"Will I Want These Stickers Tomorrow?"

Preschoolers' Ability to Predict Current and Future Needs

Gema Martin-Ordas

Newcastle University

University of Stirling

Author note

Gema Martin-Ordas, Centre for Behaviour and Evolution, Newcastle University, and Department of Psychology, University of Stirling, UK. This work was supported by a Marie Sklodowska-Curie research fellowship.

Correspondence concerning this article should be addressed to Gema Martin-Ordas, Centre for Behaviour and Evolution, Institute of Neuroscience, Henry Welcome Building for Neuroecology, Framlington Place Newcastle University, NE2 4HH, United Kingdom.

Contact: gema.martin-ordas@ncl.ac.uk; gema.martin-ordas@stir.ac.uk

Acknowledgments

I thank Cristina M. Atance and Quoc Vuong for insightful comments on earlier versions of this manuscript. Special thanks to all the children and parents who volunteered their participation.

Accepted for publication in *British Journal of Developmental Psychology* published by Wiley-Blackwell on behalf of The British Psychological Society. The published version is available at: https://doi.org/10.1111/bjdp.12195

Abstract

Between 3 and 5 years of age children develop the ability to plan for their own and others' future needs; however, they have great difficulty predicting future needs that conflict with current ones. Importantly, this ability has only been tested in the domain of physiological states (e.g., thirst). Therefore, it is still an open question whether in a different context preschoolers can disengage from their current needs to secure a different future one. In a Resource Allocation task, 4- and 5-year-olds had to distribute three types of rewards between themselves and another child for either "right now" or "tomorrow." Children's current needs were manipulated by providing them (or not) with their preferred reward at beginning of the task. Only 5-year-olds could predict future needs that conflict with their current ones and act accordingly. Younger children's performance is discussed in the context of temporal and social distance.

Keywords: Bischof-Köhler account, future needs, prosociality, preschoolers

"Will I Want These Stickers Tomorrow?"

Preschoolers' Ability to Predict Current and Future Needs

Successfully anticipating our own needs allows us to make effective decisions about our future (e.g., Suddendorf & Corballis, 2007). For example, predicting that I will be sick if I eat my whole birthday cake now allows me to save most of it for later. Correctly anticipating others' needs also has crucial implications for our future since it allows us to function effectively as social individuals (e.g., Berndt, 2002). It is by understanding what others might need that we can make prosocial decisions. For example, I know that my friend is hungry now, so I should share my birthday cake with her.

Between ages 3 and 5 there is an important increase in children's abilities to anticipate their own future needs (e.g., Atance & Meltzoff, 2005; Atance, Louw, & Clayton, 2015; McCormack & Hanley, 2011; Payne, Taylor, Hayne, & Scarf, 2015; Suddendorf, Nielsen, & von Gehlen, 2011). However, evidence for differences in performance among these age groups are mixed. For example, Suddendorf et al. (2011) showed that whereas 4-year-old children could successfully select a correct tool (e.g., a key) to solve a future problem (e.g., unlock a box to obtain a reward), 3-year-olds failed to do so. By comparison, using a similar paradigm, Payne et al. (2015) found that 3-year-olds were as likely as 4-year-olds to select a correct item. Children also start anticipating others' future needs between ages 3 to 5. For example, Russell, Alexis, and Clayton (2010) taught 3-, 4-, and 5-year-olds to play a "blow football" game in which the child and the experimenter stood on either side of a table. To play the game from the experimenter's side, however, children needed a box to stand on in addition to the straw

to blow the ball. At the end of the game, children were told that another child would be returning "tomorrow" and that the child would play from the experimenter's side. Only 4- and 5-year-olds selected the two items that the other child would need for "tomorrow." Again, Payne et al. (2015) found that 3-year-olds succeeded in a similar task. Using a very different experimental paradigm, Bélanger, Atance, Varghese, Nguyen, and Vendetti (2014) assessed preschoolers' ability to appreciate changes in others' *future* or "grown-up" preferences. Their results showed that by the age of 4 children could predict someone else's preferences in the future.

While the above studies investigated when children begin to think about their own and others' future needs, they do not necessarily address when children begin to think about future needs that are different from their current ones—the so-called "Bischof-Köhler hypothesis" in the animal literature (Bischof-Köhler, 1985; Bischof-Köhler & Bischof, 2007; Suddendorf & Corballis, 1997; Suddendorf & Corballis, 2007). This is because in the above studies children were asked to make decisions for a future need that was apparently similar to the present one (Atance, 2015; Redshaw & Suddendorf, 2013). Thus, it is possible that selecting a correct item (e.g., key) may only indicate that children knew that the item was useful *now* without having to represent its use in a future event (McCormack & Hoerl, 2011; Hudson, Mayhew & Prabhakar, 2011).

