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# Interpersonal utility and children's social inferences from shared preferences

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## ABSTRACT

Similarity of behaviors or attributes is often used to infer social affiliation and prosociality. Does this reflect reasoning using a simple expectation of homophily, or more complex reasoning about shared utility? We addressed this question by examining the inferences children make from similar choices when this similarity does or does not cause competition over a zero-sum resource. Four- to six-year-olds (N = 204) saw two vignettes, each featuring three characters (a target plus two others) choosing between two types of resources. In all stories, each character expressed a preference: one 'other' chose the same resource as the target, while a second 'other' chose the different resource. In one condition there were enough resources for all the characters; in the other condition, one type of resource was limited, with only one available (inducing potential competition between the target and the similar-choice other). Children then judged which of the two 'other' characters was being nicer (prosocial judgment) and which of the two was more preferred by the target (affiliative inference). When resources were limited (vs. unlimited), children were less likely to select the similar other as being nice. Children's initial tendency to report that the target preferred the similar other was also eliminated in the limited resource scenario. These findings show that children's reasoning about similarity is not wholly based on homophily. Instead, by reasoning about shared utility — how each person values the goals of others — children engage in flexible inferences regarding whether others' similar preferences and behaviors have positive or negative social meaning.

# 1. Interpersonal utility and children's social inferences from shared preferences

Alignment with others' behaviors, words, opinions, and choices often results in positive social outcomes. Across the lifespan, people choose to affiliate with others who have similar preferences and behaviors to themselves (Fawcett & Markson, 2010; Mahajan & Wynn, 2012; Over, 2020), and expect others to do the same (Afshordi, 2019; Liberman, Kinzler, & Woodward, 2014, 2021; Over & Carpenter, 2015). Experiencing shared behaviors during social interaction leads participants to believe that it went smoothly (Chartrand & Bargh, 1999), and to engage in prosocial behaviors (Agnetta & Rochat, 2004; Carpenter, Uebel, & Tomasello, 2013; Meltzoff, 1990; van Baaren, Holland, Kawakami, & van Knippenberg, 2004; van Baaren, Holland, Steenaert, & van Knippenberg, 2003). Adults and children will even avoid voicing dissenting opinions they believe to be correct, possibly to escape negative judgment from others for disagreeing (Asch, 1956; Haun & Tomasello, 2011). Why do shared behaviors, preferences, and choices often have these positive social effects? One prominent view holds that the social potency of shared preferences and behaviors stems from a human tendency to prefer those who are similar to oneself (Haun & Over, 2015; Liberman et al., 2021; McPherson, Smith-Lovin, & Cook, 2001; Reis, 2007). This wide-ranging preference for similar others, known as homophily, may be employed as a heuristic in social reasoning as well, shaping expectations about relationships between others. By this heuristic, more similarity between two agents should lead to an expectation of more prosociality among them, both in behavior (e.g. helping versus hindering) and attitudes (e.g. liking) — potentially helping to explain the many positive social interpretations of others' similar behavior and preferences.

Interestingly though, infants and children do not always view similar behavior and preferences as a sign of prosociality or social affiliation. Instead, similarity is sometimes viewed as socially and morally neutral, particularly when it is unintentional, coincidental, or arbitrary (Bian & Baillargeon, 2022; Fawcett & Markson, 2010; Jordan & Wynn, 2021;

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Mahajan & Wynn, 2012). For example, when choosing who they would like to play with, 3-year-olds and 1-year-old infants reliably select a character who previously chose similar toys or foods, but not a character with an arbitrary similarity, like a similar-colored sticker or mittens that were assigned (Fawcett & Markson, 2010; Mahajan & Wynn, 2012), or a similar item of clothing with an instrumental, non-social purpose (Bian & Baillargeon, 2022). When inferring friendships, 4-year-olds are more likely to select people who are similar in meaningful ways than people who have an arbitrary or coincidental similarity (e.g. it snowed on both of their birthdays; Afshordi, 2019). In adulthood, shared preferences are also seen as a weaker sign of affiliation when they are common, compared with when they are rare (Vélez, Bridgers, & Gweon, 2019).

By one cognitive account of these data, what children may be doing when they observe similar behavior is either deploying a homophilybased rule, or deciding not to deploy this rule. By this account, shared preferences and similar behavior can either be viewed as socially positive or can be dismissed as uninformative and therefore socially neutral. Notably, there is no circumstance under which this version of the homophily principle predicts that shared preferences or behaviors should be viewed as *negative*. On its own, a rule-based homophily account cannot explain why, or predict when, similarity will be seen as positive, neutral, or negative, or as holding stronger or weaker social cues.

Here we test an alternative account of children's reasoning about similar preferences and behavior. This account, the shared utility account, holds that the prosocial effects of similar behavior stem from reasoning about others' motivation for shared and congruent goals rather than (or perhaps in addition to) a simple rule-like preference for similarity. This reasoning builds on children's early-developing ability to understand others' goals and values by reasoning about the costs and benefits of actions (Powell, 2022). From a young age, people expect others to act rationally and to maximize their rewards relative to costs (i.e., overall expected utility; Baker, Jara-Ettinger, Saxe, & Tenenbaum, 2017; Gergely, Nadasdy, Csibra, & Biro, 1995; Jara-Ettinger, Gweon, Schulz, & Tenenbaum, 2016; Liu, Ullman, Tenenbaum, & Spelke, 2017). The shared utility account posits that children also track whether and when people's actions promote or intentionally align with others' goals and rewards, in effect adopting another's utilities. When this occurs, it provides evidence of a prosocial disposition or positive social relationship between agents (Hamlin, Ullman, Tenenbaum, Goodman, & Baker, 2013; Jara-Ettinger et al., 2016; Powell, 2022; Ullman et al., 2009).

