Evolution of human cooperation in *Homo heidelbergensis*: Teleology versus mentalism

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ABSTRACT

The main thrust of this paper is to argue that teleology is the way by which we tend to understand ourselves and others in routine cases. Since teleology has an inbuilt slant towards cooperation, it may be the essence of what made *Homo sapiens*, starting with *Homo heidelbergensis*, the cooperative species it is. We present the critical features of the teleological approach in terms of justifying reasons for action. These features differentiate teleology from theory of mind (theory theory) and mental simulation. Our emphasis on justifying reasons also distinguishes our teleology from other approaches under the same heading. We also point out the limitations of teleology when it comes to competition, understanding subjective mental perspectives and cultural differences. Although our grand picture is speculative, we firm up our claims with data from children's cooperation and their appreciation of competition that appear in stages reminiscent of Piaget's view on development.

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Evolution

In his *Natural history of human thinking* Mike Tomasello (2014) made an eloquent case for cooperativeness as the decisive trait in human evolution. He speculated that it might have emerged in *Homo*

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heidelbergensis: "Paleoanthropological evidence suggests that this was the first hominid to engage systematically in the collaborative hunting of large game, using weapons that almost certainly would not enable a single individual to be successful on its own, and sometimes bringing prey back to a home base (Stiner, Barkai, & Gopher, 2009). This is also a time when brain size and population size were both expanding rapidly (Gowlett, Gamble, & Dunbar, 2012)" (pp. 36–37).

While some apes' joint activity, e.g., chimpanzees' group hunting of monkeys, may look complex, it is likely no more than "a kind of coaction in which each individual is pursuing his own individual goal of capturing the monkey" (p. 35). In contrast humans cooperate on a much broader and permanent basis and from very early on, as young as one year with significant developments until three years of age. This "cooperative turn" in evolution requires a new form of second-person social engagement with a commitment to joint goals. "What emerges for the first time with early humans, in the current account, is a 'we' intentionality in which two individuals engage with the intentional states of one another both jointly and recursively" (p. 47).

Tomasello's approach is based on the assumption that our naïve psychology for predicting and explaining behaviour is based on mind reading abilities (theory of mind). On this view, cooperation, in particular cooperative communication, needs complex embeddings of intentional mental states. For instance, in the object choice task, in which participants know that one of several containers has been baited but do not know which one, chimpanzees need many trials of learning to be able to appreciate a helpful cue like pointing. Children even as young as 2 years old pick up on the cue quite readily (Tomasello, Call, & Gluckman, 1997). Children do so much better than chimpanzees on this task because, according to Tomasello (2014, p. 57), they are able to think in terms of embedded mental states: "With respect to inference, the key point is that the inferences used in cooperative communication are socially recursive. Thus, implicit in all of the foregoing is a kind of backing-and-forthing of individuals making inferences about the partner's intentions toward my intentional states. In the object choice task, for example, the recipient infers that the communicator intends that she knows that the food is in that bucket – a socially recursive inference that great apes apparently do not make."

Explanations of behaviour that rely so heavily on the understanding of mental states and recursive embedding of these states we call *mentalism*.

Tomasello's mentalist view of the cooperative turn assumes that *Homo heidelbergensis* inherited from the great apes the understanding of individual goals and added to this understanding joint goals and joint attention enabling joint action: "Joint actions, joint goals, and joint attention are thus of a piece, and so they must have coevolved together" (p. 44). In short, instead of Tomasello's incremental step in evolution, we propose a fundamental change. *Homo* switched from a view of behaviour as pursuit of individual goals to teleology (Perner & Roessler, 2010), that is, *Homo* in contrast to great apes (and other animals) developed an understanding of actions which are done for reasons. Teleology frames goal directed behaviour as *intentional actions*, behaviour for which there are good *reasons* that justify the behaviour. In working out this position, it became apparent that teleology is a most natural ally of cooperation (Roessler & Perner, 2015). Teleology may thus provide an alternative to Tomasello's view about the mental changes enabling the cooperative turn in human evolution.