The Bischof-Köhler hypothesis was established as a criterion for future thinking in non-human animals (Bischof-Köhler, 1985) and states that "... animals other than humans cannot anticipate future needs and drive states and are therefore bound to a present that is defined by their current motivational state" (Suddendorf & Corballis, 1997, p. 150). Recent findings refute the Bischof-Köhler hypothesis in non-human animals

(e.g., Correia, Dickinson, & Clayton, 2007; Raby, Alexis, Dickinson, & Clayton, 2007). In contrast, children as old as 7 years of age find it difficult to predict what they will need in the future when their future need (e.g., hunger) differs from their current one (e.g., thirst) (Atance & Meltzoff, 2006; Mahy, Grass, Wagner, & Kliegel, 2014; Mahy, 2016). For example, in Atance and Meltzoff's (2006) "Pretzel task", children were asked to eat pretzels while the experimenter read them a story. Crucially, eating pretzels made children thirsty. After reading the story, children were asked if they would want to have water or pretzels "right now" or "tomorrow." Children predicted that they would want water "right now" but also "tomorrow." In contrast, children who did not eat pretzels and, therefore, were not thirsty, predicted that they would want pretzels for "right now" and "tomorrow." Atance and Meltzoff (2006) argued that children's state of thirst "right now" was so salient that it made it difficult for them to step out of their current state to appreciate that they will no longer be thirsty (and thus desire pretzels) "tomorrow."

To date, children's abilities to predict future needs that conflict with current ones have only been tested in the context of children's predictions of hunger or thirst. However, the concept of "need" is not necessarily limited to physiological states, it can also refer to the "lack of something requisite, desirable or useful" (see Merriam-Webster dictionary). For example, adult humans can anticipate that once they retire, they will need to have savings. As such, they start saving for retirement even when their current need for money is satisfied. Moreover, previous work has shown that preschoolers have a poor understanding of how physiological states (e.g., hunger) relate to the development of desires (Moses, Coon, & Wusinich, 2000). Moses et al. (2000) told 4- and 5-year-olds a story with two characters: one who had eaten/drunk a large amount of food/water a long

time ago and another one who had done so a short time ago. Both age groups failed to predict that only the character who had had food/water a long time ago would want to eat/drink. Moses et al. (2000) argued that reasoning about physiological needs might be particularly difficult because they generate an incongruent immediate desire. For example, eating pretzels generates a physiological state of satiation and, therefore, a desire to not eat more. In light of these findings, preschoolers' poor performance at predicting future needs that conflict with current ones may be explained by a failure to understand how physiological states change over time rather than by an inability to think about future needs that they are not currently experiencing (i.e., Bischof-Köhler account).

The Current Study

The goal of the current study was to assess preschoolers' ability to predict future needs that differ from their current ones in a context that did not directly involve physiological states. In particular, children were asked to distribute rewards in a Resource Allocation task (e.g., Fehr, Bernhard, & Rockenbach, 2008) for themselves and for another child for either "right now" or "tomorrow" (e.g., Atance & Metzolf, 2006). Children's current needs were manipulated by providing them (or not) with their preferred reward at the beginning of the experiment—"Extra-reward" condition and "No extra-reward" condition, respectively. Thus, the Resource Allocation task allowed assessing whether participants' prosocial behavior (e.g., forgoing their preferred reward in order to provide another child with it) was influenced (1) by participants owning (or not) their preferred reward, and (2) by when they would have access to the rewards—"right now" or "tomorrow."

Sharing provides a compelling situation to test preschoolers' ability to predict

future needs that differ from their current ones. First of all, deciding to share involves children considering their own and someone else's needs as well as considering how someone else's needs might conflict with their own needs (e.g., if my friend does not have chocolates, I could share mine with her). Research using a delay of gratification task has shown that by the age of 3 children can make decisions that benefit someone else (Prencipe & Zelazo, 2005); however, it is not until the age of 4 that children start to make prosocial decisions that will benefit others in the future—even when sharing is costly for the child (e.g., Fehr et al., 2008; Moore, 2009; Moore, Barresi, & Thompson, 1998; Paulus & Moore, 2014; Thompson, Barresi & Moore, 1997). Secondly, deciding to share also involves children assessing how their current needs change over time and how these needs might conflict with future ones. Consequently, understanding how current and future needs conflict with each other will also be reflected on prosocial responses. If my friend does not have chocolates but I will want chocolates again tomorrow, I will probably not share my extra-bag of chocolates with her.

Since children's performance in future thinking tasks (e.g., Atance et al., 2015; McCormack & Hanley, 2011) as well as in resource allocation tasks (e.g., Lemmon & Moore, 2007; Thompson et al., 1997) improves between ages 4 to 5, these two age groups were included in the current study. If, as suggested above, children's difficulty in predicting future needs that conflict with current ones is due to their difficulties in understanding how physiological states change across time (e.g., Moses et al., 2000), then children would succeed in the current task—although older children would perform better than younger children (see Table 1 for predictions). This is because the current task involves making predictions about *needs* and not about *physiological states*. In contrast,

if as previous research has shown, children's ability to predict future needs that conflict with current ones is a late-emerging cognitive skill (e.g., Mahy, 2016), neither age nor resource distribution would affect children's performance.

Additionally, children were also assessed on their ability to allocate their preferred reward into another child's box when participants' needs did not conflict with others' needs. This task—the Knowledge task—took place before the Resource Allocation task and it entailed children allocating one of the three rewards into another child's box. It was predicted that 4- and 5-year-old children would succeed at allocating their preferred reward in the other child's box for "right now" and "tomorrow."

