner on the near part of the road). These things are going to happen soon. (Experimenter removes home and dinner cards from the road).*

*Some things on the road are really far away from us, and that means that they are going to happen a long time from now. These are things like going for a bike ride in the summer (Experimenter places a picture of a bike on the distant part of the road) and going to the splash pad in the summer (Experimenter places a picture of a splash pad on the distant part of the road). These things are going to happen a long time from now. (Experimenter removes bike and splash pad cards from the road).*

*Now it's your turn to give it a try (child is asked to place 4 example activities including going home, having dinner tonight, going for a bike ride in the summer, and going to the splashpad in the summer, along the road to demonstrate understanding of the road).*

- *You're going to go back to your home soon. Can you show me where on the road going back to your home goes? (child is corrected immediately by the experimenter).*

- *You're going to have dinner soon. Can you show me where on the road having dinner goes? (child is corrected immediately by the experimenter).*

- *You're going to go for a bike ride a long time from now. Can you show me where on the road going on a bike ride goes? (child is corrected immediately by the experimenter).*

- *You're going to go to the splash pad a long time from now. Can you show me where on the road going to the splashpad goes? (child is corrected immediately by the experimenter)."*

**Experiment 1 Event Representation Task (including prompting)**

Task wording: For each event on the Event Representation Task, children were told:

*"Let's talk about going to a birthday party. Let's imagine that you're going to a birthday party soon/a long time from now.*

*Can you tell me what's going to happen?*

*(If child doesn't understand or clarification is required): What are you going to do?*

*Anything else? (if they say nothing else, stop here and continue to Clarity Scale)*

*Anything else? (continue to Clarity Scale)"*

**Experiments 2 and 2b Event Representation Task (including prompting)**

**Task wording:**

*"I want you to imagine that you're going to a birthday party tomorrow/a year from now.*

*Can you tell me about it?*

*(If child doesn't understand or clarification is required): What are you going to do?*

*Anything else? (if they say nothing else, stop here and continue to Clarity Scale)*

*Anything else? (if they say nothing else, stop here and continue to Clarity Scale)*

*Anything else? (continue to Clarity Scale)"*

**Clarity Scale (used in Experiments 1, 2, & 2b; see Figure 1 in Coughlin, et al., 2014).**

Scale description: The Clarity Scale is a 6-point Likert Type scale that contains six identical smiley faces, each with a "thought bubble" containing an image of a home on a sunny day that increases in clarity across the scale. Each thought bubble corresponds to a verbal description of its clarity (i.e., very unclear, pretty unclear, not so clear, somewhat clear, very clear, perfectly clear).

Scale wording: When introduced to the clarity scale, children were told:

*"Some things that we imagine are perfectly clear in our heads (Experimenter points to the clearest thought bubble on the scale) and some things we imagine are not clear at all in our heads (Experimenter points to the least clear thought bubble on the scale).*

*When you thought about going to a birthday party soon/a long time from now (Experiment 1) OR tomorrow/a year from now (Experiments 2 & 2b), how clear did it look in your head? Did it look:*

| | |
|---|---|
| 1 | *Very unclear – did you see none of the things in your head? (point to corresponding bubble)* |
| 2 | *Pretty unclear – did you see just a little bit of the things in your head? (point to corresponding bubble)* |
| 3 | *Not so clear - did you see some of the things in your head? (point to corresponding bubble)* |
| 4 | *Somewhat clear – did you see a lot of the things in your head? (point to corresponding bubble)* |
| 5 | *Very clear - did you see most of the things in your head? (point to corresponding bubble)* |
| 6 | *Perfectly clear - did you see all of the things in your head? (point to corresponding bubble)"* |

On subsequent trials, children were asked an abbreviated version:

*"When you thought about going to a birthday party soon/a long time from now (Experiment 1) OR tomorrow/a year from now (Experiments 2 & 2b), how clear did it look in your head? Did it look very unclear – did you see none of the things in your head? Or perfectly clear - did you see all of the things in your head?"*

If children forgot the response options, they were reminded of all the options.

**Ease of Thinking Scale (used in Experiment 1; adapted from Coughlin et al., 2014).**

Scale description: We adapted Coughlin et al.'s (2014) scale such that children were simply asked to rate whether it was "easy" or "hard" to imagine each event. It was thus dichotomous, rather than the 3-point scale that Coughlin et al. used, and we did not use any accompanying images.

Scale wording: On all trials, children were asked:

*"Was it easy or hard to imagine going to a birthday party soon/a long time from now?"*

**Event Descriptor Task (used in Experiments 1, 2, & 2b; adapted from Vallacher & Wegner, 1989).**

Scale description: The Event Descriptor Task was created for the purposes of this study by adapting Vallacher and Wegner's (1989) questionnaire for children. We presented children with both an abstract and concrete descriptor for each event using puppets (Experiment 1; which we describe below in our example) or images of same age/gender children (Experiments 2 and 2b).

Scale wording: *This is Bert (Show Bert), and this is Ernie (Show Ernie). When Bert imagined going to a birthday party soon/a long time from now, he thought about celebrating with his family and friends. When Ernie imagined going to a birthday party soon/a long time from now, he thought about blowing out candles on the cake. When you imagined going to a birthday party tomorrow/a year from now, were you more like Bert? Or more like Ernie?*

**Subjective Distance Scale (used in Experiments 2 & 2b; adapted from Burns et al., 2019; see supplemental materials in Burns et al., 2019).**

Scale Description: The subjective distance scale is a 10-point Likert Type scale, represented as a ruler, used to ask children how far away each event representation felt in their minds. There is a cartoon figure standing at the closest end of the ruler, looking down at the ruler to the furthest end. The closest end of the ruler is labeled "Really soon", and the farthest end is labeled "A really long time from now". Our version of the scale was identical to Burns et. al.'s, except we added numbers from 1 ("really soon") to 10 (a really long time from now") along the scale so that children could indicate their responses verbally.

Scale Wording: When introduced to the distance scale, children were told:

"*Some things we imagine feel really close to us, like they're going to happen really soon. Some things we imagine feel really far away from us, like they're going to happen a really long time from now.*

*When you imagined going to a birthday party tomorrow/a year from now, how far away did it feel? Did it feel like it would happen really soon (Experimenter points to the nearest point on scale), did it feel like it would happen a really long time from now (Experimenter points to the most distant point on the scale) or somewhere in between (Experimenter points to the middle range)?"*

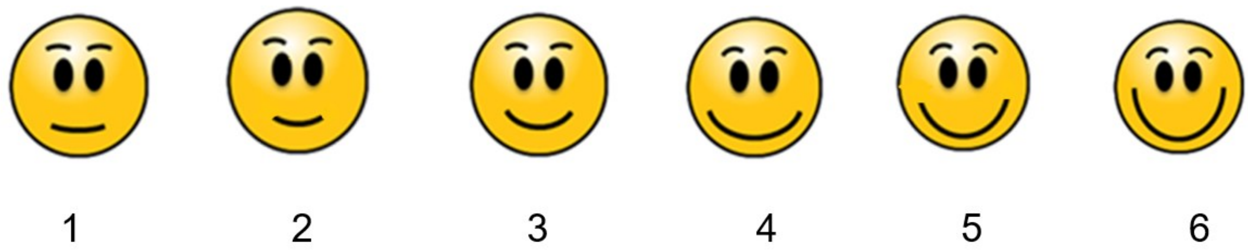
On subsequent trials, children were asked an abbreviated version:

*"When you imagined going to a birthday party tomorrow/a year from now, how far away did it feel? Did it feel like it would happen really soon (Experimenter points to the nearest point on scale), did it feel like it would happen a really long time from now (Experimenter points to the most distant point on the scale) or somewhere in between (Experimenter points to the middle range)?"*

**Emotion Scale (used in Experiments 2 & 2b; adapted from Burns et al., 2019):**

Scale Description: We adapted Burns et. al.'s (2019) Emotion Scale such that children rated their emotions on a scale that ranged from neutral to very, very happy, whereas in Burns et al., (2019), children rated their emotions from very sad to very happy. We made this adaptation because we were interested in the intensity of positive emotion, and not the valence (i.e., happy vs. sad). Furthermore, all of our events were intended to be positive, and it was not anticipated that children would expect to feel sad during these events. The Emotion Scale is a 6-point Likert Type scale (i.e., with each point represented by a happy face of increasing happiness) with which children indicated how intensely happy they expected they would feel during each future event representation. Each face corresponds to a verbal description of its emotional intensity (i.e., not sad, not happy, just normal; a teeny bit happy; a bit happy; pretty happy; very happy; very, very happy).

Scale:




Scale Wording: When introduced to the Emotion Scale, children were told:

"*Some things we imagine make us feel happy and some things we imagine make us feel less happy.*

*When you imagined going to a birthday party tomorrow/a year from now, how did you imagine you would feel? Not sad, not happy, just normal (point to corresponding face); a teeny bit happy (point to corresponding face); a bit happy (point to corresponding face); pretty happy (point to corresponding face); very happy (point to corresponding face); very, very happy (point to corresponding face)."*

On subsequent trials, children were asked an abbreviated version:

*"When you imagined going to a birthday party tomorrow/a year from now, how did you imagine you would feel? Did you imagine you would feel very, very happy (point to corresponding face), just normal (point to corresponding face) or somewhere in between (point to corresponding faces)?"*

If children forgot the response options, they were reminded of all the options.

# Chapter 3: Who Feels Happier Right Now?: The Impact of Temporal Distance on Children's Judgements of Emotional Intensity

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This manuscript was published in the *British Journal of Developmental Psychology* in 2024

DOI: 10.1111/bjdp.12505

Minor changes were made to the published manuscript to address committee comments.

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This research was supported by a Doctoral Postgraduate Scholarship from the Natural Sciences and Engineering Research Council of Canada and an Ontario Graduate Scholarship to Bronwyn O'Brien and a Discovery Grant from the Natural Sciences and Engineering Research Council of Canada (RGPIN-2022-03194) to Cristina Atance. We thank Jane Archibald and Fayth Kreisman for help with coding. Thanks to Dr. Elena Gallitto for statistical consultation. Thank you to the children and parents who participated.

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Anonymous data supporting these findings are available upon request.

**Abstract**

Do children consider temporal distance in their reasoning about the world? Using a novel method that relied minimally on verbal ability, we asked $N = 106$ 3- to 6-year-olds to judge which of two characters felt more "happy"/"sad" *right now*: one engaging in a pleasant/unpleasant activity *tomorrow* or another engaging in this same activity when they are *a year older*. That is, we examined whether children understood that the closer in time a future event, the more intense the currently-felt emotion. Starting at age 4, children correctly judged which child was more "happy"/"sad" *right now*. However, 4- to 6-year-olds tended not to explain their judgments by referring to temporal distance, per se. Results suggest that children are sensitive to temporal distance early in development, but do not yet verbally express this understanding. Implications for theories about children's future thinking and future areas of research are discussed.