To make our view intelligible we first explain how we understand the notion of reasons (in the section Reasons) and how they differ from causes (in the section Causes). In the section Three views of human action, we contrast teleology with the dominant views on how we understand human action, theory of mind and simulation. In the section Three principles of teleology, we state the main principles of teleology, contrast our teleology with another prevalent use of this term in the section Teleology versus teleology, and then in the section Developmental steps towards teleology, we speculate how teleology might emerge over the first 3 years in human children. In the section The cooperative turn, we return to our claim that teleology provides a good basis for cooperation. We argue that the cooperative turn in human evolution can be based on teleological reasoning by showing that the examples adduced by Tomasello in favour of an evolutionary propensity for embedded mental states can be covered by teleology. The section Limits of teleology outlines the limits of basic teleology and how these limits can be overcome in children. The section Links to the brain gives a brief foray into potential links to brain areas and the last section concludes.

Reasons

Reasons for acting are thoroughly familiar to us. We routinely invoke reasons in explaining why we are doing what we are doing, and this practice is hardly a marginal feature of the common sense view of intentional actions. Following Anscombe (1957), one acts intentionally when one acts for a reason that could be articulated in answer to the question why did you do that? Anscombe seems to imply that the performance of intentional actions is bound to the agent's ability to articulate the reason for which he is acting, i.e. that he is able to ascribe to himself that he is acting intentionally for a particular reason. We resist this implication and strictly distinguish between the execution and the ascription of intentional actions: To *ascribe* intentional actions to oneself as well as to others and to distinguish them from non-intentional actions, one has to be able to grasp the notion of reasons. In order to understand for example why Paul is taking a shower, we ascribe reasons to Paul for performing this action in order to explain it as an intentional action. To *perform* an intentional action on the other hand, one does not necessarily need to be able to ascribe to oneself the thought that one is performing an intentional action: The prelinguistic child opening the door because she heard that her mummy arrived or the chimp hiding the food because he noticed that he is chased by conspecifics, are acting intentionally, i.e. they are acting for reasons but they do not necessarily know that they are acting for reasons. On our view, the performance of an intentional action at a basic level is bound only to the ability to achieve a desired goal[1] and not also to a reflective understanding that one wants to do so or that one wants to achieve a goal for this or that reason.

Our objective in this paper is to argue that the distinction between our understanding of action and the understanding other animals may have about goal-directed behaviour consists of our understanding of *reasons* for action. We not only reject Tomasello's claim that non-human animals understand basic forms of intentional actions as intentional actions, i.e. that they understand something about reasons for acting (e.g., Tomasello, 2014, chapter 2). More importantly we also reject his claim that understanding reasons on an elementary and fundamental level involves mind reading abilities, i.e. is based on the ascription of mental states as internal causes of intentional actions.

The notion of objective non-mental reasons

Objective reasons need to be distinguished from subjective reasons: Objective reasons are circumstances in the world, while subjective reasons are the contents of mental states like beliefs and desires. To understand for example that someone is trying to reach the bus, I only need to understand what the goal of his behaviour is – his goal is to catch the (publicly perceivable) bus – and what is appropriate to do in his situation to reach this goal; I do not have to understand anything about his subjective reasons as given by the contents of his mental states. In other words, to understand something about reasons on a very basic level, i.e. to understand that sentient beings act for reasons, I do not need to take into account unobservable "internal" mental states. Objective reasons are typically non-psychological facts that justify or 'count in favour of' doing something (Scanlon, 1998).

We will argue in this paper that failure to distinguish objective from subjective reasons leads to an over-intellectualisation of our everyday explanations of others' actions, of young children's mind reading abilities, and of our cooperative ancestry.

