**Study 2: Does cueing future thinking improve 4-to-5-year-olds delay of gratification?**

In this study we examined whether cueing children to think about the future immediately prior to making a delay of gratification decision increased the likelihood that they would choose the delayed reward. Participants first completed an episodic future thinking interview in which they described 3 events that would either happen to them tomorrow (future condition), happened to them yesterday (past condition) or happen to them every day (semantic condition). A fourth group of children (control condition) completed a colouring in task in place of an interview. For each of the three events that children described in the interview a cue was generated which would be used to later remind children about the event. All children went on to complete a delay of gratification task with four trials. Prior to each trial children in the three cued conditions (past, future and semantic) were presented with a cue generated in the interview task and asked to think about that event before making their choice.

**Participants.** One hundred and thirty-four 4-to-5-year-olds were recruited. Four children were removed from the final sample: two due to unresponsiveness during testing, one who declined to participate and one due to absenteeism. The final sample comprised 130 participants randomly assigned to the *past* (*N* = 33), *future* (*N* = 33), *semantic* (*N* = 33) and *control* conditions (*N* = 31).

**Materials.** The delay of gratification task used a pictorial display of the 24-hour cycle to help children orient themselves correctly to references to tomorrow and yesterday (Figure 1). Four types of rewards were used: sweets (1 versus 3), stickers (2 versus 5), novelty pencils (1 versus 3) and stationery sets (a plain set versus a princess or superhero set). A white square piece of card with three squares arranged horizontally into which cards depicting various events could be placed was used in the pre-interview training task. In order to examine the nature of children’s event descriptions, a subset of interviews was recorded on a digital device and transcribed for analysis.

**Procedure.** The study was completed across three sessions on three consecutive days. We employed a group training procedure for delay of gratification task on Day 1 in which children saw 2 puppets complete a single trial each of a delay of gratification task. Children were tested individually on Day 2 and sat at a small table directly opposite the experimenter. The session began with one of the puppets from Day 1 receiving a delayed reward.

*Time period training.* We used a training procedure to ensure that children understood the time periods that were being referred to in the cue generation part of the task (see also Chernyak et al., 2017). The card with three horizontal squares was then placed in front of participants. The experimenter explained that they were going to put things into each of the squares, with things that are happening ‘right now’ going into the middle square, things that have already happened going into the left hand square from the child’s perspective and things that haven’t happened yet going into the right hand square. The experimenter then produced a card with the word ‘now’ written on it, sounded out the word for children and explained that this means everything that is happening right now. They then gave children two examples: (i) their playing the game with the experimenter and (ii) whichever activity their class mates were currently participating in. The experimenter placed the ‘now’ card in the middle square and then pointed to the left hand square and explained that ‘things that have already happened go into that square there’, and gave the example of the child coming to school that morning and going to bed the night before. Finally, the experimenter pointed to the right hand square and explained that things that haven’t happened yet go into that square there, such as going home from school today and going to bed tonight. Children were then asked two check questions, “Which square do we put things in that have already happened?” and “Which square do we put things in that haven’t happened yet?” They were corrected if they responded incorrectly to either question. Children were then presented with four cards depicting characters engaged in various tasks (skateboarding, trampolining, visiting the seaside and visiting a mountain). For each card, children were told that the character depicted had performed that activity or visited that place yesterday or would perform that activity or visit that place tomorrow. Children then sorted each of the cards in turn. Errors were corrected and only data from children who sorted three of the four cards correctly were included in the final analyses.

*Interview task.* Children were randomly assigned to one of four conditions (*past*, *future*, *semantic* and *control*). Participants in the past condition were asked about 3 events that happened to them yesterday (getting up, playing at break and going home from school). In the future condition participants were asked about the same three events located in the following day and in the semantic condition, they were asked about the same events as they usually occur. In the control condition children simply coloured in for 5 minutes (approximately the length of time of each interview). In both the semantic and control conditions the card used in the sorting task was removed; however, it remained present in the past and future conditions and was used to orient children appropriately to past or future. For each of the three events, a cartoon picture of a same gender child participating in that event was presented to children. In the past and future conditions, this picture was sorted, with help from the experimenter, into the left or right hand square depending on tense, whereas in the semantic condition it was placed on the table in front of the child.

Across the three interview conditions, children were given closely matched instructions (“Can you tell me about when you were getting up yesterday / when you will get up tomorrow / when you get up. What did you do when you got up yesterday / What will you do when you get up tomorrow / What do you do when you get up?”). Children who were unresponsive were prompted, “let’s think really hard” and were then re-asked the question. Children’s initial responses were followed up with a general prompt for more information (“Can you tell me anything more about what happened / what will happen / what happens when you got up yesterday /get up tomorrow /get up?”). They were then asked three specific what, where and who follow-up questions (“Can you tell me anything more about what happened / will happen / happens when you got up yesterday / get up tomorrow / get up? Can you tell me more about where this was / will be / is? Can you tell me more about who was /will be / is there?”). Throughout the interview the experimenter made written notes of each child’s responses and subsequently selected two propositions generated for each event. These propositions were orally presented to the participant in the subsequent delay of gratification task.

*Delay of gratification task.* Children completed four trials in which they chose between a small immediate reward and a larger reward available after 1 day’s wait. The order of presentation of rewards was counterbalanced across trials, between participants. Each trial began with the experimenter showing the rewards to the participants and distributing them to the appropriate trays. The experimenter continued with, for example, “Here are some pencils. You can get one pencil right now or you can wait and get one, two, three, pencils when I come back again tomorrow. If you take this one pencil here, you get it right now, but you won’t get the other three pencils. If you want to wait for the three pencils, you don’t get any pencils right now but you get the three pencils when I come back again tomorrow”. Two check questions were asked to make sure children understood when the rewards were available. If children responded incorrectly they were corrected and the questions were repeated.

For the first delay of gratification trial in the interview conditions, prior to offering children a choice between rewards they were asked to think again about when they will get up tomorrow/when they got up yesterday/when they get up. The experimenter repeated back to them two propositions that they had previously generated for that event and then asked them to ‘think really hard about that’. They were reminded once more about the same two propositions, after which they were asked to make their choice. Prior to the second and third trials they were cued with information taken from the ‘playing at break time’ and ‘going home from school’ events. For the fourth trial they were reminded of all the things that will happen to them tomorrow/that happened to them yesterday/that usually happen to them, and were presented with one proposition from each event in turn. Children in the control condition completed the task without being asked to think about any intervening events.



Figure 1. Pictorial 24-hour time line.