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Running Head: REASON-GIVING

The early ontogeny of reason-giving

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Abstract

Recent research suggests that the key context within which preschool children learn to justify beliefs with reasons is collaborative problem-solving and decision-making with peers, including in the moral domain, in which they engage with another coequal mind in a cooperative spirit. Evidence for this proposal comes from recent studies in which children demonstrate sensitivity to the common ground assumptions they share with their peer partner in decision-making as well as an ability to provide reasons that are relevant to their shared understanding. Training studies suggest that it is indeed discourse with others about reasons for beliefs that provide children with the appropriate learning experiences. Internalizing this communicative process may be crucial for the process of individual deliberative reasoning.

The early ontogeny of reason-giving

Classic research has shown that school-age children and adolescents can work collaboratively to solve scientific and moral problems, and this collaborative process uniquely facilitates cognitive development (e.g., Doise, Mugny, & Perret-Clermont, 1976; Berkowitz & Gibbs, 1983). Recently, researchers have focused on the epistemological dimensions of the process (see Kuhn, 2015 for a review). The theoretical starting point is children's developing theory of mind because, it is argued, understanding the distinction between an individual's belief and the objective situation is a prerequisite for reasoning (Kuhn & Pearsall, 2000). Understanding that the same reality may be perceived differently by different people incentivizes children working together to take one another's perspective in order to reach agreement (Chandler & Birch, 2010; Iordanou, 2010; 2016).

This research has uncovered many important facts about the process of collaborative problem-solving in school-age children, particularly how the process might work best in educational settings. But to get to developmental origins, recent research suggests that we must start with preschoolers. In our research, we have argued that the most fundamental skill that starts preschool children down the path to collaborative problem-solving is reason-giving. Beyond an understanding that beliefs are corrigible, the key skill for consensus building in collaborative decision-making is the ability of partners to provide each other with justifications for their beliefs, which include both empirical evidence that something is a fact and causal or logical implications that something is a fact (because it can be deduced from something already accepted as fact).

We have emphasized that key to the process are children's species-unique propensities for cooperation and shared intentionality. These include both cooperative motives in which individuals prefer a mutually satisfactory solution over winning the argument – so that partners agree, implicitly, to go with the best reason(s) – as well as

cooperative cognition in which reason-giving is finely tuned to the common ground understanding that the children share about the problem at hand (Tomasello, 2019).

In this paper, we argue for the important role cooperative skills and motivations play in children's successful engagement with peers in any kind of cooperative decision-making. It is well established that, in comprehension, around age 3, children distinguish good from poor reasons (Castelain, Bernard, & Mercier, 2018; Corriveau & Kurkul, 2014; Koenig, 2012; Mercier, Bernard, & Clément, 2014). Most striking, they prefer to interact with partners whom they take to be "reasonable", that is, those who submit to good but not poor reasons (Domberg, Köymen, & Tomasello, 2019). Here, however, we focus on children's developing skills to actively provide reasons to others.

Common Ground

The *sine qua non* of reason-giving is a mutually assumed background of beliefs and values that participants share in common ground as part of cooperative cognition. Coming to consensus about a potential solution to a problem means connecting it to things that both participants already believe and value, and know that they both believe and value. Thus, partners need to present good reasons that are based on appropriate common ground assumptions and accept these good reasons, processes which presuppose a cooperative motivation for making the best or correct decision benefitting both parties.

In Toulmin's (1958) classic analysis of argumentation, there are three key elements: a claim or proposal; a fact; and an assumption (or warrant) that turns the fact into a reason or justification for the proposal. For example, suppose that two people made plans to go for a picnic. One proposes, "We should cancel our picnic" and supports this proposal by referring to the fact that "It is raining". But why does the fact of rain suggest canceling the picnic? It would not suggest canceling a trip to the museum. What connects this claim with this fact or

what turns this fact into a “reason” is the common ground assumption, or warrant, that rain ruins a picnic (because picnics are outdoors, rain falls outdoors, rain gets people wet, people dislike getting wet, etc.). The warrant must be mutually accepted between partners because if one says, “It would be fun to get wet”, then the proposal to cancel the picnic because of rain gains no traction.