Under the shared utility account, shared preferences and similar behaviors can be powerful evidence of prosociality not merely because the observer perceives similarity between two agents, but because the observer has inferred that the similar person is intentionally sharing or promoting another agent's goals. This occurs for helpful and cooperative behaviors, which directly promote another's goals (Hamlin et al., 2013; Ullman et al., 2009). Imitation may also provide evidence of prosociality by signalling intentional goal alignment, adopting the utility and values of the other (Powell, 2022). By contrast, the fact that coincidental similarity does not reflect intentionally shared utility explains why it is often viewed as socially neutral. This does not rule out social connection over unintentional similarity: Some responses to coincidental similarity could be prosocial, and some discovered similarities, such as a shared language, cannot be coincidental but instead reflect a shared cultural background (Soley & Aldan, 2020; Soley & Köseler, 2021). In these cases there are still elements beyond mere similarity (e.g., inferences about the cause of similarity) that may account for prosocial outcomes.

Crucially, the shared utility account also makes the distinct prediction that some similar preferences and behaviors should be seen as negative or antisocial. Specifically, when intentional similarity potentially prevents another person from achieving their goal, then it should signal that one person does not share the utilities of another and may even value hindering them (Hamlin et al., 2013; Jara-Ettinger et al., 2016; Powell, 2022; Ullman et al., 2009). For example, consider the case of plagiarism, where one person produces a similar creation to another by copying their idea. Adults and children as young as 5 years evaluate plagiarizers negatively, and like people who copy ideas less than those who generate original ideas, or who coincidentally come up with the same ideas without copying (Olson & Shaw, 2011; Yang, Shaw, Garduno, & Olson, 2014). Previous work posited that reasoning about the reputational effects of stealing credit — harm to others' reputations or unjustified benefit to one's own — explains adults' and children's negative interpretation of copying ideas (Shaw & Olson, 2015; Silver & Shaw, 2018). These negative interpretations of plagiarism due to their potential harm to others is in line with the predictions of shared utility. Children's reasoning about potential reputational harm from copying may be part of a broader system of reasoning about others' behavior as motivated by either shared utilities, unshared utilities, or even *directly conflicting* utilities (placing value on hindering another).

Situations with limited resources can provide a key test of whether children use shared utilities to reason about shared preferences and similar behavior. When a resource is limited (e.g. there is only one cupcake, but three popsicles) and a second person expresses the same preference for the limited resource as the first person, this decreases the likelihood that the first person will receive their desired resource. In this case, the shared utility account predicts that stating a shared preference should be viewed as negative, and that stating a unique preference will be seen as more prosocial.

# 1.1. The current study

The current study examines how children reason about shared preferences and similar behavior in contexts where expressing shared preferences can result in conflict: situations in which resources are limited, and a shared preference reduces the likelihood someone else will get what they want (i.e., achieve their goals). In our study, 4- to 6year-old children saw scenarios of three characters choosing between two types of resources. Before seeing how many of each type were available, one of the characters (the target) expressed a desire for one type of resource. The available quantities were then revealed: In the unlimited resource trial, there were enough resources of both types for all of the characters to have one. In the limited resource trial, there were enough resources of one type for all of the characters, but only one item of the other type. In this scenario, the target character had already expressed a desire for what turned out to be the limited resource. In both scenarios, one of the remaining characters then stated the same desire as the target, while the other stated a dissimilar preference. Following the scenarios, children were asked to judge prosociality and affiliative attitudes (liking).

These scenarios allow us to adjudicate between the homophily-based and shared utility accounts, as they make different predictions. Although theories of homophily may hold that some similarities are more important than others, the nature of the similarity here is held constant across the unlimited and limited trials. Thus, a mere homophily account predicts that if participants make prosocial inferences from shared preferences in the unlimited trial, they ought to do so in the limited trial as well. Other social concerns, such as making sure to leave a scarce option available for others whose preferences are unknown (Zhao, Zhao, Gweon, & Kushnir, 2021), would have to compete against the positive social cue of similarity (see Discussion, *Relation to the development of social mindfulness*).

By contrast, on the shared utility account, the positive value of shared preferences is in their potential to indicate shared utility between two specific agents. In instances where shared preferences result in competition, similarity should become a source of negative, rather than positive, social inferences. Thus, the shared utility account predicts that when resources are limited, children should judge that the character whose choice is dissimilar from the target's is being nicer and more likely to be friends. The similar choice, meanwhile, should be viewed as antisocial and associated with negative inferences about this particular relationship because it reflects a decision to ignore or interfere with the

#### target's goal.

Several aspects of our experimental design allow us to investigate the nuances of children's reasoning about the social meaning of shared preferences. First, we asked children to make two related but potentially distinct inferences: they were asked to judge which character was being nice to the target (i.e., the similar or dissimilar character); and to infer which character the target prefers. By asking these questions, we aimed to explore whether children's reasoning about shared preferences differs depending on the particular social inference they make — prosociality versus social affiliation. We also counterbalanced the order of these questions to explore whether these inferences influence one another. For instance, reasoning first about whether the interaction was prosocial could influence subsequent inferences about affiliation (and vice-versa).