Goals are the ends of actions and their desirability provides the objective reasons for acting. Instrumental facts of the world, i.e., facts about which acts lead to the goal, determine the means for getting to the end. For a state of the world to function as a goal it must be considered attractive, desirable, needed, or "good" in some minimal sense. "Why," we might ask, "do you go to the cupboard? Because," you might respond, "To get my chocolate. Why are you getting your chocolate? To eat it. Why do you eat chocolate? Because that makes me feel good." And we all understand that someone feeling good is worth pursuing.

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[1] Not every goal-directed action is an intentional action. If an agent is not able to suppress his goal-directed action or to guide its execution intentionally, he does not perform an intentional action.

This simple example shows that not only your actions become intelligible to yourself because they are means to an appealing goal, but also to those to whom you give your justifying explanation. For you to explain to us that you went to the cupboard "because I *wanted* to," i.e. with recourse to a mental state, would be most unsatisfactory without at least indicating what made the action appealing. As Davidson (1963, p. 685) put it: "We cannot explain why someone did what he did simply by saying the particular action appealed to him; we must indicate what it was about the action that appealed." Only with final recourse to a goal, which we can understand as desirable, can we deduce the attractiveness of your instrumental actions.

In short, justification, explanation, or prediction of intentional actions is based on pursuit of a goal, which makes this kind of action explanation a case of teleology. The teleology is, however, of a special sort. It is based on justifying objective reasons for action and requires the goal to be understood as an inherently attractive, appealing, desirable, … a minimally "good" state of the world.

Causes

The ascription of intentional actions is tied to reasons that can be given in answer to questions about why one did something. However not every answer to a why question is a reason. Notably, one often answers with causes of what happened. "Why did you get wet? Because I was pushed and fell into the pool." Here the answer is a cause of getting wet. Since no justifying reason can be given for falling into the pool it does not count as intentional. In contrast, "because the house was on fire" reports a reason that justifies an intentional action of jumping into the pool.

It is often difficult to distinguish reasons from causes for why something happened, in particular when a mental state figuring subjective reasons is given as answer to a why question. Consider Mistaken Max in the false belief task (Wimmer & Perner, 1983). Max did not witness his mother moving his chocolate to a new location. He goes to the old location to get his chocolate. When asked why he went to the empty location he might answer "because I believed the chocolate was in there." So it seems his belief justifies his lack of rationality – getting chocolate from an empty cupboard. However, here we have to make a subtle distinction. His having the belief is the cause of his action; what he believed (the content of his belief) he can use to justify his action. To make this clearer, consider the following example (freely after Hyman, 1999): Being stalked gives a good reason to phone the police. To actually phone the police one has to believe that one is being stalked, but the belief is not the justifying reason, only the believed fact that one is being stalked is a good reason. The fact that one believes one is being stalked can also become a reason but for different actions: it is good reason to phone one's psychiatrist, not the police.

One should not get the impression that justifying reasons and causes are mutually exclusive. Far from it; reasons can be and often are the causes of action. Take the example of jumping into the pool because the house was on fire. It is true, the fire can only be a cause of jumping if it is perceived and the perceived threat leads to the jump, i.e., there must be a causal chain of mental processes mediating between the fire and the jump. The necessity of a mediating causal chain does not speak against the fire itself being a cause of the jump. It is a cause on the interventionist view of causation put forward by James Woodward (2003; see also Perner & Roessler 2010, pp. 208–209 for an application to teleology). If one had extinguished the fire on time the jump would have become much less likely. Also common sense tells us that to understand a causal connection between two events, e.g., flipping the switch causes the light to go on, one does not need to also understand all the intervening causal steps; fortunately, as there are infinitely many of them. An electrician will know more about these intervening steps, but even she will not be able to specify how each electron will affect its neighbour, etc. However, with her electrician's understanding of some of the intervening causes she can better help when something goes wrong, where most laymen fail.