Skill in producing reasons relies on an understanding of when assumptions or warrants are shared in common ground and when they are not. In general, if an assumption is already in the common ground of partners (e.g., that rain ruins a picnic), it need not be stated explicitly as a reason. Following this logic, Köymen, Mammen, and Tomasello (2016) exposed 3- and 5-year-old peer dyads to some unusual facts about a novel creature (e.g., selks that eat rocks). In one condition, each child within a dyad learned about these facts but separately, whereas in the other condition, they learned about them together (common ground condition). When asked to come to a correct joint decision about what the novel animal needs, both age groups produced fewest reasons in the common ground condition, typically saying, “Rocks”. In the other condition, in which both children knew what the creature needs but did not know that they shared this knowledge, children more often introduced the warrant, “This is a selk and selks eat rocks”. Even 3-year-olds produced reasons only when their partners are ignorant of them in order to convince them to reach the correct decision.

Other studies have investigated whether young children can gauge their common ground with a partner based only on general cultural facts assumed to be known by everyone (e.g., what is in a zoo). Köymen, Rosenbaum, and Tomasello (2014) asked 3- and 5-year-old peer dyads to decorate a toy zoo and come to a joint decision about how best to place various items. There were conventional items such as animals, cages, etc. and nonconventional items such as a piano. Both age groups produced less informative reasons for the conventional items. For placing a polar bear, they just provided a fact, “Here’s some ice”, assuming that

they both knew in their cultural common ground that polar bears need ice (even though they had not experienced this fact together). But for a piano, they provided more informative reasons like, “Here [beside the visitors], because this musician is playing music for the visitors who are resting.” Thus, children understood what kinds of culturally general facts about zoos they shared with their partner and used this cultural common ground to communicate their reasons efficiently.

The same basic process is at work when children are giving reasons to partners in argumentation around moral judgments. The difference is that now the common ground with which they are making contact not only concerns beliefs, but also values. If we are deciding what to do, and I say “But your suggestion means that innocent children will be harmed”, and you reply “Who cares about innocent children?”, then the discussion cannot proceed because we have no common ground values to act as warrants for our proposals. Mammen, Köymen, and Tomasello (2018) had 3- and 5-year-old peers dyads come to a joint decision about whether a transgressor should get punished. In one condition the transgression concerned an “arbitrary” social rule such as the correct box for certain colored toys; in the other condition it concerned a moral norm such as the need to respect other’s property. Both age groups explained the rule, or the warrant, less often when talking about a violation of a moral norm (they just said “Because he stole” without stating that stealing is wrong) than when talking about a violation of a context-specific rule (they explained the rule explicitly “Because in this kindergarten one has to put yellow toys in the yellow box”). In their moral reasoning as well, even 3-year-old children are sensitive to the common ground values they share with others that do not need to be explicitly stated precisely because they are assumed to be shared.

In all of these studies, 3-year-olds were skillful, but not as skillful as 5-year-olds, in producing reasons efficiently. One possibility is that they were less proficient with the language needed to formulate their reasons. In a recent study, Mascaro and colleagues (2019)

used a nonverbal task and found that when 2- to 4-year-olds' claims were challenged by an adult (e.g., "No, the dog is not there"), the children could correct the adult by pointing to where the dog actually was. Another study gave 3-year-olds a chance not just to correct the adult but to actually refer to some evidence nonverbally. Köymen, Jurkat, and Tomasello (2020) exposed children to two toy animals in the presence of an adult: one clean toy and one whose feet had been dipped in ink and so left traces (which they saw). After each animal had been hidden in one of two houses in an adjoining room, the child and adult entered and saw traces leading to one house but not to the other. When the adult acted unsure about how to solve the problem, asked where each animal was and how the child knew this, children often pointed to the traces as evidence. Importantly, they did this also when indicating how they knew where the clean toy was, thus providing an indirect reason based on exclusion. When common ground is strong enough and nonverbal communication is sufficient, even 3-year-olds are skillful and efficient at reason-giving to reach correct joint decisions.

Counter-arguments, Ranking Reasons, and Meta-talk About Evidence

Common ground is also critical when children must weigh the relative merits of competing reasons in order to reach the best joint decision (Kuhn, 2001; Mahr & Csibra, 2017). Thus, older children can produce counter-arguments that explain why a partner's reasons for their beliefs are not valid (or why their own reasons are more valid), using "meta-talk" (reasoning about reasons) to assess their validity directly (e.g., "Where did you get that evidence?"; Kuhn, Zillmer, Crowell, & Zavala, 2013, p.466; see also Papatomas & Kuhn, 2017). An important question is whether preschoolers can do this as well, since this requires common ground assumptions not just about facts but about the relative merits of different types of reasons or evidence.