Second, we included trials with two kinds of stimuli as resources: toys and foods (counterbalanced across conditions). Shared preferences for both toys and foods have been shown to be socially meaningful to children, although findings differ on whether foods or toys are more strongly linked with prosociality. For instance, 3-year-olds more consistently prefer to play with characters with similar toy preferences than food preferences (Fawcett & Markson, 2010); and 4-year-olds expect people who previously engaged in prosocial behavior to share preferences for games but not foods (Afshordi, 2019). However, other studies found that infants prefer characters who share their own food preferences (Mahajan & Wynn, 2012), and expect other affiliated people to share food preferences but not preferences for objects, such as a bowl and cup (Liberman et al., 2014; Liberman, Woodward, Sullivan, & Kinzler, 2016).

In our task, the particular pairs of toys and foods were selected to be approximately equally familiar, and of approximately equal value to one another; choosing between culturally familiar items is a common part of young children's everyday experience (Faber & Mazlish, 2012). Preferences among equally familiar toys or foods would not be expected to function as a unique social shibboleth (as in Liberman et al., 2016), as a preference for one of these items does not provide evidence of shared cultural background or common cultural knowledge (Soley & Köseler, 2021). Instead, we expected that reasoning about shared preferences for familiar foods and toys would operate in the same way, allowing trials with both kinds of stimuli to have similar social meaning.

Lastly, we counterbalanced the order of the trials to explore whether prior experiences influence how children reason about shared preferences. Children may be more likely to view shared preferences negatively even when resources are unlimited if they first reasoned about scenarios with limited resources, where expressing a shared preference can create competition. Because half of the participants were shown the scenario with unlimited resources first, while the other half were shown the scenario with limited resources first, we are able to test this possibility (though we did not pre-register this prediction). Such findings would provide further evidence that children go beyond detection of similarity when reasoning about how shared preferences relate to affiliation and consider the graded likelihood that someone is prosocially adopting a target's goals and values, versus attempting to gain rewards solely for themselves.

## 2. Methods

### 2.1. Participants

Our full sample consisted of 204 4–6-year-olds ( $M_{age} = 5;5$ , range = 4;0–6;11, 102 females). We tested preschool age children because we wanted to focus on the ages at which children have been shown to explicitly reason about shared preferences and interests, and the social meaning of intentionally similar behavior, as well as link similar preferences and choices to friendship, and consider prosociality and affiliation in their reasoning (e.g., Afshordi, 2019; Over & Carpenter, 2015; Pesowski, Kelemen, & Schachner, 2021; Selman, 1981; Watson-Jones, Whitehouse, & Legare, 2016). Testing a range of ages would also allow

us to capture any potential developmental differences, though we did not have a priori expectations of developmental change. An additional 37 children were tested but excluded from analyses for failing to correctly indicate how many resources there were or whether there were enough resources for all of the characters (6), parental interference (6), failure to correctly identify the similar-choice other (18), experimenter error (1), and failure to respond to one or more questions (6). This study was approved by the Human Research Protections Program Office at the University of California, San Diego. Children were recruited from the metro San Diego area from a database of local families interested in research, as well as recruitment ads posted on a social media platform that reaches a broad audience (Facebook). Although further demographic information was not formally collected, the population in the area is predominantly middle-class and is approximately 65% White, 30% Hispanic/Latinx, and 17% Asian (United States Census Bureau, 2019). The data was collected September 2020-March 2021.

The sample size was preregistered and based on a power analysis of the necessary sample size to detect our main effect of interest (i.e., whether children's selection of the similar character varied by trial type), as well as a planned check for order effects that could impact the size of this effect following testing of the first 102 participants ( $M_{age} = 5;4$ , range = 4;0–6;11, 54 females).<sup>1</sup> In this initial pre-registration, we specified that we would first collect 102 children, and would double the sample size and collect data from an additional 102 children if there was an effect of question order in the limited resource trial, p < .2. This meant that if this criteria were met, we would collect a total sample of 204 children, and carry out all preregistered analyses with the full sample of participants. This two-stage data collection was carried out as preregistered.

We also observed large effects related to trial and question order in the first sample (see Results) which led us to submit an additional preregistration to record our intention to perform additional analyses looking for these effects in the second sample only (N = 102,  $M_{age} = 5;5$ , range = 4;0–6;11, 48 females).<sup>2</sup> The subsequent pre-registration outlining the additional predictions for the second sample was submitted after collection of the second sample began (N = 50/102) but before any coding or analyses were conducted on that sample.