Methods

Participants

Participants were 98 typically developing children (46 females; 52 males) aged 4 (*M*=55 months, *Range*= 47 to 58, *n*=50) and 5 (*M*=64 months, *Range*= 60 to 70, *n*=48). Participants were fluent in English and from working- and middle-class populations. Children were tested individually in a quiet room at three different schools in XXX, in the child lab facilities at the XXX or at a science museum (XXX) in XXX. The experiment received ethical approval from the XXX Ethics Committee. Parents provided written informed consent for their children's participation, and children also provided their verbal assent.

Materials and procedure

The apparatus consisted of two cardboard boxes (13x12x7cm). One box had a picture depicting chocolates on its lid and the other box had a picture of stickers on its lid.

Five small transparent plastic bags—two containing 6 stickers each, two with 6 chocolates each and one bag with 6 distractor objects (i.e., 1.5 cm length x 0.8 cm width pieces of black fabric in the shape of teardrops)—were used as items to be allocated inside the boxes (i.e., one bag with chocolates, one bag with stickers, and one bag with distractors) and as rewards for the children (i.e., one bag with chocolates, and one bag with stickers).

An experimental session consisted of three main events: (1) Reward preference test, (2) Knowledge task, and (3) Resource Allocation task.

(1) *Reward preference test*. The Experimenter (E) first established children's preference for the rewards by showing them one bag with 6 chocolates and one with 6 stickers, and asking them "*What do you prefer: chocolates or stickers?*" Children could answer verbally or point to the bag with their preferred reward. Fifty percent of the children showed a preference for chocolates and the remaining 50% for the stickers. Importantly, children's performance in the current study was not related to their preferred reward (Knowledge task: χ^2= 2.23, *df*=1, *p*=.13; Resource Allocation task: χ^2= .41, *df*=1, *p*=.52). Next, children were randomly distributed to either the *No extra-reward* condition or to the *Extra-reward* condition. Whereas in the former E did not provide children with their preferred reward, in the latter E provided them with their preferred reward and told them that it belonged to them. Children were asked to not use/consume them, at least, until the task/*game* was over. This was done in order to avoid manipulating children's current states— for instance, by eating chocolates—before allocating the rewards.

(2) *Knowledge task.* E showed the child a box with a picture on the lid always depicting the child's favorite reward (e.g., if the child preferred stickers, the lid had a

picture with stickers). Then, E asked the child *"Would you like to open it?"*. Once the child found out that the box was empty, E showed him/her one bag with stickers, one with chocolates and one with the distractors. Children were then randomly assigned to the "right now" or "tomorrow" condition and E said "*Imagine that another little girl/boy the same age as you is going to open this box right now/tomorrow, ok? What would you like to put inside her/his box?"* In the "tomorrow" condition, E explained the concept of "tomorrow" by showing the child a timeline with a picture of a little child going to bed and waking up in the morning. Then E said "*everything that happens when s/he wakes up in the morning is tomorrow.*" The Knowledge task assessed children's ability to allocate their preferred reward into another child's box when participants' current needs did not conflict with others' needs.

(3) *Resource Allocation task*. The combination of the "Extra-reward" and "No-extra reward" conditions together with the "right now" or "tomorrow" conditions yielded 4 experimental conditions. Children were randomly assigned to one of them. Importantly, the temporal marker was kept constant across the Knowledge and the Resource Allocation tasks. That is, if in the Knowledge task children had to allocate rewards for "right now", the same was done in the Resource Allocation task.

(a) Extra-reward – access to rewards right now: E left the box with the picture on the lid depicting the child's preferred reward (e.g., stickers) on the table and put away the three bags with the rewards. Then, E showed the child a second box with a picture on the lid always depicting the child's less preferred reward (e.g., chocolates) and said "*Imagine that you and the other child are going to play with these two boxes right now: you are going to get to play with this box (e.g., chocolate box) and s/he is going to*

get to play with this other box (e.g., sticker box). And everything you put in your box you get to have right now and everything you put in his/her box, s/he gets to have right now!" Next, E showed the child the bags with stickers, chocolates, and the distractors and asked two questions: (1) "self" question: *"which one of these things would you like to put in your box?"* and (2) "other" question: *"which one of these things would you like to put in his/her box?"* Children could only allocate one bag to each of the two boxes and the contents of the bags could not be split. To ensure that children knew which box was his/hers and which one was the other child's box, E asked the child to put the chosen bags inside the boxes. All children succeeded at identifying his/her box and the other child's box. The order in which the "self" and "other" questions were asked was counterbalanced across participants. Importantly, the order of these questions did not affect children's choices for the other child (χ^2= 0.001, *df*=1, *p*=0.980) or for themselves (χ^2= 0.168, *df*=1, *p*=0.682) for either the "right now" or "tomorrow" conditions.

(b) Extra-reward – access to rewards tomorrow: The same procedure as the "Extra-reward — access to rewards right now" condition was used, but "right now" was replaced with "tomorrow" when E told children to imagine "*that you and the other child are going to play with these two boxes tomorrow […]. And everything you put in your box you get to have tomorrow and everything you put in his/her box, s/he gets to have tomorrow!"* The concept of "tomorrow" was again explained to children.