**Keywords**: cognitive development, episodic future thinking, event reasoning, temporal distance

# Who Feels Happier Right Now?: The Impact of Temporal Distance on Children's Judgements of Emotional Intensity

When you were first invited to give a conference talk, you were only a bit nervous. However, as the day looms nearer, you feel butterflies in your stomach. Most of us have had the experience of emotions – whether positive or negative - becoming more intense as events draw nearer in time. This may be because we mentally represent near (e.g., tomorrow) and distant (e.g., a year from now) events differently. In other words, *temporal distance* impacts our thinking and reasoning. Indeed, an extensive literature demonstrates that adults represent near future events in an action-oriented and concrete manner and distant future events in a more abstract and goal-oriented fashion (e.g., Liberman and Trope, 2008; Trope & Liberman, 2010). For example, when thinking about a talk you will give next year, you may imagine sharing ideas and engaging in interesting discussions with colleagues. However, as the conference approaches, you are more likely formulating specific talking points and predicting the questions the audience may pose. And, as alluded to above, the intensity of your currently-felt emotions also differs between both time points. For example, you likely feel more nervous about the talk *right now* when it is a week, vs. a year, away. That our event representations and emotional intensity differ as a function of temporal distance is beneficial for our future-oriented behaviours, such as self-control, planning and delay of gratification (Fujita et al., 2006; Trope & Liberman, 2010). For example, feeling more nervous for next week's talk motivates you to prepare, while feeling less nervous for next year's talk allows you to focus on more pressing tasks in the present.

## ***Temporal Distance and Children's Future Event Representations***

Young children, like adults, need to adaptively envision, and prepare for, future events (e.g., outings, trips, school presentations). Children's ability to think about the future emerges around 3 years and shows substantial development by 5 years (Busby & Suddendorf, 2005; Quon & Atance, 2010). Around the age of 5 to 6, the temporal reasoning system (i.e., the ability to think about different points in time and flexibly reason about time; Hoerl & McCormack, 2019) emerges and children's ability to think about the future continues to develop into adolescence (Gott & Lah, 2014). Furthermore, 4- to 8-year-olds can accurately distinguish between the relative temporal distance of future events (i.e., by ordering future events along a timeline; e.g., Friedman, 2000; 2002). However, children's judgements appear to be clouded by the recency of these same events in the past (e.g., underestimating how far away breakfast is because children just ate breakfast), and their tendency to use the morning, rather than the present, as a reference point in judging the temporal distance of daily events (Friedman, 2000; 2002). Four- to 8-year-olds are also developing an understanding of the deictic status (i.e., whether an event occurs in the past vs. present vs. future), sequential order (e.g., "tomorrow" comes before "next week"), and remoteness (i.e., relative distance from the present) of temporal terms. However, the ability to judge the deictic status and sequential order of temporal terms appears to emerge earlier in development than the ability to judge their remoteness and absolute duration (e.g., an hour is longer than a minute; Tillman et al., 2017; Tillman & Barner, 2015). Therefore, although these abilities are still developing, young children are beginning to think, and reason, about the future and temporal distance at a young age.

However, is children's future thinking impacted by temporal distance? By examining children's verbal reports and scale ratings, researchers have determined that 5-year-olds subjectively perceive the difference between the near and distant future (i.e., O'Brien et al., 2024; Chapter 2), and this appears to translate into their future event descriptions between 5- to 10-years-old, when they begin to represent the near future with more clarity (Coughlin et al., 2014), ease (Coughlin, et al., 2014), and episodicity (Wang et al., 2014) than the distant future. However, these findings have largely come from paradigms that rely heavily on children's expressive language which itself continues to develop through middle childhood (Coughlin et al., 2019). Overall, the use of primarily verbal measures and scales limits the extent to which we can examine even younger children's (e.g., younger than 5 years) sensitivity to temporal distance. For example, previous methods may be limited by biases such as the recency and "morning-reference" biases (e.g., Friedman, 2000; 2002), and their focus on children's still-developing understanding of the remoteness and absolute duration of complex temporal terms (e.g., Grant & Suddendorf, 2011; Tillman et al., 2017; Tillman & Barner 2015). Thus, the potentially different ways in which temporal distance influences even very young children's event representations and reasoning are unknown.

***Emotional Intensity***

Judgments about emotional intensity – and, more specifically, how future events impact currently-felt emotions - is a promising and less verbally-demanding means to examine temporal distance effects in younger children. Importantly, emotional intensity is impacted by temporal distance in adults. These paradigms ask adults to generate near or distant *future* event descriptions and rate how they imagine they will feel during the event. Adults tend to rate near, vs. distant, future event representations as more emotionally intense, which suggests a more concrete event representation (Agerström et al., 2014; D'Argembeau et al., 2011; 2004), and vice versa (Van Boven, et al., 2010). Might the same also be true of children?

Children's ability to recognize and interpret others' emotional displays emerges around 3 ½ years of age (Cheal & Rutherford, 2011), and by 4-5 years, children infer basic emotions (e.g., happiness) from facial expressions (Boone & Cunningham, 1998). Beginning around 3-4 years, children understand the link between basic emotions and the situations that elicit them (Borke, 1971; Harris, et. al.,1981). Furthermore, between the ages of 4 and 6, children understand that the intensity of emotions decreases with time, and can reason about why this might be, although this understanding is still developing during this period (Harris et al., 1985). Using a method similar to that used with adults, O'Brien and colleagues (2024) investigated the impact of temporal distance on children's ratings of the intensity of *future* emotions, by asking children to generate near or distant future event representations and rate on a Likert-type emotion faces scale how they imagined they would feel during the event. No effect of temporal distance on 5- to 9-year-olds' ratings of *future* emotional intensity was detected.

Burns and colleagues (2019) took a different approach to examining the impact of temporal distance on emotional intensity by focusing on children's and adults' ratings of *currently-felt* emotions, as opposed to *predictions* of future emotions. In fact, the adult literature has highlighted the distinction between *anticipatory* (i.e., currently-felt emotions in anticipation of a future event) and *anticipated* (i.e., how one expects to feel during a future event) emotions (Barsics et al., 2016). Thinking about currently-felt (vs. anticipated) emotions is arguably less cognitively demanding as it may not draw as heavily on other cognitive functions (e.g., self-projection) increasing the odds of detecting temporal distance effects in a younger sample. In Burns et. al.'s (2019) study, 4- to 18-year-olds and adults rated the intensity of their current emotions (i.e., how they felt *right now*) using a Likert-type emotion faces scale when imagining holidays (e.g., Christmas) that were two weeks away. Participants also rated how far away each holiday felt on a Likert-type scale. Therefore, children provided *subjective* ratings about how far away in time an event that was *objectively* two weeks away felt and, in turn, their current emotions when imagining this event. Starting at age 6, temporal distance was negatively correlated with the intensity of currently-felt emotions. In other words, when an event felt subjectively more distant, it was rated as less emotionally intense. Therefore, children may be sensitive to temporal distance around age 6, although results are mixed depending on whether they think about currently-felt vs. future emotions.

Although Burns et al. (2019) found that children younger than 6 did not appear to be sensitive to temporal distance (i.e., subjective temporal distance was not negatively correlated with emotional intensity), this may have been because the majority of 4- and 5-year-olds in their study tended to only use the endpoint ("very happy") of the emotion scale. However, might younger children show an effect of temporal distance when asked to consider if the intensity of a currently-felt emotion differs depending on whether a given event will occur in the near or distant future? For example, would children recognize that a child who will engage in a positive event *tomorrow* (e.g., going to Disney World) is more happy right now than a child who will only engage in this positive event when they are *a year older*? This approach has the advantage of placing the event in question at two objectively distinct time points (i.e., one near, one distant) rather than relying on children's judgments about the subjective distance of one given future event. Relatedly, children would not need to use a Likert-type scale to make an emotion judgment but, instead, choose which of two characters feels an emotion more strongly as a function of temporal distance. Finally, because the judgments are about another child, and not the self, children's performance may be less influenced by idiosyncratic factors (e.g., personal preferences, restriction on activities because of one's personal schedule) pertaining to any particular event or time point. For instance, it is well established that taking a self-distanced perspective by, for example, reasoning about another child, improves future-oriented behaviours, such as delay of gratification, saving, executive functioning, perseverance, reasoning about future preferences, and self-control (e.g., Bélanger et al., 2014; Jerome et al., 2023; Lee & Atance, 2016; Principe & Zelazo, 2005; White & Carlson, 2016). However, it is also important to recognize that reasoning about another child's emotions may require more sophistication due to Theory of Mind (ToM) requirements, a skill which is still developing at this age (e.g., Calero et al., 2013; Osterhaus & Koeber, 2021). For example, children demonstrate better understanding of another's false beliefs than another's belief-based emotions (Bender et al., 2011), which may therefore impact their reasoning about another child's emotions. However, work by Harris and colleagues found that young children can reason relatively accurately that another's emotions wane over time (Harris et al., 1985).

***Current Study***

The main goal of the current study was to examine children's sensitivity to temporal distance. We used children's reasoning about another child's emotions as the means to do so. Therefore, we examined 3- to 6-year-olds' ability to account for temporal distance when making judgments about the intensity of another child's currently-felt emotions. More specifically, we aimed to understand at what age children understand that a child who will engage in an activity *tomorrow* feels an emotion more intensely *right now* than a child engaging in the same activity when they are *a year older*. Furthermore, we investigated at what age children can verbally explain this understanding. Using a within-subjects design, participants were presented with six scenarios in which one character was described as engaging in an activity (e.g., going to Disney World) *tomorrow*, while another was described as engaging in the same activity when they are *a year older.* Children were then asked which child feels more "happy" or "sad" *right now* and to explain their reasoning. A "correct" response was judging that the character engaging in the activity *tomorrow* feels the emotion more intensely *right now* than the character engaging in the activity when they are *a year older*. Furthermore, children explained their judgements and we examined the degree to which children referred to differences in relative temporal distance (e.g., *she's more happy because she's doing it sooner*) in their explanations.

We hoped that the simplicity of this research design, and the focus on judging *another* child's (i.e., as opposed to one's own) *current* emotions, would allow us to uncover whether even very young children incorporate temporal distance into their reasoning about the world. A secondary more exploratory goal was to examine the role of event valence in the relationship between temporal distance and emotional intensity by presenting children with activities meant to elicit both positive (i.e., happy) and negative (i.e., sad) emotions. Finally, although not a primary goal of this research, children's understanding of the factors that may impact other people's emotions (e.g., temporal distance) has important implications for the development of empathy and has the potential to impact children's decision making.