#### 2.2. Materials and procedure

Children were tested individually online during a session with an experimenter on Zoom. Children were told two stories that each involved a unique set of 4 characters. One story involved a teacher, three girls, and two types of snacks (cupcakes, popsicles); the other story involved a different teacher, three boys, and two types of art supplies (crayons, paintbrushes). In each story, the teacher told the students they would be given a choice between two types of resources (popsicles and cupcakes in one story; paintbrushes and crayons in the other). Before seeing how many resources of each type were available, one of the students (the target character) expressed a desire for one type over the other. The resource quantities were then revealed. These quantities were manipulated across story trials (within-subject): In the unlimited resource trial, there were enough resources of both types for all of the characters to have one (e.g., three popsicles and three cupcakes). In the limited resource trial, there were enough resources of one type for all of the characters, but only one object of the other type (e.g., three paint brushes and one crayon). In this trial, the limited resource was the one the target character had expressed a desire for. During each trial, participants were asked comprehension questions to confirm they were

<sup>&</sup>lt;sup>1</sup> <u>https://aspredicted.org/8B6 718;</u> in this pre-registration we note that two children were tested while collaborators reviewed and accepted the pre-registration submission, without collaborators knowing these children's responses.

<sup>&</sup>lt;sup>2</sup> https://aspredicted.org/NPK\_HWD

aware of the number of resources and whether there were enough of each type of object for all of the characters.

Then each of the characters requested the resource they would like to have. In each story, the target character first restated the same preference they had expressed before the quantities were revealed. Then, one character (the similar character) expressed the same preference as the target, and the other character (the dissimilar character) expressed a preference for the other type of resource. After hearing the characters' requests, participants were asked two crucial test questions: 1) which character, either the similar or dissimilar character, they thought the target preferred (e.g., "Which of these two girls do you think Sara likes more?"), and 2) which character was being nice to the target (e.g., "Which of these two girls was being nice to Sara?"). Following these two test questions, children were asked a comprehension question to confirm they were aware of which character asked for the same type of object as the target (e.g., "Which of these two girls asked for the same thing as Sara?"), and an exploratory question asking whether they thought the target received the requested object (e.g., "Do you think Sara got to have the popsicle that she asked for?"). See Fig. 1 for sample images and script for one of the trials.

If children remained silent following any of the questions, the experimenter prompted them by asking them to point. Similarly, if children said "I don't know", "maybe", or "both" in response to any questions, the experimenter prompted them by saying, "What do you think? Can you guess? [repeat question]". If children said "I don't know" or "maybe" after these prompts, the experimenter noted the response and resumed testing. There were 4 trials where children said "I don't know" when asked who was being nice to the target (all unlimited trials), and 1 trial where a child responded "both" when asked which character the target preferred (limited trial). When asked whether they thought the target received the desired object, there were 3 trials where children said "I don't know" (all limited resource trials) and 4 trials where children said "maybe" (2 unlimited trials, 2 limited trials). These responses were coded as missing data in the analyses.

The order of the trials, order of the test questions regarding target preference and character niceness, and which set of characters and resources (i.e., girls with snacks or boys with art supplies) appeared in the limited and unlimited trials were counterbalanced across participants. The preregistrations, data, and analysis code are available at: htt ps://osf.io/hvx2m/?view\_only=5951240ad5624553bee219b7d77b54 93

#### 2.3. Approach to data analysis

To examine whether children consider the availability of resources in their reasoning about shared preferences, we used two separate logistic regression models, one for each question type (preference, niceness) with the full sample of 204 children as preregistered. Both of these models predicted children's selection of the similar character with the predictors of trial type (limited, unlimited) and participants' age (in months), and subject as a random factor. Nested model comparisons were then used to compare the fit of the full model to that of a simpler model with the predictor of interest removed to determine whether that predictor was a significant contributor to explaining the data (see below).

We also conducted both preregistered and exploratory analyses via similar model comparisons of logistic regression models with and without type of resource (food vs. toys), question order (niceness vs. preference question first) and trial order (limited vs. unlimited first) as predictors. After repeatedly finding large trial order effects, we also conducted exploratory analyses on the first trial data alone.

#### 3. Results

#### 3.1. Prosociality judgments

Pre-registered analyses revealed that when examining children's judgments of which character was being *nice* to the target, there was a significant effect of trial type (nested logistic regression model comparison, full model vs. a simpler model with trial type removed,  $\chi^2(1) = 12.95$ , p < .001), with children selecting the similar character more in the unlimited resource trial (M = 0.57, SEM = 0.04) than the limited resource trial (M = 0.42, SEM = 0.03). There was no significant effect of age ( $\chi^2(1) = 2.94$ , p = .087). There was also no interaction between age and trial type, as indicated by a non-significant comparison of the full model to one with this additional interaction term ( $\chi^2(1) = 1.17$ , p = .279). Binomial tests showed that children selected the similar character at chance when judging who was nice in the unlimited resource trial (p = .076), and below chance in the limited resource trial (p = .029). In other words, all children, irrespective of age, tended to choose the *dissimilar* other as being nice when resources were limited.