(c) No extra-reward – access to rewards right now: The same procedure as for the "Extra-reward — access to rewards right now" condition was used. The only difference was that E *did not* provide children with their preferred reward after she established their reward preference.

(d) No extra-reward – access to rewards tomorrow: The same procedure as for the "Extra-reward — access to rewards tomorrow" condition was used. The only difference was that E *did not* provide children with their preferred reward after she established their reward preference.

Scoring and analyses

Children's ability to correctly allocate their preferred reward (i.e., reward matching the picture on the other child's box) in the Knowledge task (chosen item matches the object depicted on the box=1, chosen item does not match the object depicted on the box=0) was scored as well as children's resource allocation for themselves—"self" question- and the other child –"other" question- (chosen item matches the object depicted on the box=1, chosen item does not match the object depicted on the box=0) in the Resource Allocation task. See Table 2 for the percentage of children choosing one of the three possible rewards.

Pearson chi-square and a three-way cross-tabulation were used to analyze children's resource distribution pattern questions in the "Extra-reward" and "No extra-reward" conditions. Binomial tests were also conducted to assess whether children were above chance in the "right now" and "tomorrow" conditions (chance=33%) for the "Self" and "Other" questions. Finally, ϕ was used to report effect size for significant effects. Statistical tests were two-tailed, and results were considered significant if $p<.05$.

Results

Resource Allocation task

"Other" questions

Choices for "right now." Age affected children's resource allocation patterns for "right now" (χ^2= 7.76, *df*=1, *p*=.005; ϕ =.420). In particular, more 5-year-olds than 4-year-olds allocated their preferred reward to the other child's box in the "Extra-reward" condition (χ^2= 5.57, *df*=1, *p*=.018; ϕ =.463) but not in the "No extra-reward" condition (χ^2= 1.94, *df*=1, *p*=.163). Further analyses showed that 5-year-olds put their preferred reward in the other's child box significantly above chance in the "Extra-reward" condition (71%, binomial test: *p*=.004) but not in the "No extra-reward" condition (38%, binomial test: *p*=.524). In contrast, 4-year-olds put their less preferred reward in the other's child box significantly above chance in both the "Extra-reward" condition (75%, binomial test: *p*=.004) and "No extra-reward" condition (90%, binomial test: *p*<.001; see Figure 1). That is, only older children allocated their preferred reward to the other child's box when their current needs did not conflict with what another child would expect to find inside the box "right now."

Choices for "tomorrow." Age also had an effect on how children distributed the rewards for "tomorrow" (χ^2= 6.19, *df*=1, *p*=.013; ϕ =.342). More 5-year-olds compared to 4-year-olds allocated their less preferred reward to the other child's box in the "No extra-reward" condition (χ^2= 4.02, *df*=1, *p*=.045; ϕ =.428) but not in the "Extra-reward" condition (χ^2= 2.36, *df*=1, *p*=.124). Further analyses revealed that 5-year-olds put their less preferred item significantly above chance in the other child's box in both "Extra-reward" and "No extra-reward" conditions (87% and 90% respectively, binomial test: *p*<.001 in both cases). In contrast, 4-year-olds put their preferred reward in the other child's box significantly above chance in the "Extra-reward" condition (63%, binomial

test: p=.015) but not in the "No extra-reward" condition (50%, binomial test: p=.171; see Figure 1). That is, irrespective of whether children's current needs did or did not conflict with what another child would anticipate to find inside the box "tomorrow", older children allocated their less preferred reward to the other child's box; in contrast, younger children tended to allocate their preferred reward to the other child's box.

"Self" questions

Choices for "right now." Age did not have a significant effect on children's performance (χ^2= 3.30, df=1, p=.069). However, more children put their preferred reward (i.e., reward matching the other child's box) in their own box in the "No extra-reward" condition compared to the "Extra-reward" condition (χ^2= 5.52, df=1, p=.019; ϕ =.354). Further analyses revealed that children put their preferred reward in their box significantly above chance in the "No extra-reward" condition (66%, binomial test: p=.004) but not in the "Extra-reward" condition (32%; binomial test: p=.496; Figure 2). That is, when children's current needs conflicted with what another child would expect to find inside the box "right now", both younger and older children put their preferred reward in their own box.

Choices for "tomorrow." Age had an effect on how children allocated the rewards to their own box for "tomorrow" (χ^2= 5.27, df=1, p=.022; ϕ =.313). More 5-year-olds than 4-year-olds allocated their preferred reward to their own box—although only in the "No extra-reward" condition (χ^2= 3.88, df=1, p=.049; ϕ =.411). Five-year-olds put their preferred reward in their box significantly above chance in both the "Extra-reward" (73%, binomial test: p=.019) and the "No extra-reward" conditions (81%, binomial test: p=.001). In contrast, 4-year-olds did not put their preferred reward in their box own

significantly above chance in either condition—41% did so in the "Extra-reward" condition and 41% in the "No extra-reward" condition (Figure 2).

Knowledge task

Neither being provided (or not) with the reward at the beginning of the task (χ^2= 1.087, *df*=1, *p*=.297) nor age (χ^2= .857, *df*=1, *p*=.355) affected children's responses. Younger (71%) and older children (65%) allocated their preferred reward significantly above chance into the other child's box (binomial test: $p<.05$ in both cases). In other words, regardless of whether children had (or not) their preferred reward, they were successful at allocating the reward matching the picture on lid of the box.

