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What's fair? How children assign reward to members of teams with differing causal structures

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ABSTRACT

How do children reward individual members of a team that has just won or lost a game? We know that from preschool age, children consider agents' performance when allocating reward. Here we assess whether children can go further and appreciate performance in context: The same pattern of performance can contribute to a team outcome in different ways, depending on the underlying rule framework. Two experiments, with three age groups (4/5-year-olds, 6/7-year-olds, and adults), varied performance of team members, with the same performance patterns considered under three different game rules for winning or losing. These three rules created distinct underlying causal structures (additive, conjunctive, disjunctive), for how individual performance affected the overall team outcome. Even the youngest children differentiated between different game rules in their reward allocations. Rather than only rewarding individual performance, or whether the team won/lost, children were sensitive to the team structure and how players' performance contributed to the win/loss under each of the three game rules. Not only do young children consider it fair to allocate resources based on merit, but they are also sensitive to the causal structure of the situation which dictates how individual contributions combine to determine the team outcome.

1. Introduction

Deciding how to distribute resources fairly is of central importance in society. The question arises in all walks of life, from a teacher deciding how to reward a group of children after a successful project, to a manager distributing a bonus pot amongst her team. This study considers how young children distribute reward to members of a team who have just won or lost a game. We know already that young children can reward based on performance (Anderson & Butzin, 1978; Baumard, Mascaro & Chevalier, 2011; Melis, Altrichter, & Tomasello, 2013), contrary to classic views that they are egalitarian (Damon, 1977; Piaget, 1932). Here we study in two experiments whether children go beyond considering individual performance, and also take into account that what is a fair reward may depend on the causal role that someone's performance played in winning or losing.

1.1. Distributive justice in children

Traditional views on moral reasoning (Damon, 1977; Piaget, 1932) held that children into the early school years simply distribute resources equally, with 5-year-olds showing no sensitivity to contextual information such as performance or need, preferring to share equally among three characters (Sigelman & Waitzman, 1991). A bias toward self-interest can further supersede principles of fairness when the children themselves stand to gain, with recent studies showing mostly egalitarian allocations, including allocations to themselves, only becoming predominant in children at around 6 to 7 years of age (Fehr, Bernhard, & Rockenbach, 2008; Rochat et al., 2009; Smith, Blake, & Harris, 2013). This tendency to distribute without regard to other potentially relevant factors such as individual merit, or need, was often interpreted to be the result of children's limited cognitive processing capacity and social perspective-taking (Damon, 1977; McGillicuddy-de Lisi, Watkins, & Vinchur, 1994; Sigelman & Waitzmann, 1991).

However, a growing body of literature has established that even young children have a sophisticated and differentiated sense for how resources are to be fairly distributed (Shaw, Choshen-Hillel, & Caruso, 2016). Melis et al. (2013) demonstrated that children's self-serving bias can be mitigated by equity considerations from early on: When sharing sweets with a puppet, children at 3 years were more likely to share equally if the puppet had helped them retrieve the sweets, but gave themselves more if the puppet had been unhelpful. Indeed, 21-months-olds are surprised if two characters are rewarded equally, when only

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one has completed a chore (Sloane, Baillargeon, & Premack, 2012), demonstrating that toddlers already expect individuals to be rewarded according to their efforts. When asked to distribute cookies between two characters who put in different degrees of effort while baking them, 3-year-olds first gave one cookie each, but tend to give a third cookie to the character who put in more effort (Baumard et al., 2011). From 4 years onwards, children spontaneously assign rewards based on merit rather than in egalitarian fashion (Anderson & Butzin, 1978).

Children also consider factors other than merit: Children aged three to eight years, increasingly distribute resources according to characters' needs, when both are equally industrious (Rizzo & Killen, 2016). From age four, children can integrate need with merit when both vary (Anderson & Butzin, 1978), and from age 6 children balance multiple moral concerns more widely (Rizzo, Elenbaas, Cooley, & Killen, 2016).

In all these studies children distributed a fixed amount of resources between two characters. It is therefore not clear whether children considered both characters fully. Children could focus on rewarding one character's performance, and simply leave the remainder, without any consideration of the second character's performance. A less ambiguous approach is to let children allocate from two independent resource pots, one for each character. Preliminary work in our lab suggests that 4-year-olds can not only distribute fixed resources between two characters playing a collaborative game, but they also can reward these characters independently for their performance. This independent reward format is adopted for the research reported below.