Similarly, we can understand that fires cause (under certain circumstances with some likelihood) jumps into the water without having to understand the necessary mediating causal chain of mental and neural events. This is the shallow causal understanding of the teleologist. The mentalist has a deeper understanding which enables her to understand deviant cases, like in the false belief task. Mistaken Max has objective reasons to go to his chocolate's actual location but he goes to the empty location. To understand this one needs to understand something about mental states like beliefs, i.e., to understand

something about *subjective* reasons. To understand subjective reasons one has to understand that different persons can have different belief contents (or wishes) about one and the same object, event or fact in the world, i.e. one has to understand that different persons can simultaneously have different mental perspectives on the same situation.

The difficult question about teleology and causality is about the causal influence of goals. Goals are non-existing states of the world yet to be achieved. They cannot be intervened on and in general possible future states cannot cause earlier events (the action that brings about the goal). Perner & Roessler (2010) suggested that it is not the goal state in the future that has causal power but the desirability of that state.[2] The desirability exists at the time of the action – so no violation of time's arrow – and it can be intervened on by, e.g., devaluating the goal. If a goal's desirability is played down it will not cause actions to obtain it.

To avoid confusion of different kinds of causes we make clear that the distinction between reasons and mental states is not the same as the distinction between distal and proximal causes. They are both proximal causes. Distal causes are the evolutionary conditions that led to the causal link between observable conditions (that provide reasons), mental states, and action.

Three views of human action

The main contenders for explaining how we understand and predict behaviour are the theory theory (Churchland, 1984; Gopnik & Meltzoff, 1997) and simulation theory (Gordon, 1986; Heal, 1986). To get a more concrete feel for the difference between theory, simulation, and teleology, consider Bernhard the baker. Why does he get up every day at the ungodly time of 3 o'clock? Bernhard has to have the bread ready by 7 and he can only deliver it by 7 if he gets up at 3. Under these conditions, it seems clear that Bernhard has a good reason to get up at 3, and that this furnishes a good explanation of his action: he is getting up at 3 because the bread needs to be ready by 7 and he needs 4 hours to prepare it. Importantly, not only Bernhard but also those who find his action rationally intelligible need to 'put together' the end and the means that inform his action. In other words, we all need to appreciate the force of a practical inference to the conclusion that Bernhard has a good reason, or ought, to get up at 3.

It is important to note that in this explanation we did not resort to subjective reasons, like "Bernhard believes that *he should get up at 3 o'clock*" or "He desires that *the bread be ready by 7 o'clock*." We only referred to objective facts surrounding Bernhard; facts which not only Bernhard himself but any person who can see these facts will understand as objective reasons for action.

The explanation we just gave here is a teleological one and seems the most natural. Let us now consider what an explanation in terms of a theory or a simulation account would look like.

Theory theory

To explain Bernhard's strange habit to get up at 3 o'clock using a theory of mind, we would have to know something about Bernhard the baker to infer what Bernhard wants and believes. His training as a baker and being a good citizen made him want to keep his customers. His training as a baker gave him the knowledge/beliefs about how long it takes to get bread ready. He has been told that the bakery wants his bread by 7. He can figure out that he has to get up at 3 to get it ready by 7. Since he wants to satisfy his customers and knows that he needs to get up at 3 to satisfy his customers, he will get up at 3.

Two aspects are worth commenting on. (1) The explanation in terms of wanting and knowing/believing does not add anything to the earlier explanation in terms of objective reasons (at least not in this common case where no problems of misinformation or lack of information occur). (2) We do not really know enough about Bernhard to infer whether he really wants to satisfy his customers and

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[2] This makes it different from Aristotle's *causa finalis*: "the end, that for the sake of which a thing is done" (Falcon, 2015). For us it is not goals but the desirability of goals that can figure as a cause in the sense of being a difference maker (Woodward, 2003).

knows/believes the relevant facts. The best we can do is to assume that all this comes with being a baker, which puts us back to general reasoning about when a baker has to get up.