**Hypotheses.** We hypothesized that, by age 4, children would correctly judge emotional intensity as a function of temporal distance. This is because future thinking (Atance & Meltzoff, 2005; Busby & Suddendorf, 2005; Hayne et al., 2011; Quon & Atance, 2010), along with other related cognitive abilities including theory of mind (e.g., Gopnik & Astington, 1988; Perner et al., 1987), develop substantially around this age. Furthermore, by age 4 children can differentiate the distance of various future events from the present with relative accuracy (e.g., Friedman 2000; 2002; Tillman et al., 2017; Tillman & Barner, 2015). However, we predicted that children would only correctly explain their judgments around ages 5 or 6 when the temporal reasoning system is more developed (Hoerl & McCormack, 2019). Our study pre-registration can be found here: https://osf.io/hg9fs/?view_only=7684804fb4124ce9825bad6341b1847b

## Method

### *Participants*

Data were collected between September 2022 and April 2023. Participants were 118 English speaking, typically developing 3- to 6-year-olds recruited from a local science museum and from a university database. Nine children were excluded for not completing the study, two for not understanding English, and one due to experimenter error. The final sample consisted of 106 3- ($n$ = 24; 13 females; range = 36 – 47 months), 4- ($n$ = 27; 14 females; range = 48 – 59 months), 5- ($n$ = 27; 16 females; 60 – 70 months), and 6- ($n$ = 28; 12 females; 72 – 84 months) year-olds.

Forty-four percent of children were identified as White, 11% as mixed ethnicity, 4% as Asian, 1% as Middle Eastern, 1% as Latin, 1% as Black, and 1% as South Asian (35% provided no information). Sixty-three percent of mothers and 57% of fathers (35% provided no information) reported attaining a college or university degree or higher. The total household income was over $80,000 for 48% of families (39% provided no information). Children were compensated with a small sticker or toy. Anonymous data supporting our findings are available upon request.

### *Procedure*

After obtaining consent and assent, children completed the experiment in a quiet testing room at a local science museum or online via Zoom. In both contexts, the stimuli were presented via PowerPoint on a laptop. Children tested in person sat in front of the laptop with the researcher beside them, while children tested online completed the study on a Zoom call with the researcher. There were no other methodological differences between testing in person vs on Zoom.

To introduce children to the focal *Emotion* task, they were shown a slide with images of cartoon children and told that these children were the same age as them. They were then told: "I'm going to tell you some stories about some things that are going to happen to these kids and ask you some questions about them. Some of these things are going to happen to these kids soon, like tomorrow, and some of these things are going to happen to these kids a long time from now, when they're [x]-years-old" (i.e., where *x* was always one year older than the child's current age).

**Emotion Task Test Trials.** Children were presented with six test trials, with each trial comprising 1) memory, 2) judgement, and 3) explanation questions. The content of the trials was generated by the authors and specific items were selected through pilot testing. To start, children were told that a character would be engaging in an activity (e.g., having ice cream) "tomorrow" whereas another character would be engaging in the same activity when they are "a year older" (i.e., a year older than the child's current age). Four of the test trials were "happy" activities and two were "sad" activities (see Table 1 for test trials), such that children indicated which of the two characters was "more happy/sad" *right now* (i.e., judgement question). For example, "Here is the green kid, and here is the orange kid. The green and orange kids are both *4* years old just like you. The green kid is going to have ice cream tomorrow, and the orange kid is going to have ice cream when she is *5*". Before children were asked to judge which character was more happy/sad right now, they were given two memory questions (i.e., "When is the green kid getting ice cream?" and "When is the orange kid getting ice cream?"). Children were given three attempts to correctly answer the memory questions. On each trial, incorrect responses were corrected immediately by the experimenter. Three-year-olds passed the memory questions on

75% of the trials, while 4-, 5-, and 6-year-olds passed the memory questions on over 97% of trials.

Importantly, all children were reminded of when each character would engage in the activity (e.g., “The green kid is going to have ice cream tomorrow. The orange kid is going to have ice cream when she is 5 years old”), and only then asked the judgement question (i.e., “Who feels more happy right now? Is it the green kid, who is going to have ice cream tomorrow? Or the orange kid, who is going to have ice cream when she is 5 years old”) followed by the explanation question (i.e., “Why does the [character the child chose] feel happier right now?”). The two sad events were always presented as the last of the six trials because this aspect of our study was more exploratory. The trial order, the order in which characters were presented (i.e., the character doing the activity tomorrow vs. when they are a year older), the gender of the characters, and the colour of the character’s clothes were counterbalanced in all the test and comprehension and bias check questions (i.e., described below) within this structure to control for order effects.

**Table 1**

*Description of Test Trials*

| Test Trials |
|---|
| Happy Trials |
| 1. Character going to Disney World tomorrow vs. character going to Disney World when they are a year older |
| 2. Character eating their favourite dessert tomorrow vs. character eating their favourite dessert when they are a year older |
| 3. Character receiving a brand-new toy tomorrow vs. character receiving a brand-new toy when they are a year older |
| 4. Character having ice cream tomorrow vs. character having ice cream when they are a year older |
| Sad Trials |
| 1. Character going on a boring car ride tomorrow vs. character going on a boring car ride when they are a year older |
| 2. Character giving away their favourite toy tomorrow vs. character giving away their favourite toy when they are a year older |

Correct responses (i.e., choosing the child doing the activity *tomorrow*) on the judgment questions were given a score of one and incorrect responses a score of zero. Separate mean scores for children's judgments on the happy and sad test trials were calculated by adding scores across each type and dividing by the number of happy or sad trials completed. Scores ranged from zero to one. Sad trials were introduced part way through data collection; therefore only 52 children (16 4-year-olds, 20 5-year-olds, 16 6-year-olds) completed these.[3] It is important to note that we therefore had less statistical power in the sad condition.

A researcher, blind to hypotheses, scored children's responses to the explanation questions on a scale ranging from zero to two, where higher scores indicated responses with a more sophisticated understanding of relative temporal distance (see Table 2 for scoring description). A reliability coder coded 50% of responses. The intraclass correlation between coders was .87 (i.e., "good" reliability). The primary coder's codes were used in all analyses. Separate mean scores for the happy and sad explanation questions were calculated by adding scores across each type and dividing by the number of happy or sad trials completed, ranging from zero to two. In calculating these mean scores, only explanation questions for which the child passed the corresponding judgment question were included, as we were interested in investigating children's rationale when they demonstrated an understanding of the effect of temporal distance on current emotions.

**Table 2**

*Description of Explanation Question Scoring*

| Score | Category Description | Examples |
|---|---|---|
| 0 | Response does not refer to temporal distance. | "Because she's excited", "Because she's going to Disney World." |

[3] Although not every child will consider the intended sad events to be "sad", (i.e., they could evoke other emotions such as anger or boredom), they are nonetheless negatively (as opposed to *positively*) valenced.

| | | |
|---|---|---|
| 1 | Response refers to the fact that the child is more happy/sad right now because they are doing the activity *tomorrow.* | "Because she's getting an ice cream cone tomorrow", "Because he's going tomorrow." |
| 2 | Response refers to the fact that the child is more happy/sad right now because they are doing the activity *sooner* (i.e., refers to relative temporal distance). | "Because he's getting an ice cream cone soon", "Because she's getting a brand new toy before the other kid." |

**Comprehension and Bias Checks.** Three kinds of comprehension and bias checks were interspersed throughout the test trials (see Table 3).

***"More" Check.*** To ensure that children understood the concept of "more" happy/sad, they completed two trials in which they indicated which of two characters was "more happy" *right now* (see Table 3). Incorrect responses were given a score of zero and correct responses a score of one and the mean score was calculated.

***Response Bias Check.*** On all test trials, the correct response to the judgement question was the child engaging in the activity *tomorrow*. This raises the possibility that children could pass these questions by defaulting to the "tomorrow" option (though, this option was counterbalanced). To control for this possibility, we included two trials in which the correct response was the character engaging in the activity when they are a *year older* (see Table 3). Incorrect responses were given a score of zero and correct responses a score of one and mean scores were calculated. Children also explained their choices.

***Temporal Terms Check.*** To ensure that children understood that tomorrow is *sooner* than when the character is a year older, they completed one trial in which they indicated which of the two characters would get candy first: one who is going to the store *tomorrow*, or one who is going when they are *a year older* (see Table 3). Incorrect responses were given a score of zero and correct responses a score of one (see Figure 1 for a flowchart of the procedure).

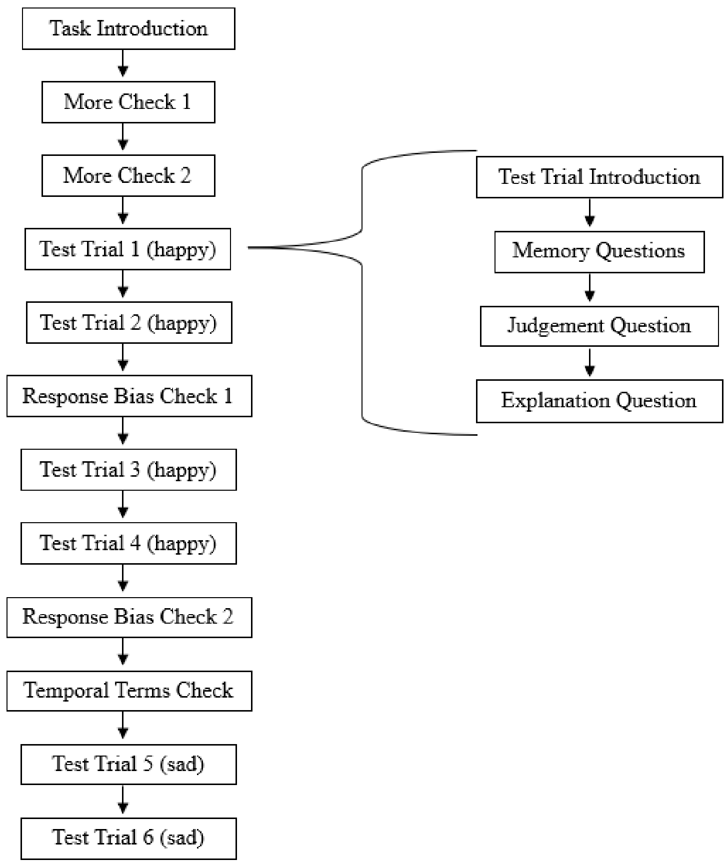
**Table 3**

*Description of Comprehension and Bias Check Trials*

| Comprehension and Bias Checks |
|---|
| *More* Check |
| 1. The grey kid got 10 candies. The pink kid got 1 candy. Who feels more happy right now? Is it the grey kid, who got 10 candies? Or the pink kid, who got 1 candy?<br>2. The yellow kid got a pencil for her birthday. The purple kid got a puppy for her birthday. Who feels more happy right now? Is it the yellow kid, who got a pencil for her birthday? Or the purple kid, who got a puppy for her birthday? |
| *Response Bias* Check |
| 1. The purple kid has to clean up a big mess tomorrow. The yellow kid gets to watch her favourite movie when she is [x] years old (where *x* was always one year older than the child's current age). Who feels more happy right now? Is it the purple kid, who has to clean up a big mess tomorrow? Or the yellow kid, who gets to watch her favourite movie when she's [x] years old?<br>2. The orange kid is getting a present when he's [x] years old (where *x* was always one year older than the child's current age). The red kid has to drink yucky medicine tomorrow. Who feels more happy right now? Is it the orange kid, who's getting a present when he's [x] years old? Or the red kid, who has to drink yucky medicine tomorrow? |
| *Temporal Terms* Check |
| 1. The green kid is going to walk to the store to get candy tomorrow. The red kid is going to walk to the store to get candy when they are [x] years old (where *x* was always one year older than the child's current age). Who will get candy first? Is it the green kid who is going to the store tomorrow? Or the red kid who is going to the store when they are [x] years old? |