Discussion

The results indicated that only older children's ability to distribute resources for "right now" and "tomorrow" was determined by their current and future needs. In the "Extra-reward" condition, 5-year-olds allocated their preferred reward into another child's box only for "right now" but not for "tomorrow"—consistent with the Bischof-Köhler account. Moreover, in the "No extra-reward" condition 5-year-olds allocated their preferred reward into their own box for "right now" and "tomorrow." In contrast, 4-year-olds' performance was mostly affected by *when* they had access to their preferred reward. They tended to allocate their preferred reward into their box for "right now" but into the other child's box for "tomorrow." Note that when participants provided the other child with their less preferred reward, they tended to equally allocate their less preferred reward (either chocolates or stickers—depending on the participants' reward preferences) and the distractor objects. However, when the participants allocated their less prefer

reward to themselves, they mostly allocated chocolates or stickers—depending on their reward preferences. Crucially, both 4- and 5-year-olds provided the other child with their preferred reward when their own needs did not conflict with the other child's needs—as the findings from the Knowledge task indicated. Finally, providing the children with the reward at the start of the task *only* affected their performance in the Resource Allocation task—suggesting that it is only when there is a conflict between their current needs and another child's expectations that they distribute resources differently.

Consistent with the predictions, 5-year-olds' performance indicates that they were able to take into account their current and future needs when distributing resources for themselves and another child for "right now" and "tomorrow." This is because in the "Extra-reward" condition (i.e., current need is satisfied) older children allocated their preferred reward into *another child's box* when they could access the rewards "right now." In contrast, they allocated their preferred reward into their *own box* when they could access the rewards "tomorrow." This suggests that 5-year-olds could anticipate that even if their current needs were satisfied, they would want to have their preferred reward again "tomorrow." In contrast, when their current need for the reward was not satisfied (i.e., "No extra-reward" condition), they allocated their preferred reward into their *own box* for "right now" and "tomorrow." Thus, in contrast to previous findings (Atance & Meltzoff, 2006; Mahy et al., 2014; Mahy, 2016), the present study suggests that 5-year-olds can anticipate non-physiological future needs that differ from their current ones.

Because children in the current study were not asked to use/consume the rewards immediately after being provided with them, one could argue that their current needs were not actively manipulated. Two important points can be made here. First, even if

children did not have to predict a future *physiological state* that was different from their current one (e.g., thirsty now *vs*. hungry tomorrow), they still have to predict a future *need* that was different from the current one (e.g., owning a bag with chocolates now *vs*. not owning a bag with chocolates tomorrow). Second, it is precisely older children's difference performance between the "Extra-reward" and the "No extra-reward" conditions that supports the conclusion that they are able to predict future needs that are different from the current ones. Otherwise, they should have behaved identically in both conditions.

In contrast to older children, younger children failed to take into account their current and future needs when distributing resources for "right now" and "tomorrow" for both the "self" and the "other." Four-year-olds kept their favorite reward for "right now" (60%, binomial test: p=.011) but they tended to allocate it into another child's box for "tomorrow" (68%, binomial test: p=.001). The results from the Knowledge task show that younger children allocated their preferred reward into the other child's box when their needs were not in conflict with each other. Moreover, their choices in this task did not differ between "right now" and "tomorrow" (χ^2= 0.298, df=1, p=0.585). This suggests that 4-year-olds knew which reward to put in another's child box regardless of *when* the other child had access to the reward. Therefore, it is difficult to argue that younger children's performance in the Resource Allocation task is due to a lack of understanding of what is expected to be found inside the box. Additionally, previous research on future thinking has shown that by the age of 4 children can anticipate their own and others' future needs (e.g., Russell et al., 2010; Suddendorf et al., 2011).

Why did 4-year-olds allocate their less preferred rewards into another child's box

for "right now" and their preferred reward for "tomorrow"—irrespective of whether there was or was not a cost to them? It is possible that younger children struggled to inhibit choosing their preferred reward because they could obtain it "right now" (e.g., Mischel & Metzner, 1962; Moore et al., 1998). This is because although they had already been provided with their preferred reward (i.e., current need was satisfied), they were not necessarily satiated. Alternatively, younger children may have a preference for less egalitarian distributions than 5-year-olds (Fehr et al., 2008). However, this does not explain why younger children tended to make more prosocial decisions when the rewards could be accessed "tomorrow." It is also possible that younger children's difficulty in the present task was due to their failure to understand the concept of "tomorrow"—even though all children were presented with a timeline in which "tomorrow" was physically represented and conceptually explained to them. However, if 4-year-olds had difficulties to understand what "tomorrow" entailed, they would have also had difficulties to allocate the rewards in the Knowledge task. Crucially, no differences were found between the "right now" and "tomorrow" conditions for the Knowledge task.