Trial order effects were found in preregistered analyses (see below); we therefore performed exploratory analyses of children's responses during the first trial only, to examine their judgments without the impact of a previous trial. On the first trial, children were more likely to believe the similar other was being nice in the unlimited resource condition than the limited condition (Cohen's d = 1.07,  $\chi^2(1) = 43.19$ , p < .0001, 95% CI of the difference in proportions [-0.60, -0.34]); see Fig. 2. In the unlimited trial, children selected the similar other at a rate above chance when deciding who was being nice (binomial test; p < .0001, M = 0.76). In contrast, in the limited trial, children selected the similar character at a rate lower than chance (binomial test; p < .0001, M = 0.28).

#### 3.2. Affiliative judgments

Pre-registered nested logistic model comparisons revealed that when examining children's inferences of which character the target *likes* more, there were no effects of trial type ( $\chi^2(1) = 0.68$ , p = .411), age ( $\chi^2(1) = 1.23$ , p = .268), nor an interaction between trial type and age ( $\chi^2(1) = 0.02$ , p = .900). Binomial tests showed that children selected the similar character in response to this question at rates greater than chance for both the unlimited and limited resource trials,  $ps \le 0.024$  (unlimited: M = 0.61, SEM = 0.03; limited: M = 0.58, SEM = 0.03).

Because trial order effects were found in further preregistered analyses (see below), we again performed exploratory analyses of children's responses to the first trial only. On the first trial, and in line with a shared utility prediction, children were more likely to select the similar other as the preferred character in the unlimited resource trial than the limited trial (Cohen's d = 0.336,  $\chi^2(1) = 4.97$ , p = .026, 95% CI of the difference in proportions [-0.30, -0.02]); see Fig. 2. In the unlimited trial, children selected the similar other above chance when inferring who the target preferred (binomial test; p < .0001, M = 0.71). In the limited trial, children were at chance in selecting the similar other as who the target preferred (binomial test; p = .426, M = 0.54).

# 3.3. Order effects

As preregistered<sup>1</sup>, we conducted initial analyses to check for question order effects after the first 102 participants. These analyses revealed an effect of question order in the limited trial (i.e., whether the preference or niceness question was asked first; nested model comparison of full model with the predictors of question order and question type, to a simpler model without question order,  $\chi^2(1) = 2.98$ , p = .084), which passed the threshold outlined in our initial pre-registration (p < .2) and led to the collection of the second sample. We preregistered a new confirmatory test for a replication of this question order effect in the new sample<sup>2</sup>, and found it in both our second and full samples,  $\chi^2(1) = 18.93$ ,



Ms. Jones goes to get the snacks. Sara is excited and tells Becky and Hazel Jones, and here are the three students in her class. This is Sara (C), Becky (L), that she wants a popsicle. and Hazel (R). Ms. Jones says it's snack time, and has food for the class. The students can choose either a popsicle or a cupcake. Unlimited Resource Trial Ms. Jones brings the snacks over and savs. Limited Resource Trial "Look! There [are 3 popsicles/ is 1 popsicle], and 3 cupcakes." How many popsicles are there? Are there enough popsicles for all of the kids in the class? [Yes, there are enough popsicles for all of the kids in the class! There are 3 popsicles and 3 kids. / No, there are not enough popsicles for all of the kids in the class. There is 1 popsicle and 3 kids.] How many cupcakes are there? Are there enough cupcakes for all of the kids in the class? Yes, there are enough cupcakes for all of the kids in the class! There are 3 cupcakes and 3 kids. Before Mrs. Jones hands out any snacks, she is going to ask each student what they want. Mrs. Jones asks Sara what she wants first. Sara says she wants [a/the] popsicle. Then Mrs. Jones asks Becky what she wants. Becky says she wants [a/the] popsicle. Then Mrs. Jones asks Hazel what she wants. Hazel says she wants a cupcake. Which of these two girls do you think Sara likes more? Which of these two girls was being nice to Sara? Which of these two girls asked for the same thing as Sara? Do you think Sara got to have the popsicle that she asked for?

Fig. 1. Methods. Sample images and script for the trial involving three girls (target, similar character, dissimilar character) and two types of snacks (popsicles, cupcakes). Children saw another trial involving three boys (target, similar character, dissimilar character) and two types of art supplies (crayons, paint brushes). The order of the trials, order of the test questions regarding target preference and character niceness, and which set of characters and resources (i.e., girls with snacks or boys with art supplies) appeared in the limited and unlimited trials were counterbalanced across participants. Text varying between conditions for this trial appears in brackets.

p < .0001 and  $\chi^2(1) = 17.89$ , p < .0001 respectively: In the limited trial, children who were first asked to infer which character the target preferred were more likely to select the similar character overall than children who first judged which character was nice (see Fig. 3).<sup>3</sup>

Exploratory analyses of the first sample also revealed a large effect of trial order on children's judgments of which character was nice to the target ( $\chi^2(1) = 22.59$ , p < .0001). We preregistered a replication test for the second sample<sup>2</sup>, and again found the same main effect of trial order ( $\chi^2(1) = 14.91$ , p = .0001): Children who saw the limited trial first were less likely to judge the similar character as nice than those who saw the unlimited trial first (M = 0.39 and 0.69 respectively, combined across

both trial types).4

# 3.4. Additional analyses

Pre-registered nested model comparisons<sup>1</sup> also revealed that children's selection of the similar character for either question was not influenced by the type of item (each of the two full models specified in *Approach to Data Analyses*, with vs. without 'type of item'; food or toys' as a predictor;  $ps \ge 0.442$ ). Their judgments for each question were also independent of their beliefs of whether the target received the desired object (nested model comparisons, with vs. without 'whether target received object';  $ps \ge 0.603$ ), suggesting that children's judgments were

<sup>&</sup>lt;sup>3</sup> In the first half of the sample, we also observed an interaction between question order and niceness inference ( $\chi^2(1) = 9.18$ , p = .002), reflecting a stronger effect of question order on children's preference judgments when the different other was judged to be nicer. A test for this effect was included in the second preregistration, but it did not replicate ( $\chi^2(1) = 0.76$ , p = .383).