**Figure 1**

*Procedure Flowchart*




***Power Analyses***

Burns and colleagues (2019) found a small- to medium-sized effect of temporal distance on emotional intensity, and we therefore aimed to detect a medium sized effect of our predictors. A priori power analyses using G*Power 3.1.9.4 (Faul et al., 2009) were run to determine required sample sizes for each analysis. To determine whether children's performance was above chance on the happy and sad judgement questions using one sample *t*-tests (test value = 0.5) required a sample of 27 ($d$ =.5). To determine whether performance on the judgement and explanation questions improved with age in months using linear regression required a sample of 55 ($f^2$=.15). Finally, using ANOVA to examine the effect of age in years, valence, and age in years X valence on judgement and explanation question performance required a sample of 42 ($\eta p2$ =.06). With these constraints in mind, we aimed to collect a sample of 96, in order to also have at least 20 children in each cell (i.e., 24 in each age group).

**Results**

***Preliminary Analyses***

Data were evaluated for outliers, normality, independence of residuals, linearity, homoscedasticity and multicollinearity. The only assumption violated was the presence of outliers in the happy and sad judgement question scores. Five outliers with z-scores greater than +/- 3.29 were winsorized to the closest non-outlier score (Tukey, 1962).

**Temporal Terms Check.** Nine 3-year-olds, seven 4-year-olds, and three 5-year-olds failed the temporal terms check question. Children who passed this check performed better on the judgement and explanation questions than children who failed, $p$s <.001. The 4-, 5-, and 6-year-olds performed above chance on this check question ($p$s <.05), while the 3-year-olds did not, $t$ (23) = 1.24, $p$ =.11 (see Table 4 for descriptives). This suggested that our method was not appropriate for 3-year-olds, given that this fundamental knowledge about time is likely required to judge how temporal distance impacts another person's currently-felt emotions. Three-year-olds were thus excluded from the remainder of analyses, as were all other children who failed the temporal terms check (as per our pre-registration).

**More Check.** Three 4-year-olds and two 6-year-olds did not pass one or both more check trials and, as pre-registered, were excluded from the main analyses. Although all age groups performed above chance on these two check questions (see Table 4 for descriptives), children who passed these checks performed better on the judgement and explanation questions than children who failed, $p$s <.05.

**Response Bias Check.** Six 4-year-olds, four 5-year-olds, and five 6-year-olds did not pass one or both of the response bias check trials. However, all three of these age groups performed above chance on these check questions (*p*s <.05; see Table 4 for descriptives). Moreover, children's performance on these check questions did *not* significantly affect their performance on the judgement or explanation questions, all *p*s >.05. Therefore, we ran our main analyses both including and excluding these children. Because results did not differ between these two samples, we retained all children in our main analyses (as per our pre-registration).

**Table 4**

*Descriptive Statistics by Age in Years*

| | 3-year-olds | 4-year-olds | 5-year-olds | 6-year-olds |
|---|---|---|---|---|
| Preliminary Analyses | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) |
| Temporal Terms Check (0 – 1) | .62(.50) | .74(.45) | .89(.32) | 1.00(0) |
| More Check (0 – 1) | .83(.38) | .89(.32) | 1.00(0) | .93(.26) |
| Response Bias Check (0 – 1) | .54(.51) | .78(.42) | .85(.36) | .82(.39) |
| Main Analyses | | *M*(*SD*) | *M*(*SD*) | *M*(*SD*) |
| Judgment Question | | | | |
| Happy (0 – 1) | | .92(.13) | .96(.10) | 1.00(0) |
| Sad (0 – 1) | | .87(.24) | .95(.15) | .83(.24) |
| Explanation Question | | | | |
| Happy (0 – 2) | | 1.06(.42) | 1.06(.51) | 1.19(.29) |
| Sad (0 – 2) | | .87(.44) | .97(.44) | .73(.56) |

*Note: Mean scores are proportion scores for the happy and sad judgement and explanation trials.

***Main Analyses***

As detailed above, only 4-, 5-, and 6-year-olds who passed the temporal terms and more check questions were included in the main analyses. The final sample thus included 69 4- (*n* = 19; 9 females; range = 48 – 59 months), 5- (*n* = 24; 14 females; 60 – 69 months), and 6- (*n* = 26; 11 females; 72 – 84 months) year-olds. Sex, ethnicity, location of testing, and counterbalancing order did not influence our dependent variables.

**Judgement Question Performance.** A linear regression showed that age in months explained 11% of the variance and significantly predicted children's judgments on the happy test trials, $F$ (1, 68) = 9.29, $SE$ =.09, $p$ =.003. In contrast, age in months explained 0% of the variance and did not significantly predict children's judgments on the sad test trials, $F$ (1, 51) = .32, $SE$ =.22, $p$ =.58. In other words, as age increased, children's performance improved for the happy, but not the sad, trials.

***Chance Analyses for Judgement Question Performance.*** A series of one-sample $t$-tests (test value = 0.5) showed that 4-year-olds, 5-year-olds, and 6-year-olds performed above chance on the happy and sad judgement question (Table 4 for descriptives, Table 5 for $t$ statistics, and Figure 2). Furthermore, binomial tests were run on the individual items and performance was above chance on all items. Children's performance did not differ across individual trials, $F$ (5, 50) = 1.60, $p$ = .16, $\eta p2$ = .03.

**Table 5**

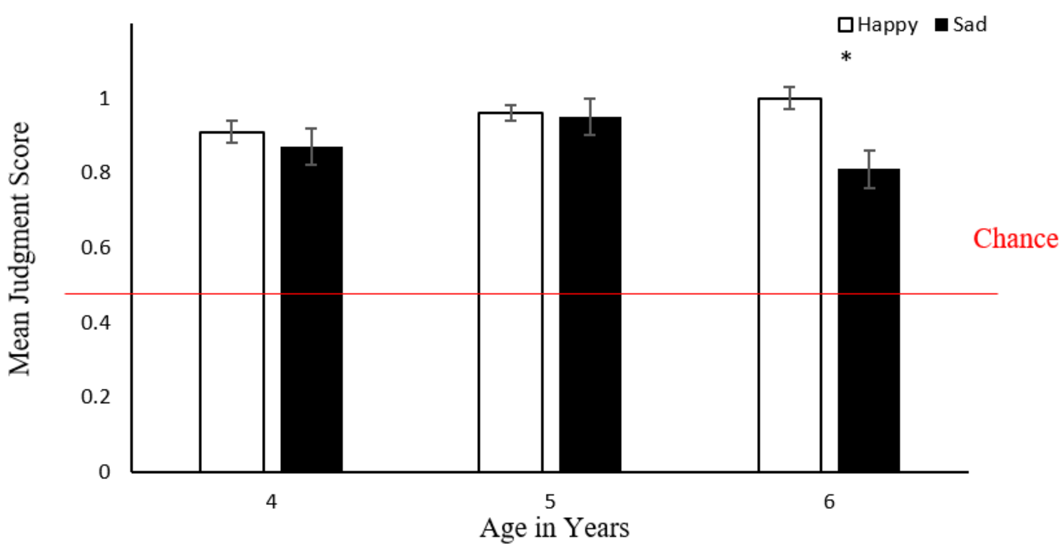
*Chance Analyses Examining Judgement Question Performance*

| | Happy Judgement Trials | | Sad Judgement Trials | |
|---|---|---|---|---|
| Age | $t$ (df) | $p$ | $t$ (df) | $p$ |
| 4 | 13.81(18) | <.001 | 6.25(15) | <.001 |
| 5 | 23.41(23) | <.001 | 13.08(19) | <.001 |
| 6 | Not computed because $M$ = 1, $SD$ = 0 | | 4.72(15) | <.001 |

***Effect of Valence on Children's Judgements.*** A mixed ANOVA with age in years (4 vs 5 vs 6) and valence (happy vs sad) as the independent variables found no main effect of age on mean judgement question performance, $F$ (2, 49) = 1.28, $p$ =.29, $\eta p2$ =.05. There was a main effect of valence, such that children performed better on happy ($M$ =.96, $SE$ =.01), than sad events ($M$ =.88, $SE$ =.03), $F$ (1, 49) = 6.97, $p$ =.01, $\eta p2$ =.12. This was qualified by a significant interaction between age and valence, $F$ (2, 49) = 3.50, $p$ =.04, $\eta p2$ =.13, wherein 6-year-olds performed better on the happy ($M$ =1.0, $SE$ =.03) vs. sad ($M$ =.81, $SD$ =.05) trials, $p$ <.001. Four- and 5-year-olds performed no differently on the two, $p$s > .05 (see Figure 2).