It may also be possible that 4-year-olds failed at distributing resources because there is a conflict between what they themselves prefer and what another child expects to find inside the box. However, previous studies have reported that by age 4 children already engage in prosocial behaviors (i.e., altruistic sharing) in Resource Allocation experimental paradigms (e.g., House, Henrich, Brosnan, & Silk, 2012; Fehr et al., 2008; Moore, 2009; Moore et al., 1998; Thompson et al., 1997). Importantly, research has also shown that children's sharing behavior can be affected by different factors—including the amount of resources available (e.g., Hay, Caplan, Castle, & Stimson, 1991), the

history of previous collaboration (e.g., Warneken, Lohse, Melis, & Tomasello, 2011) or, among others, the type of relationship with the other child (e.g., Fehr et al., 2008).

In this regard, the Resource Allocation task used here introduced two new factors that could affect how children distribute resources. The first factor is the *type of reward* to be distributed. In the present study children had to allocate rewards that were qualitatively different—as opposed to allocating certain amounts of the same reward between themselves and another child (e.g., House et al., 2012, for a review). The second factor is the *temporal distance* between children's choices and when they could access the rewards—either "right now" or "tomorrow." Despite recent findings (Redshaw & Suddendorf, 2013) showing that 4-year-olds seem to rely on the same mechanisms when selecting an item that they can use in a near (e.g., 5 min) and in a more distant future (e.g., 15 min), research on temporal discounting—using paradigms similar to the one used here—shows that preschool children are sensitive to the length of delay before they can obtain the rewards (e.g., Lemon & Moore, 2007; Mischel & Metzner, 1962; Schwarz, Schrager, & Lyons, 1983). For example, Schwarz et al. (1983) found that 3 to 6 year olds chose to delay a reward more often when they could obtain it at the end of day rather than the next day. Moreover, a more recent study reported an association between the development of temporal distance and social distance (Garon, Johnson, & Steeves, 2011). In particular, the results showed that by the age of 4 children who favored a future self that is close in time also displayed prosocial behaviors (e.g., share) to socially close children (e.g., friends; Garon et al., 2011). In contrast, the ability to share with strangers has been shown to develop later in ontogeny and there seems to be an increase between ages 5 to 7 (Fehr et al., 2008).

Thus, it is conceivable that both social distance *and* temporal distance could explain younger children's behavior in the present study. Children might have decided to keep their favorite reward for "right now" because even if gender and age between the participants and the other child was matched, the latter was a "stranger" to them. It follows that younger children might have discounted the value of the future reward and, consequently, decided to give it to the other child "tomorrow." That is, once the value of their preferred reward reaches the same level as the other two rewards, "sharing" becomes less costly to them. Taken together, these findings suggest that 4-year-olds might have considered the temporal distance *and* the social distance, but failed to incorporate their own current and future needs into their decision-making process.

The current study provides new insights into children's future thinking abilities and shows that 5-year-old children take into account their current and (different) future needs when deciding how to allocate resources between themselves and another child. In contrast, 4-year-old children failed to do so. Two factors—temporal distance and social distance— are suggested to be at play in younger children's performance. One way to address this possibility is by presenting preschoolers with a task in which in addition to manipulating their current needs, the social distance between participants and the other is also manipulated. This would help to disentangle whether the role of the "other" in this type of task overrides children's abilities to take into account how their present and future needs change over time. Another line of research would be to address children's performance when their current needs *and* someone else's current needs are being manipulated. This would help to shed light on the kinds of contexts that are particularly challenging to young children's future-oriented decision-making, both for themselves and

for someone else. Finally, the implications of the present study are crucial for understanding the development of future thinking skills. At the theoretical level, the ability to think about future needs that conflict with current ones seems to emerge earlier than previously thought (e.g., Atance & Meltzoff, 2006). At the methodological level, the present study highlights the importance of investigating children's future-oriented skills in different contexts.

References

Atance, C. M., & Meltzoff, A. N. (2006). Preschoolers' current desires warp their choices for the future. *Psychological Science*, *17*, 583–587

Atance, C.M, Louw, A., & Clayton, N. S. (2015). Thinking ahead about where something is needed: New insights about episodic foresight in preschoolers. *Journal of Experimental Child Psychology, 129*, 98-109.

Bélanger, M. J., Atance, C. M., Varghese, A. L., Nguyen, V., & Vendetti, C. (2014). What will I like best when I'm all grown up? Preschoolers' understanding of future preferences. *Child Development*, *85*, 2419–2431.

Berndt, T. J. (2002). Friendship quality and social development. *Current Directions in Psychological Science*, *11*, 7–10.

Bischof-Kohler, D. (1985). Zur phyogenese menschlicher motivation [On the phylogeny of human motivation]. In L. H. Eckensberger, & E. D. Lantermann (Eds.), *Emotion und reflexivitut [Emotion and reflexivity]* (pp. 3–47). Vienna: Urban & Schwarzenberg.

Bischof-Köhler D. & Bischof N. (2007). Is mental time travel a frame-of-reference issue?

Behavioral and Brain Sciences 30, 316-317. doi: 10.1017/S0140525X07002014

Blake, P. R., & Rand, D. G. (2010). Currency value moderates equity preference among young children. *Evolution and Human Behavior*, *31*, 210–218.

Correia, S. P., Dickinson, A., & Clayton, N. S. (2007). Western scrub-jays anticipate future needs independently of their current motivational state. *Current Biology, 17*, 856–861.

Fehr, E., Bernhard, H., & Rockenbach, B. (2008). Egalitarianism in young children. *Nature*, *454,* 1079–1083.