<sup>&</sup>lt;sup>4</sup> In the first half of the sample, we also observed a trial order by trial type interaction ( $\chi^2(1) = 6.33$ , p = .012), reflecting a larger effect of trial order on the unlimited than the limited trial. A test for this effect was included in the second preregistration, but it did not replicate ( $\chi^2(1) = 0.41$ , p = .521)





not based on what they believed the outcomes of the scenarios were.

#### 4. Discussion

Overall, we find that when resources are limited, 4- to 6-year-old children do not view the expression of shared preferences as a prosocial interaction. This contrasts with their judgments when resources are not limited: In this case we replicate the typical finding that a similar other is seen as more prosocial. Notably, when resources were limited, children did not treat similar choice behavior as neutral or socially meaningless (which might lead to chance responding). Instead, children avoided choosing the character who made a similar choice when judging who was being nice to the target, and systematically chose the dissimilar-choice character as more prosocial. When judging the target characters' affiliative attitudes (liking), children's judgments followed a similar pattern, though to a lesser extent: Pre-registered and replicated trial order effects motivated analyses of the first trial, to best capture children's spontaneous judgments. On their first trial, as predicted, children were less likely to select the similar other as more liked by the target when resources were limited (vs. unlimited).

Overall, the current data show that shared utility plays a major role in children's reasoning about shared preferences and similar behaviors. This reasoning goes beyond a homophily heuristic, such that similarity is taken as evidence of prosociality and affiliation only if the similar individual has decided to promote another agent's goals, needs, and rewards. In addition, this reasoning goes beyond previous findings that similarity can be seen as meaningless or socially neutral when an expectation of homophily is not warranted (Bian & Baillargeon, 2022; Fawcett & Markson, 2010; Jordan & Wynn, 2021; Mahajan & Wynn, 2012). Instead, when similarity implies a lack of shared utilities, we find that children judge it as less prosocial than a dissimilar action. Such judgments reflect an understanding that similarity, particularly expressing a shared preference in the context of a zero-sum resource, has the potential to result in competition and conflict. This suggests that children reason about whether or not similarity is prosocial by considering its underlying intentions and consequences in a complex, causal way. By reasoning about shared utility - how each person values the goals of others - children thereby engage in flexible inferences regarding whether others' similar preferences and behaviors have positive or negative social meaning.

# 4.1. Only shared utility reasoning, or also a homophily heuristic?

Overall, the current data show that shared utility plays a major role in children's reasoning about similar preferences and behaviors. Does homophily also play a role? In particular, in the unlimited resource



**Fig. 3.** Proportion of children (full sample) selecting the similar character, only in the limited resource trial, for each of the two test questions (nice, preference). The left panel shows judgments from children who were first asked to make prosocial judgments (niceness of the behavior) and then infer social affiliation (preference of the target character). The right panel shows judgments from children who were first asked to infer social affiliation and then make niceness judgments. Error bars show 95% bootstrapped Confidence Intervals. As shown, children who were first asked to judge the niceness of the characters' behaviors were overall less likely to select the similar character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation character than children who were first asked to infer social affiliation when resources were limited.

condition we replicate the typical finding that similar preferences are seen as prosocial and affiliative, in line with the predictions of homophily. We believe data from this condition are consistent with two possible interpretations.

First, in this condition, children may be relying on a homophily heuristic. If children believed that the characters' preferences preexisted the observed situation, and were only similar coincidentally, then homophily provides the best explanation. Shared utility does not provide a reason for children to believe that coincidental, nonintentional similar preferences are prosocial, as they do not provide evidence of shared utility (Powell, 2022). In this case, our overall findings would indicate that children use both homophily and shared utility to reason about similar behavior. When these different processes conflict (i.e. in the limited resource condition), shared utility has a larger impact on children's reasoning.

Alternatively, if the characters' choices were viewed as intentional alignment, the overall current findings would be consistent with shared utility alone. Children may plausibly have interpreted the characters' similar preferences as due to intentional alignment, or imitation: By this interpretation, two characters hear what the target character wants; one intentionally matches the choice of the target, while the other does not. Under the shared utility account, imitation provides evidence of prosociality when it signals intentionally adopting the utility and values of the other (Powell, 2022). Similarly, if the characters' choices were viewed as intentional alignment, the overall current findings would be consistent with shared utility alone (without the need to invoke a second explanation, homophily). One important avenue for future work is to test whether children interpret picking the same object in this context as an act of intentional alignment or simply as pre-existing shared preferences; and to ask whether children's judgments of prosociality differ for shared preferences that are intentionally imitative versus pre-existing.