A theory of mind explanation has to defer to beliefs (knowledge) and desires because it focuses exclusively on internal mental states as causes of intentional behaviour and typically side lines any role of objective reasons, i.e. reasons which are provided by circumstances in the world with which the agent is confronted. It runs in the tradition of the causal theory of action (Brand, 1984; Davidson, 1963; Searle, 1983) which states that a person's doing something is an action if it is caused by a mental event. In the theory of mind research these causal regularities are thought to form the tenets of the adult theory, which "are perhaps best summarised by the 'practical syllogism': 'If a psychological agent wants event y and believes that action x will cause event y, he will do x" (Gopnik & Meltzoff, 1997, p. 126).

A causal theory for predicting and understanding when organisms will do what is greatly helpful. Nevertheless, it is not how we view ourselves as agents. We do not see ourselves as being made to act by unobservable internal states. We see ourselves as acting for reasons, which are provided by publicly accessible circumstances in our surroundings. And so – our claim – we consider others to be and act like us; we see them as acting for good reasons. In that respect theory of mind is missing out on a most central feature of our common sense view of action because it ignores objective (i.e., publicly accessible) reasons for acting.

Simulation

Simulation theorists maintain that we understand Bernhard's actions by simulating Bernhard's first-personal practical reasoning. Simulating practical reasoning means reasoning, in what is described as imaginative identification with Bernhard in 'pretend-mode', from the relevant facts of the situation, e.g., 'I have to get the bread ready by 7 and it takes me 4 hours to do so,' to the conclusion, 'I need to get up at 3'.

The obvious question is why we should go through the rigmarole of pretend reasoning when we may reason, more straightforwardly and without any pretence or imaginative identification, from the facts of the case to the conclusion that Bernhard ought, or has a reason, to get up at 3. After all, we endorse the premises of the practical inference in question, and there is nothing idiosyncratic about the rules of inference that license its conclusion. In other words, given the background assumption that one shares Bernhard's outlook on the situation, one can make sense of his action by employing teleological reasoning.

Moreover, the pretend mental states posited by simulation theorists (Goldman, 2006; Gordon, 1995) are controversial and – to our mind – undermine the natural appeal of simulation (Perner & Brandl, 2009; but see Goldman, 2009 reply). Teleology can do without such pretence. Using teleology we simply see the objective reasons as they present themselves as facts as we see them from our own view of the world, our own perspective. There is no need to pretend to be someone else.

Teleology

When describing the case of Bernhard the baker, we naturally provided reasons for explaining his unusual behaviour of getting up at 3 in the morning. This made it a natural explanation, which makes us think that teleology is our standard way for making sense of what people are doing. The use of a theory of mental states as assumed in "mentalising", or imaginative identification as assumed in simulation theory, remain the techniques for special cases.

One might object that an explanation in terms of reasons feels so natural in Bernhard's case because his case is special. He behaves according to a social script for bakers. But search for reasons is also triggered by observing unusual behaviour: when I see a person walk along the horse sleigh trail with a little shovel picking up every substantial specimen of horse droppings and putting it into a plastic bag I can infer that he wants to collect horse droppings. This does not tell us any more than that he *is* collecting droppings. We still want to know why he (wants to collect) collects these things. The puzzle is solved only when I learn that the person clears the droppings of the trail so that others will not step into them, or that the person grows roses and horse droppings are the best manure for roses. A

teleological explanation is not satisfactory unless the explanatory chain reaches a point where one can see something desirable being achieved, but it can go beyond a standard social script.

To use teleology for interpreting and predicting behaviour, we need more than just good reasons. For interpreting and predicting actions with teleology, we specify the following three principles and a pragmatic constraint:

1 Publicity: Objective reasons are objective facts and publicly accessible.
2 Normativity: If there are objective reasons to do something then one should do it.
3 Explanatory power: People do what they have reason to (should) do.
   3.a Competency: Of all the reasons people have to act, they will only act on those for which they are competent[3] to do so.