**Figure 2**

*Judgement Question Performance as a Function of Event Valence*

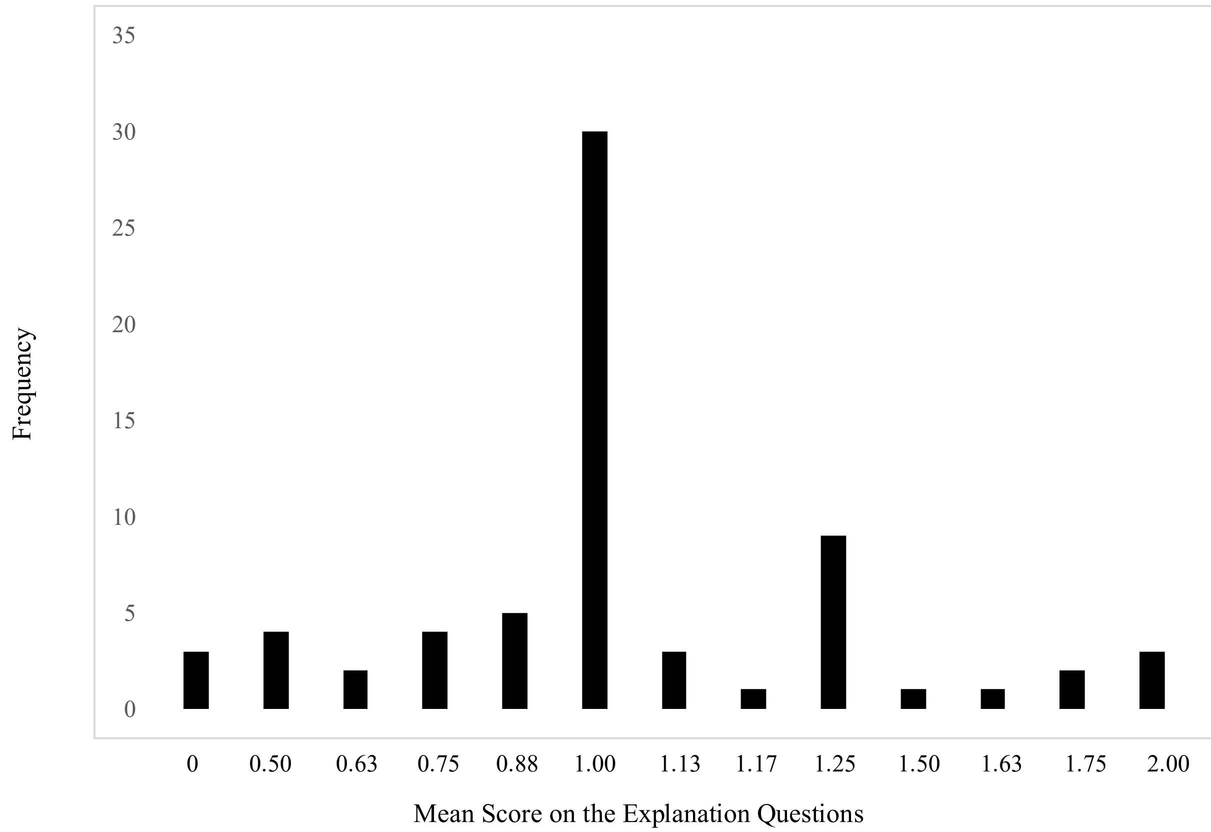



Note: Error bars represent standard error, * $p$<.001

**Explanation Question Performance.** A linear regression showed that age in months only explained 3% of the variance and did not significantly predict children's performance on the happy explanations, $F$ (1, 67) = 3.01, $SE$ =.40, $p$ =.09. Similarly, age in months explained 0% of the variance and did not significantly predict performance on the sad explanations, $F$ (1, 49) = .84, $SE$ =.48, $p$ =.36 (see Figure 3 for the distribution of mean explanation scores and Table 4 for descriptives).

**Figure 3**

*Distribution of Mean Explanation Scores*




*Note: This figure represents the mean score of all explanation question scores (i.e., collapsed across event valence and age).

***Effect of Event Valence on Children's Explanations.*** A mixed ANOVA with age in years (4 vs 5 vs 6) and valence (happy vs sad) showed that there was no main effect of age on children’s explanations, $F$ (2, 47) = .20, $p$ =.82, $\eta p2$ =.01. There was a main effect of valence, such that children were better at explaining their choices for the happy ($M$ = 1.12, $SE$ =.06) vs.

sad (*M* =.86, *SE* =.07) test trials, $F$ (1, 47) = 16.91, $p$ <.001, $\eta p2$ =.27. There was no interaction between age and valence, $F$ (2, 47) = 2.53, $p$ =.09, $\eta p2$ =.10.

**Discussion**

The current study used a novel method to examine the impact of temporal distance on 3- to 6-year-olds' judgements about another child's currently-felt emotions. As predicted, by 4 years of age, children expected the character who would be engaging in an activity in the near future to feel a corresponding emotion more intensely *now* than the character engaging in the activity in the distant future. Contrary to hypotheses, age did not predict children's explanations for their judgements and, even at 6 years, children failed to draw on a more sophisticated understanding of relative temporal distance (e.g., mentioning the concepts of "sooner" or "long time from now") to explain their judgements. Importantly, 3-year-olds were excluded from analyses because they did not demonstrate the rudimentary understanding of temporal distance required to complete the focal emotion task (i.e., tomorrow is sooner than when the character is a year older). Although intended as a manipulation check, we next discuss the implications of these findings for 3-year-olds' understanding of temporal distance. Following, we consider 4- to 6-year-olds' performance, and then turn to the effect of valence on performance. We highlight limitations and directions for future research throughout.

***Temporal Terms Check Performance***

The fact that 3-year-olds performed no different than chance on the temporal terms check, while 4- to 6-year-olds performed above chance, is consistent with previous research demonstrating that the production of temporal terms, and the ability to accurately report future events occurring at specific time points, undergoes substantial development between ages 3 and 4 (Busby & Suddendorf, 2005; Grant & Suddendorf, 2011). This highlights a widespread limitation across research in this area: reliance on verbal ability. We attempted to mitigate this issue by using a method that relies minimally on verbal ability, although our method still relied on a rudimentary understanding of the specific temporal expressions we used (i.e., tomorrow, when the character is a year older). Future work could replicate our design while using temporal terms that may be understood earlier in development, such as "soon" vs. "when they are bigger" (Grant & Suddendorf, 2011).

### ***Judgement Question Performance***

Judgements on the happy test trials improved with age (because event valence was an exploratory analysis, we discuss performance on the sad trials separately in the "Valence" section below), though all age groups performed above chance on them. This is notable given that previous research has not detected effects of temporal distance on such phenomenological aspects of children's future event descriptions until later in development (i.e., between 5 and 7 depending on the specific phenomenological indicator) and Burns et. al. (2019) did not find effects of temporal distance on judgements of one's *own* currently-felt emotions until age 6. However, our method relied less on verbal skills and asked children to consider how two events that differ in their temporal distance may differentially impact *another* child's emotions in the *present* as opposed to one's *own* emotions in the *future*. This suggests that children as young as four consider temporal distance in their reasoning, but this does not translate to verbal event descriptions and phenomenological scale ratings of *future* events until later in development, perhaps due to improvements in future thinking, self-projection, and verbal expression (Coughlin et al., 2014; 2019, Wang et al., 2014). This is supported by our findings that even 6-year-olds did not verbally explain their correct judgements using higher-level temporal reasoning (i.e., references to relative temporal distance) on the explanation questions. Furthermore, the current study used emotion judgements as the means to examine temporal distance sensitivity. Future work could employ a similar design, but instead look at the effect of temporal distance on variables other than emotions, such as the clarity of the event representation, level of certainty vs. uncertainty, and future-oriented actions, such as planning. For example, children could be asked questions such as, "Sally is going to the beach tomorrow. Alex is going to the beach when she is 6 years old (i.e., a year older than the child's current age). Who should pack sunscreen in their backpack right now?".

***Explanation Question Performance***

Contrary to hypotheses, across both the happy and sad trials, children's explanations did not improve with age. Furthermore, although our explanation question scoring ranged from 0 - 2, the majority of 4-, 5-, and 6-year-olds gave level 1 responses (i.e., "He's happier because he's going *tomorrow*"; see Figure 3). Therefore, although children may have a rudimentary understanding of how temporal distance impacts another person's current emotions, a more nuanced understanding that draws on relative differences in temporal distance (i.e., "He's happier because he's going *sooner*") may not emerge until after age 6, perhaps due to increases in children's language and metacognitive abilities/awareness. In fact, previous research suggests that children may have difficulty referring to mental states when providing explanations for their judgements of others' emotions (Harris et al., 1985). Alternatively, the structure of our task may have precluded children from showing a more sophisticated understanding of relative temporal distance because the most obvious explanation for why the character felt happier is because they were going to engage in the activity "tomorrow" (i.e., our coding scheme may have been too stringent). Finally, it may be that children did in fact possess this more nuanced understanding of temporal distance but were not able to verbalize it at this point in development. In fact, to obtain full marks on our coding scheme, children had to spontaneously use temporal terms such as 'soon', 'before' and 'after'. Although accurate use of these general temporal terms appears to develop earlier than more specific temporal terms (e.g., Grant & Suddendorf), this may have limited children's performance on the explanation questions. Therefore, it is possible that our explanation questions were less a measure of children's temporal distance *understanding*, per se, and more a measure of their ability to *verbalize* this understanding. Future work could replicate the current method, but provide additional prompts (e.g., "Why does going to Disney World tomorrow make her happier right now?") to scaffold children's ability to verbalize more sophisticated reasoning about temporal distance.

### *Valence*

Although exploratory, age positively predicted performance on the happy, but not sad, judgement questions. Furthermore, 6-year-olds performed better on the happy, vs sad, judgement questions, while 4- and 5-year-olds performed no differently on both. To clarify these findings, we more closely examined children's explanations when they failed the sad judgement test trials. Half of 6-year-olds who failed the sad judgement test trials provided sensical, temporally-oriented, rationales (e.g., "the child going on a boring car ride tomorrow is more happy because he will get it over with"). Only one 4-year-old and no 5-year-olds provided this type of response. Perhaps 6-year-olds possess a more sophisticated understanding of temporal distance, which led them to give the "incorrect" response on the sad questions, resulting in an artificially deflated score. This is in line with the adult literature on anticipatory dread, suggesting that a sizable number of adults prefer to get emotional or physical pain "over with" as opposed to delaying it (Harris, 2012). Therefore, perhaps 6-year-olds were more likely to indicate that the child going on a boring car ride or giving away their favourite toy tomorrow is more happy *right now* than the child doing these activities in a year's time because they will get the pain of the sad event over with sooner. Furthermore, this may suggest that, for these 6-year-olds, the sad judgement questions were not measuring their temporal distance understanding, due to the presence of anticipatory dread. To clarify this, and to better understand the effect of valence, future work could replicate this method with an extended age range (e.g., 4- to 8-year-olds), while having an equal number of sad and happy trials, all presented in a counterbalanced order, while accounting for maturing verbal skills. To do so, perhaps prompting methods, such as those outlined above, could be used to help children describe their reasoning (i.e., including anticipatory dread).

### *Conclusion*

We used a method that relied minimally on verbal ability and that focused on children's judgements of another child's (i.e., as opposed to one's own) currently-felt emotions. Starting at age 4, children considered temporal distance in their reasoning. However, even the 6-year-olds in our sample did not express a more sophisticated understanding of temporal distance to explain their judgements. Therefore, children may begin to consider temporal distance earlier in development than previously thought, but this understanding may not translate to the verbal and phenomenological aspects of their future event descriptions until a later age. Future work should consider a less cognitively demanding method that relies minimally on verbal ability to examine 3-year-olds' sensitivity to temporal distance, and further investigate the impact of event valence on children's reasoning.