Köymen, O'Madagain, Domberg, and Tomasello (2020) presented 3- and 5-year-old

peer dyads with a problem to solve jointly, for example: “A girl must walk to school in the rain. Which of these two boxes contains the thing she needs?”. The target child had been given two pieces of extra information (the umbrella is broken; the rain boots have polka dots). If the partner suggested they choose the box with the umbrella, the target child could raise the objection “The umbrella is broken” and assume that this would serve to reject the suggestion (based on a common ground causal assumption that broken umbrellas do not keep people dry). If the partner suggested they choose the box with the rain boots, the target child could not raise the objection “Boots have polka dots”, as mentioning the polka dots would not make contact with any common ground causal assumptions relevant to their usefulness. The finding was that 5-year-olds, but not 3-year-olds, used the relevant but not the irrelevant information to produce counter-arguments, based on judgments not only about which facts they shared in common ground with their partner but also about which reasons their common ground causal knowledge would deem relevant to the problem at hand.

In some joint decision-making contexts, both partners have seemingly good reasons for their beliefs, so they need to decide whose reasons are better based on evaluative criteria they share in common ground. Köymen and Tomasello (2018) tested whether 5- and 7-year-old peer dyads are able to settle on the best decision by comparing the merits of each partner’s reason. Each child learned about a novel animal, a selk. In the key condition, partners within a dyad were given conflicting facts about the selk, for example, one child heard that it eats rocks, whereas the other heard that it eats sand. Crucially, these differing facts emanated from sources that differed in reliability: one child heard a first-hand report by a selk, and the other heard a second-hand report by a girl who expressed uncertainty. Children of both ages placed more weight on the fact stated by the selk than that stated by the girl, invoking the judgment that an informant with direct knowledge is more reliable than an informant who relies on uncertain hearsay. Importantly, the 7-year-olds, but not the 5-year-

olds, often engaged in discourse evaluating the different evidence they had in comparative fashion. For example, one 7-year-old said, “A girl said that someone told her they eat sand.” The partner then replied, “I had no girl but the selk itself said rocks.” The first child then acquiesced, “Then we take yours.” The children here are not just discussing whether selks eat rocks or sand, but rather engaging in a kind of meta-talk in which they submit to reason and evaluate the relative merits of different types of evidence based on evaluative criteria that they share, and assume that they share, in common ground in order to make a correct decision.

As 5- to 7-year-old children are just beginning formal schooling, then, they are able not just to provide reasons, but to provide counter-arguments for the reasons given by others and to use meta-talk to evaluate reasons and evidence in comparative fashion, using common ground beliefs and values as standards.

Learning to Give Reasons

In many studies, 3-year-old children show basic skills in justifying their beliefs with reasons. But in the more sophisticated tasks, they are clearly not as skillful as 5-year-olds (much less 7-year-olds) in such things as meta-talk about evidence and producing counter-arguments. But with particular reference to counter-arguments, we might expect children to learn to be more skillful if they engage in reason-giving discourse with others employing counter-argumentation (Kuhn & Udell, 2003; Papatomas & Kuhn, 2017). Köymen and colleagues (2020, Study 2) thus encouraged 3-year-olds to engage in collaborative problem-solving discourse of two kinds: one involving the evaluation of the validity of counterarguments and one involving counter-arguments but without evaluation. The general finding was that both types of discourse led the 3-year-olds to produce more counter-arguments in a subsequent test than they did a condition in which they were exposed to no

relevant discourse. Young children can learn to argue in more sophisticated ways by participating in argumentative discourse.

We do not know the mechanism of the effect of discourse on children's developing abilities to give reasons. But a relevant finding is that young children reason in more sophisticated ways with peers than adults, at least in some contexts. Mammen, Köymen, and Tomasello (2019) had 4- and 6-year-old children reason about moral dilemmas with their mother or a peer. They found that children of both ages more often opposed their partner's views and explicitly justified their own views with reasons when interacting with a peer rather than with their mother (see also Kruger, 1992). It may be that mothers' moral judgments are experienced as more authoritative – either because parents are more knowledgeable or because they have more power – whereas the moral judgments of coequal peers are experienced as the expression of personal beliefs that can be negotiated. In fact, children attribute similar authority also to peers with age, depending on the peer's knowledge, social position, etc. (Laupa, 1991; Laupa & Turiel, 1986). The moral domain may be special in some way, but if this represents more general processes, it suggests that discourse facilitates children's developing skills of reason-giving not so much because they are copying this behavior from others (in which case they might learn more from adult experts) but rather they are gaining practice at taking perspectives and negotiating collaboratively with others on an equal footing toward a common end.