Three principles of teleology

Objective reasons are public facts

Basic teleology assumes objective reasons for actions. Objective reasons are objective facts. Objective reasons are (usually non-psychological) facts that justify or 'count in favour of' doing something (Scanlon, 1998). Objectivity of goals as reasons requires that the desirability (or goodness) of the goal be conceived of as objective and, hence, publicly accessible.

This requirement of objective desirability can easily be misunderstood. We illustrate one such misunderstanding with an example from developmental psychology. Repacholi & Gopnik (1997) showed that children as young as 18 months understand the subjectivity of preferences in the context of a choice between broccoli, which children dislike, and crackers, which they like. Repacholi and Gopnik interpreted their finding to show that children as early as 18 months understand something about subjective perspective on desirability. But children's responses do not speak to that. Perner (2004; Perner et al., 2005) argued that children's actions show an understanding of objective desirability of goals: their actions are governed by the objectively desirable goals to give broccoli to broccoli lovers, and something else to broccoli haters. Children's sensible actions thus do not demonstrate an understanding of conflicting mental perspectives in the same sense as passing the false belief test does, where children have to understand that Mistaken Max has a different perspective on where his chocolate is from their own perspective. The relevance of desires as objective goals and true beliefs of objective facts is understood early. How subjective views on goals (subjective desires) and on facts (beliefs) modulate action is understood around 4 years (we come back to this in the section Limits of teleology).

Reasons are normative for everyone

Since at the fundamental level reasons are objective, they provide reasons for anyone to act. This makes it a central feature for cooperation. For illustration we use the example of a young mother and her hungry baby on the train. The baby's need for food provides a good reason to feed the baby. Since the mother is equipped to do so, and it is her social role, we expect her to do it, rather than the passenger sharing their compartment (see the section Competency). However, a teleologist passenger will also be moved by the need for feeding the baby and the need to give him the bottle. So, when the mother is busy storing away the buggy, etc., an empathetic onlooker, who keeps track of the unfolding situation and registers how new reasons for action arise, is poised to help out since he is aware of what is needed: give the baby the bottle, help with the buggy, etc. The empathetic teleologist is thus tuned to cooperation and is poised to produce helpful behaviour.

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[3] Importantly we mean "competent" in its two connotations of having the needed (1) practical ability and (2) the societal license or responsibility.

Explanatory power

The cooperative power of teleology comes from the objective desirability of goals. If something is desirable people will be poised to take the needed action to bring it about. At the same time it is severely limited for predicting actual behaviour. Nobody could ever pursue all goals that are worth while pursuing. A selection has to be made. Teleology makes this selection on the basis of enabling conditions in the widest sense which we characterise as *competency*.

Competency

Reasons for acting are necessary conditions for intentional action to occur, but do not provide sufficient conditions for predicting which actions will actually occur. Competency to act provides additional constraints. Competency and reasons together approximate sufficient conditions. Only if a person is competent to pursue a goal will she take the needed actions. We use competency in both of its senses as being competent in executing the needed instrumental actions (practical ability) and in its sense of having the agreed (societal) license or responsibility to carry out the needed action.

Competency can also be illustrated with our example of the young mother on the train. The hungry baby's crying gives everyone reason to give the baby her bottle. Clearly the mother is more competent in that the baby will be happier if the mother feeds her than a stranger, and it is the mother's responsibility to take care of her baby. Hence the teleologist will predict that the mother will feed the baby and it would be inopportune to take over that responsibility. However, the teleologist will stay poised to help out when the need arises.

Another important factor regulating when people will act on good reasons is their ability to do so. If the young mother is tied down with storing the buggy, she cannot at the same time give her baby the bottle. She will do so later when she is able to or she will ask for help.