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# Chapter 4: General Discussion

## Summary of Studies and Findings

The current dissertation investigated whether, and at what age, temporal distance impacts young children's future event representations (Study 1) and reasoning (Study 2). Study 1 comprised three experiments all examining whether, and how, temporal distance influences the concreteness of children's future event representations via their verbal event descriptions and scale ratings (i.e., indicators of concreteness). To do so, we examined the effect of temporal distance on a comprehensive list of verbal aspects and scale ratings of 5- to 9-year-olds' future event descriptions. Furthermore, Study 1 explored the effect of a novel variable, event frequency, on the relationship between temporal distance and future event representation. We hypothesized that children would describe near future events more concretely, across all indicators of concrete event representation, than those in the distant future, and that this trend would increase with age. We also predicted that frequent events would be described more concretely than infrequent events. Overall, results showed that temporal distance did not significantly impact the indicators of concreteness examined, apart from clarity in Experiment 2. Importantly, however, in Experiments 2 and 2b, young children perceived the difference in relative temporal distance between the near and distant future, rating the near future as feeling closer in time than the distant future (i.e., on the Subjective Distance Scale).

The effect of event frequency on children's event descriptions was in the opposite direction than that which we hypothesized. In Experiment 1, infrequent events contained significantly more information units, more concrete information units, and more pronouns than frequent events. Furthermore, although these findings must be interpreted with caution due to potential confounding variables (i.e., see "Cross Experiment Comparison Between Experiments

2 and 2b), when we compared 8- and 9-year-olds' event representations between Experiments 2 and 2b, we found that the intended infrequent events (i.e., events from Experiment 2b) contained more information units, pronouns, and emotional intensity than the intended frequent events (i.e., events from Experiment 2).

Therefore, although Study 1 suggests that young children perceive the difference in relative temporal distance between the near and distant future, this study does not indicate how, and when in development, the concreteness of young children's event representations are impacted by temporal distance. Importantly, however, Study 1, and the literature more broadly, is significantly limited by its reliance on children's verbal output and ability to engage in self-projection, which may also explain our mostly null findings.

Study 2 addressed these limitations using a novel paradigm to examine the effect of temporal distance on young children's reasoning via their ratings of emotional intensity. Children were asked to consider how the intensity of another child's currently-felt emotions about a future event would differ when imagining the event occurring in either the near or distant future (i.e., "The red kid is going to Disney world tomorrow. The green kid is going to Disney world when they are 5 years old [one year older than the child's current age]. Who feels more happy right now?") and explain their rationale. We hypothesized that, at age 4, children would begin correctly judging which character would feel "more happy/sad" *right now* at a level significantly above chance, but that they would only be able to explain their judgements by referring to relative temporal distance (i.e., "he's happier because he's going *sooner*") at age 5 or 6. A secondary exploratory goal was to examine the role of event valence in the relationship between temporal distance and judgements about emotional intensity by presenting children with both "happy" and "sad" activities. Results showed that by the age of 4, children were able to correctly judge the effect of temporal distance on another child's current emotions about an anticipated future event (i.e., indicating that the child engaging in the event tomorrow would be more happy/sad right now). However, even by the age of 6, children did not refer to relative temporal distance (e.g., "He's happier because he's going sooner") to explain this understanding.

## Contributions, Limitations, and Future Directions

Although the current dissertation did not find large effects of temporal distance, it is among the first attempts to look at the impact of temporal distance on children's future event representations and reasoning, and the first to do so from a CLT perspective. Subsequently, I explore the contributions, limitations, and directions for future research specific to Studies 1 and 2 that were not discussed in the relevant articles, followed by the contributions, limitations, and directions for future research for the entire dissertation more broadly. I end with clinical implications of this work and concluding remarks.

### *Study 1*

**Event Frequency.** As previously discussed, Study 1 was the first attempt, to our knowledge, to examine the impact of event frequency on children's event representations. Therefore, a major contribution of this work is that infrequent events may be represented more concretely than frequent events. However, several methodological limitations make it difficult to draw conclusions from the current frequency findings. First, we (as the researchers) decided which events were infrequent vs. frequent. Although we checked this with children in Experiments 2 and 2b, future work could replicate the current study, but first conduct a pilot study to check the frequency of events with children. Moreover, because of the type of events we chose, children likely had strong scripts associated with both frequent, and infrequent, events. Therefore, even for infrequent events, children may have defaulted to script-like descriptions regardless of temporal distance. We chose these events because they were activities that would apply to all children and could feasibly happen in the near or distant future. Nevertheless, future work could address this issue by coding the data to explicitly examine whether children are providing script-like descriptions or more episodic event descriptions (e.g., coding details as either: 1) a detail that is unique to a singular instance of a birthday party vs. 2) a detail that is shared by all birthday parties). Finally, as highlighted in the General Discussion section of Study 1, it will be important for future work to isolate the effect of event frequency from other confounding variables, such as event length, emotional intensity, or event excitement, as we cannot be sure that our results are due to frequency per se, or another variable. To do so, future work could manipulate event length, for example, as well as event frequency, and compare the effect of both variables on event representation in one paradigm.

**Verbal Ability.** A major limitation of Study 1 is its reliance on verbal skills. First, children had to provide verbal event descriptions. Second, temporal terms (e.g., "tomorrow" vs. "a year from now") for which children do not yet have adult-like understanding were used to denote temporal distance (an issue discussed later in the General Discussion under the heading "Disparate Findings with Previous Similar Research: Relative Temporal Distance"). It is critical that future work clarify when children's event representations become sensitive to temporal distance while controlling for effects of verbal ability. Researchers could replicate Study 1 but also measure children's verbal skills through standardized tests, and control for verbal ability in all analyses.

Alternatively, paradigms that do not utilize verbal ability as a means to examine event representations, such as drawing paradigms (see "General Discussion" Section of Study 1), or behavioural methods, could make a large contribution to the literature. For example, the effect of temporal distance on more "behavioural" dependent variables, such as saving, delay of gratification, or perseverance could be examined by drawing on CLT literature more broadly. In one such design, Liberman and colleagues (2012) examined the effect of spatial distance on children's creativity by inducing children to a spatially proximal or distal perspective and then measuring their creativity. To do so, 6- to 9-year-olds were presented with pictures of increasingly distal objects (e.g., from their desk to the galaxy) or increasingly proximal objects (from the galaxy to their desk). Furthermore, White and Carlson (2016) investigated the effect of social distance on 4- and 6-year-olds' perseverance by priming children to a socially proximal vs. distal perspective by asking them to complete a perseverance task from a first-person perspective, third-person perspective, or that of another character (e.g., Batman, Dora the Explorer). Researchers could use these paradigms as inspiration for investigating the effect of children's temporal distance sensitivity on more behavioural dependent variables.

Finally, previous paradigms have used prompting to help children construct their verbal event representations (e.g., Coughlin et al., 2014). To further understand the potentially limiting role of verbal ability in children's future event representations, future work could replicate Study 1 but add two conditions, one in which children are prompted to provide additional detail during event representation and one in which they are not. Comparing performance across these two conditions could clarify whether verbal ability, or another factor, is limiting children's ability to provide detailed event representations.

***Study 2***

**Anticipatory Dread.** An interesting finding that emerged from Study 2 was 6-year-olds' superior performance (based on our coding scheme) on the happy vs. sad judgement questions. We posited that anticipatory dread may be an explanation for this finding, such as when an individual prefers to get emotional or physical pain "over with" as opposed to delaying it (Harris, 2012). Perhaps 6-year-olds were more likely to indicate that the child going on a boring car ride or giving away their favourite toy tomorrow is happier *right now* than the child doing these activities in a year's time because they will get the pain of the sad event over with sooner. This type of reasoning might in fact demonstrate a more advanced understanding of temporal distance, perhaps due to increased cognitive development, including perspective-taking, and reasoning. Importantly, as mentioned in the Discussion of Chapter 3, this may suggest that, for these 6-year-olds, the sad judgement questions were not directly measuring temporal distance understanding, perhaps due to anticipatory dread.

It would be interesting for future research to further investigate the emergence of anticipatory dread in children's reasoning about temporal distance. Researchers could replicate Study 2 but focus on negative events, for example asking children to reason about whether a child doing a class presentation tomorrow vs. next week is more happy *right now* and to explain their rationale. If children state that the child doing the presentation tomorrow is more happy right now, this would suggest that anticipatory dread is impacting their reasoning. Furthermore, detailed analysis of children's explanations could allow for a preliminary investigation of anticipatory dread in children (i.e., "She's happier right now because she'll get the presentation over with sooner"). Future work could scaffold children's explanations of their judgements, for example, by including more prompting. For instance, if children provide an explanation such as, "She's happier right now because she's doing the presentation "tomorrow" (i.e., therefore demonstrating some sensitivity to temporal distance), they could be asked, "Why does doing it *tomorrow* make her happier?". Scaffolding children's verbal output in this way might allow researchers to investigate whether anticipatory dread, and therefore a more sophisticated understanding of relative temporal distance (i.e., “Doing it tomorrow makes her happier because she is doing it sooner and will get it over with”), is impacting children’s reasoning.

**Reasoning About Other vs. Self.** Study 2 focused on children’s reasoning about how temporal distance affects the intensity of another child’s currently-felt emotions. Again, we decided to ask children to reason about another child because we thought that children’s performance may be less influenced by idiosyncratic factors pertaining to any particular event or time point when thinking about another child. Furthermore, it has been shown that children’s reasoning in certain related contexts is more sophisticated when it pertains to “other” vs “self” (e.g., White & Carlson, 2016). However, future work could investigate the impact of reasoning about self vs. other on children’s sensitivity to temporal distance. For example, Study 2 could be replicated with the addition of two conditions, one in which children reason about another child’s judgments of emotional intensity, and one in which they reason about their own judgements of emotional intensity, as a function of temporal distance. For example, children could be asked to imagine that they themselves, or another same aged child, are giving away their favourite toy “tomorrow” or “a year from now” and rate how sad they (i.e., they themselves or another child) feel *right now* in anticipation of this event. I would hypothesize that children, particularly younger children, would perform better in the “other” vs “self” condition, until later in development. Importantly, however, this task could be limited by Theory of Mind (ToM) requirements, a skill which is still developing across middle childhood (e.g., Calero et al., 2013; Osterhaus & Koeber, 2021) and into adolescence and early adulthood (e.g., Dumontheil et al., 2010; Valle et al., 2015). For example, children may have difficulty feeling the emotion as strongly for another child, as opposed to for themselves, which could influence their judgements.