The studies mentioned so far focus on rewards for positive actions, but one may also consider children's response to a negative act or outcome. This has not been studied as extensively, but in Hamlin, Wynn, Bloom, and Mahajan (2011) 19- to 23-month-old children were more likely to take a treat away from a badly behaved character rather than from the one who behaved well. Similarly, in Kenward and Dahl (2011) helpful puppets were allocated more biscuits than hinderers by 4 ½ year olds. It is unclear whether children actively punished the bad character, or focused on allocation to the meritorious character, but by 4 years children clearly consider intentionally harmful acts punishable, and more punishable than accidentally harmful acts (Cushman, Sheketoff, Wharton, & Carey, 2013; Leon, 1984). Five-year-olds also distribute unpleasant items as punishment to an anti-social adult (Kenward & Österh, 2015) and 6-year-olds punish unfair distributions even at a cost to themselves (McAuliffe, Jordan, & Warneken, 2015).

Taken together, these studies support a view that even pre-school children have a sense of equity and justice that includes merit-based allocation of resources; they can also take more than one factor into account in their distributive decisions. However, to our knowledge, previous research has not investigated whether young children penalize based on performance, similar to the merit-reward relationship. Our major focus, however, is whether children already see agents' performance in context, allocating reward/penalty to individuals not just based on their performance, but also based on how this performance contributes to group outcome.

1.2. Complex group structures and responsibility attribution in adults

Most studies discussed above considered the simplest situation: If effort is directly proportional to outcome, it makes intuitive sense to allocate reward proportionally as well. However, group dynamics are rarely so simple. Unlike effort, outcome may be categorical (winning or losing), not continuous. For instance, what if a given performance threshold needs to be reached for success, and going further beyond this threshold is irrelevant? A running team might qualify only if all members run a minimum time, or a quiz team might succeed as soon as one of its members answers a question correctly. In such cases is it still fair to reward proportionally to individual performance? Similar complications arise when performance is not satisfactory and the team loses. If all members of the running team are below threshold, are they all equally to blame, or does it matter how far an individual was from the qualifying time? These examples highlight the different ways in which an individual may contribute to the group outcome, depending on the causal structure of the situation. Steiner's group functions (Steiner, 1972) formalize three common rules for three different types of causal structure. Under an additive rule, each member still contributes proportionally, up to the threshold for team success, for example, a group of children painting a classroom wall. Under a conjunctive rule, all members need to surpass a minimum threshold for success, for example, school playtime cannot start until each desk is clear. Under a disjunctive rule, only one member needs to surpass a threshold for success, for example, the whole team can win the math quiz if one member knows the correct answer.

It is not straightforward anymore what constitutes a fair allocation of reward when both individual effort, as well as the causal structure of the situation vary. For instance, one might think that one team member may be rewarded more than other team members, if this individual's performance is crucial for winning, as under a disjunctive rule. However, if all are above a given threshold as under a conjunctive rule, would an unequal reward based on differences in performance still be fair? We know from the studies discussed above that children reward based on performance. The present study looks at the extent to which children's reward allocations to individuals are influenced by the causal structures of the game, which determines how important the performance was for the team outcome.

To our knowledge, there has been no research to date exploring how differing causal structures influence children's reward attribution, but recent studies with adults (Gerstenberg & Lagnado, 2010; G&L hereafter; Lagnado, Gerstenberg, & Zultan, 2013; Zultan, Gerstenberg, & Lagnado, 2012) motivated the present work. G&L implemented the three causal structures discussed above as rules within a complex, speeded counting game common to all three structures. Participants counted triangles in a diagram, playing in a team with three other fictional players. Whether a particular round was won or lost depended on each player's accuracy and the team game rule (additive, conjunctive or disjunctive). After each round, participants were informed of the correct answer, with all players' counts shown. Participants then assigned responsibility to the players for the outcome of each round.

One finding was that the relationship between responsibility ratings and a player's performance differed between the three rules. In general, more inaccurate players were given less responsibility for winning and more for losing. This, however, was mediated by the causal structure: Under the disjunctive rule, in which the team won only if at least one player's count was 100% correct, players with small inaccuracies were given more responsibility for the loss and less for the win than under the other rules, where small inaccuracies could still contribute to a team win. Thus, adults considered players' individual performance in relation to the role it played for the team outcome. Here, we investigate how this sensitivity to the causal group structure develops, in two studies with a similar experimental paradigm to G&L, simplified to make it appropriate for children.

G&L's study suggested that adults use a type of counterfactual reasoning (Lewis, 1973) to determine how much responsibility each player deserved for the outcome. This involves imagining an alternative game scenario in which the player arrives at a different count; if this imagined count changes the outcome from actual win to imagined loss (or vice versa), then the player is deemed responsible for the actual outcome. G&L found that participants' attributions were well accounted for by Chockler and Halpern's (2004) modified counterfactual model (also called structural model) in which responsibility depends on how close a player's contribution was to having made a difference to the team outcome.

Children's counterfactual reasoning increases over the age range studied here. While children from age 3 or 4 can consider counterfactual states in very simple circumstances, more complex considerations of what might have been, involving detailed consideration of differences/commonalities between the imagined and real world, as