The ability to act depends not only on physical constraints but also on informational factors. Teleology recognises that having informational access to the relevant facts is a prerequisite for action. The, for our discussion, important point is that mentalising is not needed to become sensitive to the importance of people's access to relevant information. The teleologist just has to recognise when a person has a particular relationship to an event in the world, e.g., the mother with her headphones cannot hear her baby crying (see the section Can a teleologist communicate intentionally? for a more detailed discussion). For this the teleologist need not construe people as entertaining mental representations of events in the world. Mentalising only becomes relevant for covering unusual cases, which go beyond the teleologist's fundamental understanding.

Teleology versus teleology

As we propose teleology as our main way of understanding people's behaviour, we should make clear how our version of teleology differs from other versions. Teleology draws its name from being goal oriented. We follow here the notion of teleology elaborated by Perner & Roessler (2010, Roessler & Perner 2013), which – among other features – emphasises goals as inherently value laden. Teleology with inherent values is reminiscent of Aristotle's conception of 'teleological causation', where the explanatory force of a goal is inseparable from its evaluative properties: the goal is 'the good to be achieved' (Charles, 2012, p. 227). We may call our version, therefore, Aristotelian teleology.

This Aristotelian notion of teleology differs from an influential use of teleology in cognitive development by Gergely & Csibra (2003; Csibra & Gergely 1998). The common denominator is goal orientation but the differences are many.

1 Lawful generalisation: Gergely and Csibra's teleology stands in the tradition of the theory-theory. The suggestion is that infants find rational actions intelligible by employing a 'teleological' schema of action explanation in terms of lawful generalisations, which relate a possible future state, situational constraints, and the behaviour that is to be predicted or explained. The agent's goal can be inferred by, e.g., observations of *equifinality*: "Heider (1958) argued that one stimulus basis for identifying the particular goal of an agent lies in the equifinal structure of his actions: the goal of a rational agent can be discerned from observing that under varying environmental conditions his

different actions result in one and the same consequence." (Gergely, Nadasdy, Csibra, & Biro, 1995, p. 171). Knowledge of which actions can bring about this goal under the observed situational constraints allows children to predict that the most efficient of these actions will be taken. On this view, goal pursuit is construed as in cybernetics. A system is set up so that it responds to different circumstances in such a way that it ends up in a particular state (the goal state). We therefore dub this the "cybernetic view of goal pursuit". In any case, it seems clear that the cybernetic schema need not involve any reference to the end state's desirability or attractiveness – which is simply seen as that state towards which the system tends to go. In our view – to paraphrase our earlier (the section Reasons) quote of Davidson – we cannot simply say a particular goal attracted him; we must indicate what it was about the goal that was attractive.

2 Evaluative properties: In Gergely and Csibra's view the teleologist infers from the movements of an agent the agent's goal. The goal need not have any understandable appeal to the teleologist. The goal's explanatory force is divorced from its evaluative properties, in contrast to the Aristotelian view. Instead of a general appeal of goals as something that gives reason to all to pursue their conception of goals is individualistic; another critical difference to our view.

3 Individualism: Gergely and Csibra conceive of goals belonging to particular agents. This has the great advantage of explaining why a particular agent is pursuing the goal and not everyone else. Its disadvantage from the point of view of explaining our natural inclination for cooperation is that any incentive for cooperation must come from outside by assuming a tendency to cooperate and to form shared intentions in terms of mutually embedded individual intentions (Bratman, 1992). Our Aristotelian view takes the exact opposite tack. It makes goals universally appealing giving everyone reason to bring about the goal. It then uses competency considerations to explain why only some agents contribute to goal achievement. In short, our notion of teleology puts the general appeal conducive to cooperation first, and sets the limiting constraints for individual involvement later: we first feel that we should get involved and then ask whether our involvement is needed or wanted.