### *Overall Dissertation*

**Disparate Findings with Previous Similar Research: Relative Temporal Distance.** Taken together, the main contribution of both Studies 1 and 2 is the finding that young children can perceive differences in relative temporal distance between the near and distant future during event representation (i.e., the near future feels closer in time than the distant future) and reasoning (i.e., understanding that someone doing an activity sooner is more happy right now). However, results suggest that such knowledge of temporal distance may not translate into the verbal descriptions and scale ratings of children's event representations (Study 1) or verbal explanations of their judgments (Study 2) until later in development. This finding is important, given that it deviates from previous studies in the field that have found effects of temporal distance on the verbal descriptions and scale ratings of children's event representations at this stage in development (e.g., Coughlin et al., 2014; Wang et al., 2014, Burns et al., 2019). Understanding why we obtained disparate findings has important implications for our understanding of the effect of temporal distance on young children's future event representation and reasoning. For example, clarifying this could provide insights into 1) when in development children become sensitive to temporal distance during event representation and reasoning, 2) how children develop the ability to think about the near vs. distant future, and 3) how to support children in engaging in effective future event representation and reasoning.

***Event Provision.*** As discussed in the General Discussion section of Study 1, our disparate findings could potentially be due to methodological differences between our Study 1 and previous similar research (i.e., the use of a between-subjects design and providing children with the exact events to describe). Therefore, it is possible that previous research may have overestimated the impact of temporal distance on children's future event representations and reasoning by scaffolding their performance through, for example, allowing children to choose the events to describe. Alternatively, the current studies may have underestimated the impact of temporal distance on children's future event representations and reasoning by making the task more difficult (i.e., providing children with the exact events to describe). Ultimately, however, we cannot draw definite conclusions as to why we obtained disparate results.

Future research could attempt to clarify this issue by replicating Study 1 of this dissertation, but adding two conditions, one in which children must describe a specified near or distant future event (i.e., replicating our study), and another in which children are given the freedom to generate their own near or distant future event to describe from a cue word (i.e., replicating previous research). Comparing performance between both conditions could clarify the disparate findings and provide insight into when sensitivity to temporal distance emerges in development.

***Temporal Terms.*** As outlined in the General Introduction, children do not acquire adult-like understanding or accurate use of temporal terms, including their deictic status, sequential order, remoteness, and absolute duration, until around 7 or 8 years of age (Grant & Suddendorf, 2011; Tillman et al., 2017; Tillman & Baker, 2015). In fact, this understanding may continue to develop past the age of 9 (Friedman et al., 1995) and into adolescence (Friedman, 1986). Therefore, the current experiments are limited by the fact that they relied on temporal terms (e.g., "tomorrow", "a year from now") to illustrate the relative temporal distance of conditions (i.e., near vs. distant future) from the present. Furthermore, previous research in this area has used diverse temporal terms to illustrate the near and distant future. As a result, differences in results between the current dissertation and previous research may be due to differences in the temporal terms used across these studies, as children may have had differing levels of understanding of these temporal terms.

For example, Chernyak and colleagues (2017) detected temporal distance effects in 3- to 5-year-olds using the general temporal terms "right after this game" (i.e., near future) and "when you're a grown up" (i.e., distant future). Therefore, perhaps the more specific temporal terms we used (i.e., "tomorrow" vs. "a year from now" or "when they're 6 years old") were more difficult for children to understand (e.g., Grant & Suddendorf, 2011), leading to a reduction in temporal distance effects. Future research could mitigate this by replicating the current studies while providing more extensive training on the temporal terms used. For example, the difference between "tomorrow" and "a year from now" could be illustrated to children before beginning the experiment (i.e., which we attempted in Experiment 1 of Study 1 only). This could be done by, for instance, discussing how many "sleeps" remain until "tomorrow" vs. "a year from now", or by demonstrating the relative temporal distance of both time points from the present using a calendar. Alternatively, more general temporal terms that are understood earlier in development (Grant & Suddendorf, 2011; e.g., "when big", "after") could be used instead of the more specific terms used in this dissertation, and in previous research (e.g., Coughlin et al., 2014).

***Relative Temporal Distance Between Conditions.*** Furthermore, perhaps the time points we chose to differentiate our temporal distance conditions (e.g., "tomorrow", "a year from now", "when they're 6 years old") were not distant enough from each other to detect an effect of temporal distance, owing to the temporal distance effect. As described by Deker and Pathman (2021), according to the temporal distance effect, young and older adults demonstrate greater accuracy in ordering two past events when the events are temporally distant from each other, as opposed to when the events are closer together in time. (Madsen & Kesner, 1995; St. Jacques, et al., 2008). In fact, Pathman et al. (2013) and Deker & Pathman (2021) found evidence of this effect in 8- to 10-year-olds, but not younger children (Deker & Pathman, 2021). Therefore, perhaps we would have been more likely to detect temporal distance effects in this age group if we had chosen temporal labels that were further apart in time (e.g., "tomorrow" vs. "in 10 years" or "when you're as big as your mom/dad"). Even in Experiment 1 of Study 1, in which the temporal labels were "soon" vs. "a long time from now", "a long time from now" was only explained to be about 6 months in the future (i.e., the upcoming winter when it was currently summertime). This would be interesting for future research to investigate.

***Single Time Point vs. Direct Comparison of Two Time Points.*** Finally, it is notable that results from Studies 1 and 2 suggest different developmental timelines of children's sensitivity to temporal distance. Importantly, however, these two studies differed substantially in their methodology. Study 1 used a between-subjects design in which children were asked to provide event descriptions for a single time point, whereas Study 2 asked children to compare and reason about two different time points simultaneously. This "direct comparison method" may have made temporal distance more salient to children, therefore allowing us to detect the effects of this variable in this younger sample. Future research could investigate this possibility by replicating Study 2 using a between-subjects design and Study 1 using this "direct comparison" method, and examining whether temporal distance sensitivity emerges at different points in ontogeny using these disparate methods.

**Springboard for Future Research: Episodic Memory.** The current dissertation provides guidance for research questions and paradigms that may clarify when sensitivity to temporal distance emerges in development. This is important considering that the effect of temporal distance on children's thinking is understudied to date. Indeed, focusing on episodic memory, instead of episodic future thinking, may be a promising means by which to examine the effect of temporal distance on event representation and reasoning. This is because episodic future thinking and memory are posited to be highly related abilities. For example, although findings are somewhat mixed (see Nyhout & Mahy, 2023), a large body of research suggests that memory and future thinking rely on many of the same underlying cognitive mechanisms, including mental time travel (Tulving, 1985b), self-projection (Buckner & Carroll, 2007), and scene construction (Hassabis & McGuire, 2007). Moreover, both episodic future thinking and memory involve activation of the same areas of the brain, such as the Default Mode Network (DMN; Addis, 2020, Addis et al., 2007, Spreng et al., 2009), and are similarly affected by brain lesions (Tulving, 1985b, Rosenbaum et al., 2009, Klein et al., 2002a, b).

Furthermore, the literature suggests that episodic memory may emerge earlier in development than episodic future thinking (i.e., therefore making it easier for children to engage in), and that future thinking relies on episodic memory (see General Introduction*, constructive episodic simulation hypothesis*; Schacter et al., 2007). For example, studies focusing on middle childhood indicate that children provide more episodic detail when describing past vs. future events (Coughlin et al., 2014, Coughlin et al., 2019, Gott and Lah, 2014, Richmond & Pan, 2013; Wang et al., 2014), rate future events as more difficult to imagine than past events (Coughlin et al., 2014), and require more prompts to generate future vs. past events (Coughlin et al., 2019).

In fact, this may be true even for younger children. For instance, Richmond and Pan (2013) found that 3- to 5-year-olds provided more specific episodic detail when describing past vs future episodes. Moreover, a behavioral paradigm (Prabhakar & Hudson, 2019) in which 3- and 4-year-olds were taught a sequence of tapping animals in a specific order to play a song supported this conclusion. Children performed better when asked to remember the sequence when the game was played in the past than when asked to imagine the same sequence when playing the game tomorrow. Taken together, episodic memory may emerge earlier in development than episodic future thinking (e.g., Nyhout & Mahy, 2023). Importantly, further research is needed to understand why memory may emerge earlier in development than future thinking. However, memory and future thinking differ in their degree of certainty, wherein memory involves set past events that cannot be changed because they have already occurred, while future thinking is speculative, and involves considering hypothetical situations that could change. Future thinking may therefore involve more complex cognitive processes and rely on the accumulation of experiences and knowledge to simulate potential future events, therefore leading to its delayed development.

Therefore, to better understand when in ontogeny children become sensitive to temporal distance, future work could focus on memory as opposed to future thinking. In one such study, Maftei and colleagues (2021), assigned 7- to 10-year-olds to one of six conditions in which they were asked to recall and describe a recent or distant past moral, immoral, or neutral behaviour that they had engaged in. Following this, children were asked to decide how many stickers they would like to give to another child. For children who recalled immoral past behaviours, those who thought about *distant* past behaviours shared more stickers than those who thought about *near* past behaviours. This suggests that children were sensitive to temporal distance and that taking a more temporally-distanced perspective impacted children's reasoning about sharing. Perhaps paradigms that focus on memory, such as this, could be employed with younger children to determine when sensitivity to temporal distance emerges.

Indeed, future research could replicate both Studies 1 and 2 of this dissertation but instead ask children to describe and reason about near or distant *past* events. For example, to examine sensitivity to temporal distance during event representations, children could be asked, "Think of a time you ate a snack yesterday/a year ago. Can you tell me about it?" I would predict that children would provide more concrete descriptions for near vs. distant past events, and that this effect would emerge earlier in development than what has been found in the future thinking literature. Similarly, children could answer questions such as, "Sally went to Disney world yesterday. Christie went to Disney world when she was 4 years old (i.e., one year younger than the participant's current age). Who feels more happy right now? Why?" In line with CLT, I would expect children to rate the character doing the activity in the *near* past to feel more happy *right now* than the character doing the activity in the *distant* past. However, the opposite trend is also possible. For example, children could perceive that the character who went to Disney World "yesterday" is actually more sad *right now* because she just left Disney World and the sadness of leaving is fresh in her mind. At the same time, the character who went to Disney World "a year ago" may no longer be thinking about it, and therefore may not be feeling sad. Consequently, this paradigm would need to be pilot tested to determine how children interpret the test questions and whether it could adequately assess sensitivity to temporal distance. Nonetheless, because of its earlier emergence, focusing on episodic memory may allow future research to examine even younger children's sensitivity to temporal distance.

**COVID-19: The Role of Uncertainty and Unpredictability.** Another overall limitation of this dissertation is that the majority of data collection (i.e., apart from Experiment 1 of Study 1) occurred during the COVID-19 pandemic. Not only did this influence the types of events we could ask children about in our tasks, but COVID-19 also likely increased children's sense of uncertainty and unpredictability about the future overall (e.g., not knowing when they will return to school, when they may next see their grandparents or friends, etc.) which may have made it difficult for children to envision the future events throughout the tasks. In fact, we know that uncertainty significantly impacts future thinking, for example, by reducing adults' ability to generate future events, and access episodic future thoughts (Terpini & D'Argembeau, 2024). Similarly, Wu and colleagues (2022) found that uncertainty about COVID-19 decreased adults' ability to delay gratification. Similar findings have been observed with children. For example, Redshaw and colleagues (2018) found that 2.5-year-old children have more difficulty preparing for uncertain vs. certain outcomes. Similarly, Kidd et. al. (2013) found that 3- to 5-year-olds waited less time in a delay of gratification task after experiencing an unreliable vs reliable experimenter.