A Developmental Proposal

So far, we have emphasized that children's reason-giving requires cooperative cognition (common ground between partners) and cooperative motivation (a cooperative spirit in their discussions). Although most theoretical accounts agree on the key role of common ground, they disagree on the motivation behind reason-giving. Focusing on the

evolution of individual reasoning, Mercier and Sperber (2011) proposed that humans developed skills of reasoning not to improve their own individual reasoning but rather to prevail in argumentation with others. This is what explains such errors of reasoning as the confirmation bias. Tomasello (2014) adopted this general social-communicative perspective, but with an important difference: the key motivation was not winning arguments but coming to a good collaborative decision because the key context was cooperative decision-making in which both partners benefitted. Partners thus argued for their proposal, but in the end submitted to the best reason. As evidence for this hypothesis, Domberg, Köymen, and Tomasello (2018) compared the reason-giving of 5- and 7-year-old peer dyads in a competitive context (only the individual who convinced his/her partner more often would win and get a reward) and a cooperative context (the dyads who made good joint decisions would win together and each child would get a reward). Children in the cooperative context produced more arguments overall and also more “two-sided” arguments in which they gave their own reasons and also engaged with their partner’s reasons.

Our general conclusion is thus that children’s reason-giving rests both on their skills of cooperative cognition – creating and using flexibly the common ground assumptions that they share with their partner – and on their cooperative motivations for coming to the best joint decision in collaboration with a partner who benefits as well. Tomasello (2019) argues and presents evidence that such cooperative skills and motivations are in fact characteristic of human development in virtually all of the psychological domains in which humans differ significantly from their nearest primate relatives.

Overall, then, the developmental picture painted by the studies reviewed here, along with these theoretical considerations, is this. Infants and toddlers are capable of thinking and making inferences on their own; as individuals, they form beliefs about how the world works. Then, as young children, they start communicating with others, especially in a conventional

language, and in such interactions their beliefs about things are often called into question. This kind of perspective-shifting discourse is in fact what leads children to an understanding of the distinction between individual subjective beliefs, on the one hand, and the objective situation independent of those individual subjective beliefs, on the other (Lohmann & Tomasello, 2003; see Tomasello, 2018, for a review and theoretical account).

Once children understand beliefs, there then arises in certain contexts, especially cooperative problem-solving and decision-making (especially with peers), the need to resolve conflicts among beliefs. Once again, it is discourse with others that provides children with the raw materials, as evidenced by the training study of Köymen and colleagues (2020). The mechanism by which this raw material is leveraged into developmental change is not certain. On the one hand, it might be that in discourse with others children hear reasons expressed, and they simply socially learn those reasons and use them. But in the training study of Köymen and colleagues, children did not learn specific reasons from their discourse training because the test materials were novel – so at the very least there had to be some kind of generalization. Alternatively, it might be that in cooperative decision-making children are prompted into re-examining their own reasons for their beliefs, without regard to any specific reasons given by a partner, and on this basis buttress their beliefs with “better” reasons. The finding that in some contexts young children are more sophisticated reasoners in interaction with peers, rather than adults, might suggest that it is indeed this internal process of re-examination of their own beliefs (requiring some executive-level processes) that is the key driver of change.

Finally, we might speculate that individual deliberative reasoning – in which the child engages in a kind of endogenous discourse, weighing the different reasons for possible beliefs to come to the best individual decision – is a kind of Vygotskian internalization of the back-and-forth process of perspective-shifting discourse that children experience in

cooperative decision-making with others.

Future Challenges

Investigating the developmental origins of reason-giving is just beginning. We have argued here that children's skills and motivations of reason-giving are part and parcel of their more general cooperative approach to all kinds of social interaction. But it is possible that this works differently in different domains; for example, an important question is whether the process is similar across all domains of development, including the moral domain in which the common ground foundation is more about values than facts. Also important is the question whether the process is similar with all kinds of interactants and whether this interacts with domain. Thus, it may be that children are more sophisticated reason-givers with peers in the moral domain but with adult experts in more scientific domains. We also do not know the mechanism by which the developmental changes reported here – e.g., in skills of counter-argumentation and meta-talk – are produced, whether more by social learning from adults or more by endogenous processes of identifying and resolving contradictions. And it would be extremely interesting to know whether individual deliberative reasoning is in fact a result of, or made possible by, reason-giving discourse with others.

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