# 4.2. Explaining differences between measures of prosociality versus preference

While our two measures showed similar patterns, children's responding was more systematic regarding the prosociality of the non-targets' behavior, versus the target's social preferences. For example, in the limited condition, children systematically avoided choosing the similar character as nicer, selecting them at a rate lower than chance. However, when asked who the target prefers, although children selected

the similar character less often in the limited condition than the unlimited condition, their judgments did not differ from chance.

Why might children's judgments of the behavior's prosociality be more systematic than their judgments of the target's social preferences? We see two plausible explanations. First, if both shared utility and a homophily heuristic play a role in children's reasoning, children may apply a homophily heuristic more strongly to the question of who is friends than who is nice, in which case preference judgments would be less sensitive to our manipulations. Second, the niceness judgment involves a first-person evaluation of the valence of an observed behavior (was that behavior nice or mean?), whereas the preference judgment explicitly requires reasoning about the mental states of another person. As a result, the preference judgment may require additional theory of mind reasoning beyond what is required by the niceness judgment, and thus be more difficult for young children (Wellman, 2014).

### 4.3. Order effects as evidence of rational social inference

In our dataset, we found strong effects of both trial order and question order, which appear robust: They replicated in a pre-registered analysis of the second half of our sample. The strong effects of order in our findings provide evidence of flexible reasoning, integrating new information — in line with what is expected under a shared utility account, and the rational inference of the naive utility calculus (Jara-Ettinger et al., 2016).

First, the effect of trial order suggests that children have some prior expectation of whether similarity is likely to be prosocial, and that they update this expectation based on experience. In particular, we find that children who first saw the limited resource trial (in which similarity is not positive) carried their belief that similarity was antisocial into the second, unlimited trial — resulting in more negative interpretations of similarity in the unlimited trial than for children who received the unlimited trial first. This suggests that children can update their priors regarding whether shared preferences are likely to reflect shared or unshared utilities, and use these updated priors to interpret subsequent social interactions they observe.

Second, we find an effect of question order, such that children who were first asked to judge who was being nice when resources were limited were subsequently less likely to select the similar character as preferred by the target, as compared to children who were asked about the targets' preference first. This suggests that making the valence of a behavior salient (i.e., that it potentially creates conflict) may allow children to more easily use this information to make subsequent inferences about affiliation (i.e., that the target may not like them). The variation in children's judgments could reflect a conflict between children's beliefs that people who are similar are friends, and that friends (and ingroup members) are nice to one another (Afshordi, 2019; Dunham, Baron, & Carey, 2011; Liberman & Shaw, 2017; Misch, Paulus, & Dunham, 2021; Rhodes & Chalik, 2013).

#### 4.4. Relation to the development of social mindfulness

Recent work has found evidence for a phenomenon termed social mindfulness: Children positively evaluate those who leave multiple options for others when the other persons' preference is unknown (Zhao et al., 2021; for similar work with adults, see Davis, Carlson, Dunham, & Jara-Ettinger, 2021; Van Doesum, Van Lange, & Van Lange, 2013). In this other work, characters choose one of two types of resources; however, those who choose first do not know which option a last character wants. In this context, 6-year-old children, though not 4–5-year-olds, judge that a character who leaves at least one of both options for the last character is nicer. This seemingly reflects an understanding that this 'leaves them a choice': No matter which one the last person wants, they could get what they want.

While highly relevant, the current work contains important differences that lead to distinct theoretical implications and developmental findings from this prior work. Firstly, our task involves a component of similarity and shared preference that is not present in the previous work (Zhao et al., 2021): Because the target's preference was unknown in the mindfulness studies, this removed the potential for the other characters' choices to be either similar or different. As a consequence, our task allows us to ask a notably different question, pitting the role of similarity against reasoning about shared utilities.

In addition, we find an earlier developmental trajectory than this previous work: 4- and 5-year-old children in our study more negatively evaluated the character who requests the limited resource that another person wants. In contrast, when the last character's preference was unknown, children did not appreciate social mindfulness until age 6 (Zhao et al., 2021). In previous work, neither the child nor the characters deciding what to take knew the preference of the character next in line. This likely made it harder to perceive when the character was avoiding taking something another person (might) want — potentially making it more difficult to apply shared utility reasoning. In contrast, in our dataset, the characters and children both knew which resource the target character wanted (but had not yet actually received), and made their choices with that knowledge in mind.

These findings together suggest that reasoning about shared utilities occurs earlier in development than does social mindfulness of others' unknown goals. Reasoning about shared utilities may form a foundation for this social mindfulness; however, more complex reasoning may also be needed to appreciate the prosociality of acting considerately toward others' unknown goals.

#### 4.5. Broader implications and predictions of the shared utility account

Reasoning about shared utilities offers a unifying explanation for previous findings that children view similar behaviors positively in many contexts where utilities align (Over, 2020; Over & Carpenter, 2015; Powell & Spelke, 2018); yet as negative in other cases, where utilities diverge (Olson & Shaw, 2011; Yang et al., 2014). For example, children as young as 5 years evaluate plagiarizers negatively (Olson & Shaw, 2011; Yang et al., 2014), perhaps due to reasoning about potential reputational harm (Shaw & Olson, 2015; Silver & Shaw, 2018). In this case, two people producing a similar design is seen as negative when it indicates non-shared interests. Shared utility thus provides a parsimonious explanation for these results as well, in line with the idea that children's reasoning about shared preferences in the current work may be part of a broader system of reasoning that applies to many kinds of behaviors, not only shared preferences. Future work should test if children are also sensitive to the possible negative consequences of similarity in other situations, such as cooperative situations where complementary rather than identical behaviors are required for the group's success (Warneken, 2018).