Consequently, in the current dissertation, because testing for Experiments 2 and 2b of Study 1 occurred during the height of COVID-19, it may have been more difficult for children to generate detailed future event representations than if testing had occurred during a period with less uncertainty. As a result, this may have reduced our ability to detect effects of temporal distance in children's responses in these Experiments. Study 2 may also have been affected by COVID-19, although this is less likely considering that testing occurred later in the pandemic once restrictions were almost entirely removed, and we did detect temporal distance effects. It would be interesting for future research to compare children's sensitivity to temporal distance during future event representation and reasoning tasks throughout periods of more vs. less uncertainty.

**Clinical Implications**

Episodic future thinking is highly implicated in different forms of psychopathology, such as the reduction of positive future thoughts (MacLeod et al., 1996, 1997) and expectations (Gadassi Polack et al., 2020) in patients with depression, and higher perceived plausibility of negative and neutral vs. positive future events in individuals with Generalized Anxiety Disorder (Wu et al., 2015). Interestingly, research suggests that construal level, or degree of concrete vs. abstract thinking, may be an important mechanism in the vulnerability to, and perpetuation of, certain forms of psychopathology. For example, it has been suggested that depression is characterized by “high-level” rumination (i.e., focusing on causes, meaning, and consequences of events) as opposed to “low-level” rumination (i.e., focusing on how events unfolded and scene construction; Rimes & Watkins, 2005; Stöber & Borkovec, 2002; Watkins & Moulds, 2005, 2007; Watkins et al., 2008). Similarly, voluntarily recalling an emotional event on an abstract level (e.g., causes, implications) produces increased emotional intensity, as compared to recalling it at a concrete level (i.e., how the event unfolded; Philippot et al., 2003; 2006).

To illustrate, Watkins and colleagues (2008) asked adults to read positive (e.g., “you have a successful job interview”) and negative (e.g., “you get in a fight with your best friend”) scenarios. Participants were assigned to think about the events on either a high level (i.e., causes, implications, meaning) or low level (i.e., vividly imagine the scene). Following, both groups were exposed to a stressful task. Results showed that those who thought about events on a high level were more despondent following the stressful task than participants induced to low level thinking. In line with this, Galfin and Watkins (2012) found that patients with chronic health conditions and their caregivers were characterized by more uncertain and abstract rumination than age matched healthy controls. Furthermore, increased abstractness in rumination was associated with more uncertainty, psychological distress, and pathological rumination.

Therefore, more high-level, abstract representations may be a feature of psychopathology and may contribute to the perpetuation of symptoms. This is supported in a review paper by Brunnette and Schacter (2021) that argues that individuals with many different forms of psychopathology, including depression, anxiety, schizophrenia, bipolar disorder, and posttraumatic stress disorder, tend to represent and describe future events with less concrete and specific details, clarity and vividness. Consequently, increased understanding of the role of construal level in the development and maintenance of symptoms of psychopathology could lead to improved interventions for these disorders. For example, supporting individuals to think about events more concretely, or on a low-level, has the potential to ameliorate symptoms. In fact, Hallford and colleagues (2020) found that individuals with major depressive disorder anticipated experiencing more pleasure, and experienced more pleasure in the present, when they represented future events with more detailed imagery (i.e., more concretely). Similarly, Renner and colleagues (2017) found that future mental representations that were rated as more vivid (and therefore more concretely) were associated with increased behavioural activation (i.e., engaging in positive, enjoyable, valued activities) in individuals with major depressive disorder.

Conversely, it is established that taking a more self-distanced (and therefore more abstract) perspective can help reduce symptoms of psychopathology and is in fact a cornerstone of some evidence-based therapies, including Acceptance and Commitment Therapy (ACT, Hayes et al., 2011). For example, research has found that inducing adults to a more self-distanced perspective can reduce distress associated with upsetting memories and severity of depression (Travers-Hill et al., 2017). Similarly, taking a self-distanced perspective by referring to oneself using non-first-person pronouns vs. first-person pronouns during introspection was found to lead to less displays of anxiety, less maladaptive post-event processing, less negative self-talk, and increased performance on a speech task in individuals with social anxiety (Kross et al., 2014). Therefore, it is evident that construal level, or degree of concreteness, plays an important role in psychopathology, and could be an important factor to address during intervention. In sum, there appear to be potential benefits to taking *either* a concrete or abstract perspective, depending on the context. Perhaps "concreteness" vs. "abstractness" is actually an important dimension of psychopathology, along which different forms of psychopathology could be differentiated, therefore having implications for diagnosis and treatment. For instance, if thinking is very abstract (i.e., focusing solely on a vague problem), and one is failing to consider the concrete ways in which they will cope with the problem at hand or other incidental, and more positive, aspects of their lives, taking a concrete perspective could be beneficial. Contrarily, if thinking is very concretely focused on one specific difficulty, one may fail to generate alternative solutions by, for example, taking a distanced perspective. Further research is therefore needed to understand the role of construal level in psychopathology, and when it may be more adaptive to take a concrete vs. abstract perspective.

Research into the role of construal level and self-distancing in the development and maintenance of psychopathology in children is limited. Notably, however, preliminary research has determined that inducing children to take a self-distanced perspective improves future-oriented behaviours, such as delay of gratification, saving, executive functioning, perseverance, reasoning about future preferences, and self-control (Jerome et al., 2023; Lee & Atance, 2016; Prencipe & Zelazo, 2005; White & Carlson, 2016). For example, White and Carlson (2016) found that 4- and 6-year-olds persevered longer on a boring task when they pretended to be another character (e.g., Batman, Dora the Explorer) than when they took a third-person perspective on themselves (e.g., referring to themselves by their name), or a first-person perspective on the task. Therefore, although further research is needed, self-distancing may be a promising means to help children with symptoms of psychopathology, such as the procrastination or executive functioning difficulties found in ADHD (e.g., Bolden & Fillauer, 2020; Niermann & Scheres, 2014), or perhaps even symptoms of anxiety and depression. Consequently, understanding when in development children are capable of representing events at different levels of construal could contribute to prevention efforts and interventions that help children cope with symptoms through self-distancing.

**Conclusion**

The current dissertation investigated whether, and at what age, temporal distance impacts young children's future event representations (Study 1) and reasoning (Study 2). By holding events constant across temporal distance conditions and examining a comprehensive list of indicators theorized to be impacted by temporal distance, Study 1 demonstrated that young children perceived the difference between the near and distant future, but that this did not translate into their verbal descriptions or the scale ratings of their representations. Importantly, Study 1 highlighted the role of event frequency in the relationship between temporal distance and future event representation.

Using a novel method that relied minimally on verbal ability and that focused on children's judgements of another child's (i.e., as opposed to one's own) currently-felt emotions, Study 2 found that, starting at age 4, children considered temporal distance in their reasoning. However, even the 6-year-olds in our sample did not express a more sophisticated understanding of temporal distance to explain their judgements.

Taken together, children may begin to consider temporal distance earlier in development than previously thought, but this understanding may not translate to their verbal descriptions and scale ratings until substantially later in development. This research therefore raises important questions as researchers endeavor to uncover when in development, and how, children's future event representation and reasoning are impacted by temporal distance.

**References for General Introduction and General Discussion**

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## Appendix B: Certificate of Ethics Approval

22/11/2023

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

### CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL

| | |
|---|---|
| **Numéro du dossier / Ethics File Number** | H-12-18-1396 |
| **Titre du projet / Project Title** | Testing construal level theory in young children |
| **Type de projet / Project Type** | Recherche de professeur / Professor's research project |
| **Statut du projet / Project Status** | Renouvelé / Renewed |
| **Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)** | 21/12/2018 |
| **Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)** | 20/12/2024 |

### Équipe de recherche / Research Team

| Chercheur / Researcher | Affiliation | Role |
|---|---|---|
| Cristina ATANCE | École de psychologie / School of Psychology | Chercheur Principal / Principal Investigator |
| Bronwyn O'BRIEN | École de psychologie / School of Psychology | Co-chercheur / Co-investigator |
| Michela RODRIGUEZ | École de psychologie / School of Psychology | Étudiant-chercheur / Student-researcher |
| Mohamed EBEID | École de psychologie / School of Psychology | Étudiant-chercheur / Student-researcher |

**Conditions spéciales ou commentaires / Special conditions or comments**

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22/11/2023

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Le Comité d'éthique de la recherche (CÉR) de l'Université d'Ottawa, opérant conformément à l'*Énoncé de politique des Trois conseils* (2014) et toutes autres lois et tous règlements applicables, a examiné et approuvé la demande d'éthique du projet de recherche ci-nommé.

L'approbation est valide pour la durée indiquée plus haut et est sujette aux conditions énumérées dans la section intitulée "Conditions Spéciales ou Commentaires". Le formulaire « Renouvellement ou Fermeture de Projet » doit être complété quatre semaines avant la date d'échéance indiquée ci-haut afin de demander un renouvellement de cette approbation éthique ou afin de fermer le dossier.

Toutes modifications apportées au projet doivent être approuvées par le CÉR avant leur mise en place, sauf si le participant doit être retiré en raison d'un danger immédiat ou s'il s'agit d'un changement ayant trait à des éléments administratifs ou logistiques du projet. Les chercheurs doivent aviser le CÉR dans les plus brefs délais de tout changement pouvant augmenter le niveau de risque aux participants ou pouvant affecter considérablement le déroulement du projet, rapporter tout évènement imprévu ou indésirable et soumettre toute nouvelle information pouvant nuire à la conduite du projet ou à la sécurité des participants.

The University of Ottawa Research Ethics Board, which operates in accordance with the *Tri-Council Policy Statement* (2014) and other applicable laws and regulations, has examined and approved the ethics application for the above-named research project.

Ethics approval is valid for the period indicated above and is subject to the conditions listed in the section entitled "Special Conditions or Comments". The "Renewal/Project Closure" form must be completedfour weeks before the above-referenced expiry date to request a renewal of this ethics approval or closure of the file.

Any changes made to the project must be approved by the REB before being implemented, except when necessary to remove participants from immediate endangerment or when the modification(s) only pertain to administrative or logistical components of the project. Investigators must also promptly alert the REB of any changes that increase the risk to participant(s), any changes that considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project or the safety of the participant(s).

Coordonateur / COORDINATOR
Coordonnateur de l'éthique / Ethics Coordinator
Pour/For **Daniel LAGAREC** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences de la santé et sciences / Health Sciences and Sciences Research Ethics Board**

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