Garon, N., Johnson, B., & Steeves, A. (2011). Sharing with others and delaying for the future in preschoolers. *Cognitive Development, 26*, 383-396.

Hay, D. F., Caplan, M., Castle, J., & Stimson, C. A. (1991). Does sharing become increasingly "rational" in the second year of life? *Developmental Psychology, 27*, 987–993. doi:10.1037/0012-1649.27.6.987

House, B.R., Henrich, J., Brosnan, S.F., & Silk, J.B. (2012). The ontogeny of human prosociality: behavioral experiments with children aged 3 to 8. *Evolution and Human Behavior*, 33, 291–308.

Hudson, J. A., Mayhew, E. M. Y., & Prabhakar, J. (2011). The development of episodic foresight: Emerging concepts and methods. *Advances in Child Development and Behavior, 40*, 95–137.

Lemmon, K., & Moore, C, (2007). The development of prudence in the face of varying future rewards. *Developmental Science, 10*, 502-511.

Mahy, C. (2016). Young Children Have Difficulty Predicting Future Preferences in the Presence of a Conflicting Physiological State. *Infant and Child Development, 25,* 325-

338 DOI: 10.1002/icd.1930

Mahy, C. E. V., Grass, J., Wagner, S., & Kliegel, M. (2014). These pretzels are going to make me thirsty tomorrow: Differential development of hot and cool episodic foresight in early childhood? *British Journal of Developmental Psychology*, *32*, 65–77.

McCormack, T., & Hanley, M. (2011). Children's reasoning about the temporal order of past and future events. *Cognitive Development*, *26*, 299–314.

McCormack T., & Hoerl, C. (2011). Tool use, planning, and future thinking in animals and children. In T. McCormack, C. Hoerl, & S. Butterfill (Eds.), *Tool use and causal cognition* (pp.129-147). Oxford, UK: Oxford University Press.

Mischel, W., & Metzner, R. (1962). Preference for delayed reward as a function of age, intelligence, and length of delay interval. *Journal of Abnormal and Social Psychology*, *64*, 425-431.

Moore, C., Barresi, J., & Thompson, C. (1998). The cognitive basis of future-oriented prosocial behavior. *Social Development, 7*,198–218.

Moses, L. J., Coon, J. A., & Wusinich, N. (2000). Young children's understanding of desire formation. *Developmental Psychology*, *36*, 77–90.

Payne, G., Taylor, R., Hayne, H., & Scarf, D. (2015). Mental time travel for self and other in three- and four-year-old children. *Memory, 23*, 675-682. doi: 10.1080/09658211.2014.921310

Prencipe A., & Zelazo, P.D. (2005). Development of affective decision making for self and other: Evidence for the integration of first- and third-person perspectives. *Psychological Science, 16*, 501-505. doi: 10.1111/j.0956-7976.2005.01564.

Raby, C. R., Alexis, D. M., Dickinson, A., & Clayton, N. S. (2007). Planning for the

future by western scrub-jays. *Nature, 445*, 919–921.

Redshaw, J., & Suddendorf, T. (2013). Foresight beyond the very next event: Four-year-olds can link past and deferred future episodes. *Frontiers in Psychology, 4*, 1-6. doi: 10.3389/fpsyg.2013.00404

Russell, J., Alexis, D., & Clayton, N.S. (2010). Episodic future thinking in 3- to 5-year-old children: The ability to think of what will be needed from a different point of view. *Cognition*, *114*, 56–71.

Schwarz, J.D., Schrager, J.B., & Lyons, A.E. (1983). Delay of gratification by preschoolers: evidence for the validity of the choice paradigm. *Child Development, 54,* 620–625.

Suddendorf, T., & Corballis, M. C. (1997). Mental time travel and the evolution of the human mind. *Genetic, Social, and General Psychology Monographs, 123*, 133–167.

Suddendorf, T., & Corballis, M.C. (2007). The evolution of foresight: what is mental time travel and is it unique to humans? *Behavioral and Brain Sciences, 30*, 299-313.

Suddendorf, T., Nielsen, M., & von Gehlen, R. (2011). Children's capacity to remember a novel problem and to secure its future solution. *Developmental Science*, *14*, 26–33.

Thompson, C., Barresi, J., & Moore, C. (1997). The development of future-oriented prudence and altruism in preschoolers. *Cognitive Development, 12*, 199–212.

Warneken, F., Lohse, K., Melis, A. P., & Tomasello, M. (2011). Young children share the spoils after collaboration. *Psychological Science*, *22*, 267–273.