The shared utility account makes a number of additional predictions that may be tested in future work. First, because utilities are graded, reasoning about shared utilities should enable graded inferences (e.g., to what extent does A value B's utilities), not merely binary ones (e.g., A values or does not value B's utilities). Future work should test for graded inferences, as a means of testing the quantitative predictions of a formal model. For example, future work could change the cost to the chooser of avoiding what the target character wanted, by specifying that the character in the limited scenario who selects the plentiful item either really likes the scarce item, somewhat likes it, or does not like it at all. This could be accompanied by a utility equation with a term for the chooser's weight on the target character's rewards:

 $U(c) = R(c) + w \ast R(t) - C(c)$ 

where U = utility, R = reward, C = cost, c = chooser, t = target, w = weight on the other's rewards. Lowering C(c) of choosing the plentiful item should also lower the estimate of w, and thus lower the extent to which the action provides evidence of shared utility, in a graded

manner.

Second, shared utility predicts that situations where individuals *revise* their desires to promote someone else's goal should provide particularly strong evidence of prosociality. For instance, imagine that all agents state their desires before knowing the number of available resources; but then, once the limited resources are revealed, one agent changes their choice away from the limited resource, while the other character does not. This choice revision may provide additional evidence that the preference of the character who changes their choice is not driven by pre-existing coincidental desires, but instead by shared utilities. Future work may test the prediction that children take this change toward dissimilarity as even stronger evidence of prosociality than the situation tested in the current work.

Children may also make the reverse inferences and *expect* others to revise their desire for a scarce resource if their friend or group member also desires it. Such findings would provide further evidence that children make rich and flexible inferences about shared utility to explain and predict similarity. The absence of such expectations during the early preschool years would also be informative, and would suggest that other cognitive processes may be at play when predicting others' choices. For instance, children may draw upon their own tendency to share more with friends when predicting whose utility others will act to maximize (e.g., Paulus & Moore, 2014; also see Blake, McAuliffe, & Warneken, 2014; Fehr, Bernhard, & Rockenbach, 2008).

Future work could also compare children's first-person reasoning to their reasoning about third-party scenarios (as tested here). In situations where children themselves play the role of the target character, and the other characters either have shared or non-shared preferences with the child, it may be easier for children to reason about the shared utilities of the other two characters. Future research could explore whether young children view shared preferences negatively in the context of zero-sum resources when they themselves have shared preferences with others, and whether this influences who they prefer or want to affiliate with. Because reasoning about similarity in third-party scenarios requires thinking about greater number of people's behaviors and mental states (e.g., goals and desires), it is possible that children might view shared preferences that create conflict as antisocial at younger ages when their own goals and rewards are at risk, versus the goals and rewards of others.

Lastly, this work raises important future questions regarding group membership, beyond dyadic affiliations. Children likely use behavior, which reflects shared utility between agents, to infer social groups (Cikara, 2021; Powell, 2022); which is the reverse of using social categories to infer interpersonal obligations (Rhodes & Chalik, 2013). Our findings make the prediction that in situations involving limited resources, children may be more likely to infer that agents who express opposing preferences belong to the same social group. Such findings would be informative given that shared social category membership often leads children to predict group members will exhibit the same preferences (e.g., Diesendruck & HaLevi, 2006).

#### 5. Conclusion

Overall, these findings provide evidence that children flexibly reason about the meaning of similarity using a shared utility framework. Similarity is a powerful social cue that is often interpreted positively by children from a young age; we replicated this perception of similarity as both nice and socially preferred in children who initially saw a scenario where resources were plentiful. It was possible that similarity would outweigh reasoning about shared utilities in all contexts; but instead we found that when similarity resulted in competition, indicating that the character failed to adopt another's utilities, children reversed their normal pattern and judged the similar character as less prosocial than the dissimilar character. This reinforces how important children think it is to consider others' desires. Even at age 4–5, when children fail to successfully consider others whose desires are ambiguous (Zhao et al., 2021), we find that considering others' desires is robustly seen as prosocial — and that this outweighs any impact of the behavioral similarity itself. Overall, our findings suggest that children reason about the meaning of similar behavior by considering others' shared utilities, with implications for understanding the nature of children's reasoning about a broad range of interactions and social behavior.

#### Author note

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#### CRediT authorship contribution statement

Madison L. Pesowski: Methodology, Formal analysis, Investigation, Writing – original draft, Visualization, Project administration. Lindsey J. Powell: Conceptualization, Writing – review & editing, Supervision. Mina Cikara: Conceptualization, Writing – review & editing. Adena Schachner: Conceptualization, Writing – review & editing, Supervision, Funding acquisition.

# Data availability

The data and analysis code are available on OSF (link noted in text)

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