Table 1. Predicted resource distribution for the "other" and "self" according to the Bischof-Köhler account

Bischof-Köhler account		**"other" questions**	**"self" questions**
right now	**no extra-reward**	5-year-olds and 4-year-olds would allocate their less preferred reward (i.e., does not match the reward depicted on the other child's box) to the other child's box. This is because their current need is not satisfied.	5-year-olds and 4-year-olds would allocate their preferred reward (i.e., does not match the reward depicted on their own box) to their own box.
	extra-reward	5-year-olds > 4-year-olds would allocate their favorite reward (i.e., matches the reward depicted on the other child's box) to the other child's box. This is because their current need is satisfied.	5-year-olds > 4-year-olds would allocate their less preferred reward (i.e., matches the reward depicted on their own box) to their own box.
tomorrow	**no extra-reward**	5-year-olds and 4-year-olds would allocate their less preferred reward to the other child's box This is because their future need may not be satisfied.	5-year-olds and 4-year-olds would allocate their preferred reward to their own box.
	extra-reward	5-year-olds > 4-year-olds would allocate their less preferred reward to the other child's box. This is because even if their current need is satisfied, children have to anticipate that their future one may not be satisfied.	5-year-olds > 4-year-olds would allocate their preferred reward to their own box.

Table 2. Percentage of children choosing each of the three rewards for the other child ("Other" questions) or for themselves ("Self" questions) grouped by age group.

Age	Conditions	Bag with stickers	Bag with chocolates	Bag with distractors
4YO	"Other" questions	54	23	23
	"Self" questions	35	63	2
5YO	"Other" questions	40	36	24
	"Self" questions	48	48	4

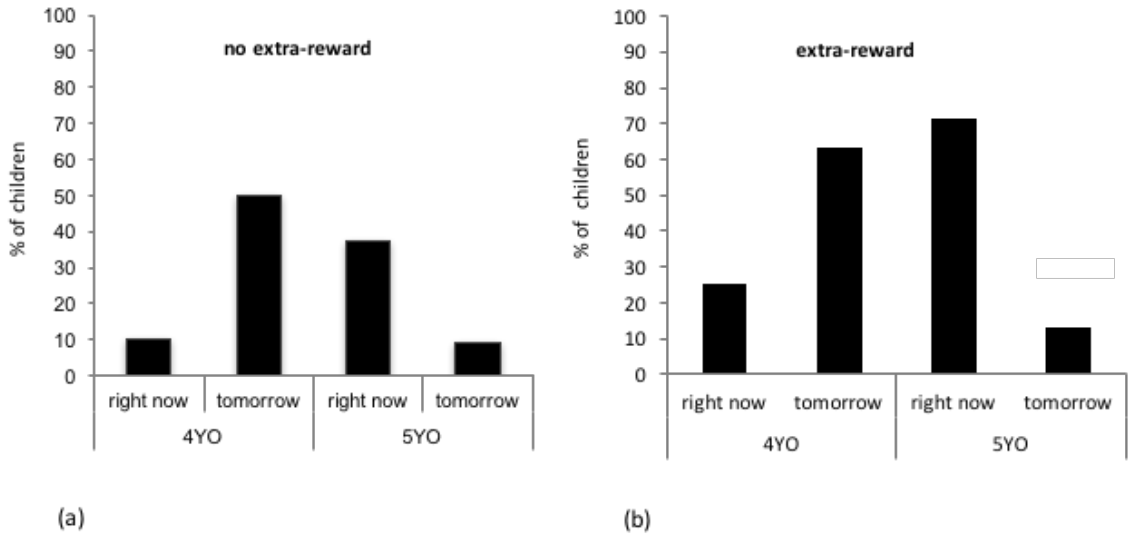

Figure 1. Percentage of 4- and 5-year-old children who allocated their preferred reward into the other child's box for "right now" and "tomorrow" in the Resource Allocation task. (a) represents the condition in which children were not provided with the reward at the beginning of the task (No extra-reward condition) and (b) represents the condition in which children were provided with the reward (Extra-reward condition)

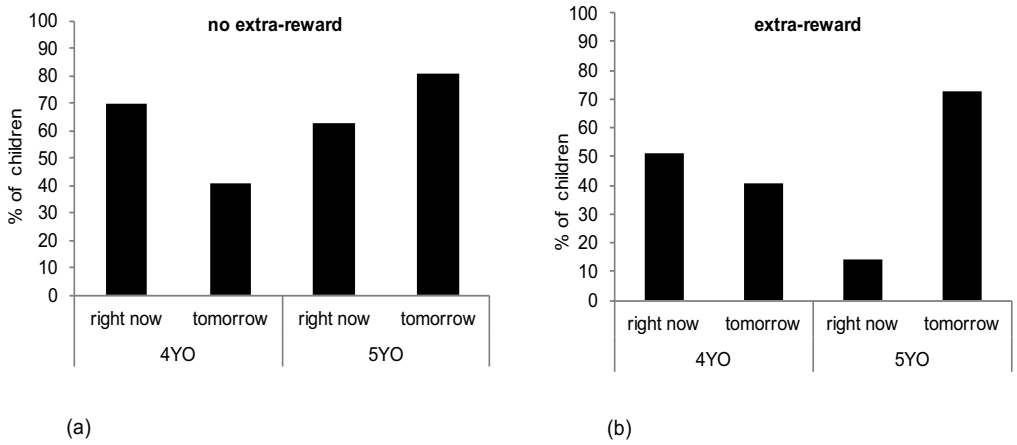

Figure 2. Percentage of 4- and 5-year-old children who allocated their preferred reward into their own box for "right now" and "tomorrow" in the Resource Allocation task. (a) represents the condition in which children were not provided with the reward at the beginning of the task (No extra-reward condition) and (b) represents the condition in which children were provided with the reward (Extra-reward condition)