4 Rationality: Csibra & Gergely (1998, p. 255) state as principle of rational action "that an action can be explained by a goal state if, and only if, it is seen as the most justifiable action towards that goal…" They equate rationality with optimality and use "justifiable" in the sense of theoretically explicable. The ascription of goals, on their view, does not possess an evaluative dimension, i.e. goals are not judged as being valuable. For us an action counts as rational if an acceptable reason can be given in favour of it. "An account of rationality is an account of the capacity to perceive reasons and to conform to them" (Raz, 1999, p. 355). We now try to make use of having distinguished two kinds of "teleology" by proposing that children might develop a teleology based on objective reasons out of a cybernetic understanding of goal pursuit.

Developmental steps towards teleology

Our core suggestion is that at a *first level*, from 6 to 12 months infants gain competence in three areas which they later combine into a reason based teleology. They start to master (1) the cybernetic scheme of goal pursuit, they learn about the (2) value of actions and objects from emotional reactions of their caregivers (social referencing), and they develop (3) means-end reasoning, i.e., the ability to figure out what they have to do in order to obtain a desirable outcome. At this level infants' understanding of behaviour may resemble that of non-human primates with the exception of social referencing, for which there is little evidence in apes (possibly in dogs: Merola, Prato-Previde, & Marshall-Pescini, 2012).

Around 6 months infants realise that hands tend to move to the same object regardless of the object's position (Woodward, 1998). Around 9–12 months infants expect objects to take different routes to an end point depending on the environmental constraints (for review: Gergely & Csibra, 2003). There is no evidence that infants consider the end point as particularly desirable. In the second half of their first year when infants become mobile, they begin to reference their mother's facial expression (social referencing: Campos & Stenberg, 1981) before approaching a novel object (Hornik, Risenhoover, & Gunner, 1987) or venturing over a visual cliff (Sorce, Emde, Campos, & Klinnert, 1985). Around this age infants also begin to use means-end reasoning when they become able to recombine "secondary circular

reactions" (Piaget, 1936). There is still controversy when this ability emerges but perhaps between 6 and 8 months (Willatts, 1999).

On a *second level* culminating at around 18 months infants, unlike apes, put these pieces of understanding together. They combine the cybernetic goal pursuit with the evaluative properties of goals experienced in their own actions and in the emotional reactions of other people. This results in a teleology based on the desirability of goals which provides good reasons for acting. This achievement is evidenced by infants' natural tendency to help achieve attempted goals. Several studies have shown that infants starting at around 14–18 months have a natural tendency to help others solve their problems (for example, infants pick up an object and hand it to someone who tries to get the object but cannot reach it or is otherwise occupied), even when it is a stranger and they will receive no benefit at all (Warneken & Tomasello, 2007). Apes, besides some human raised ones, who do show some forms of helping in interaction which human caregivers, do not show much of a tendency to help others (Warneken and Tomasello, ibid.).

At 18 months infants infer from failed actions on an object the intended goal and produce the goal when being handed the object (Meltzoff, 1995). Most notably in contrast to infants' apparent interest in figuring out what the point of the model's actions could possibly be chimpanzees show interest only in the object (Wobber, Herrmann, Hare, Wrangham, & Tomasello, 2014[4]). Children apparently expect something desirable to result from intentional action. In contrast, apes unless it infringes on their current goals do not expect a good reason for others' actions, so they are not interested what the point of such action might be.

The data from Repacholi & Gopnik's (1997) study mentioned earlier show that from an adult's positive emotional signal when tasting broccoli, 18-month olds infer that this broccoli lover eating broccoli is a desirable state and therefore help bring about this state by handing her broccoli to eat. Whereas 14 month olds hand the broccoli lover and the cracker lover the tasty crackers, presumably they are still governed by the observed regularity that most people eat crackers but not raw broccoli. At this age children are also observed to show empathy with other people's mishap and help out with appropriate consoling helpful actions (e.g., offering their own teddy bear when the other person's teddy bear was broken; Bischof-Köhler, 1988; Zahn-Waxler, Radke-Yarrow, & King, 1979).

On a *third level* of children's understanding intentional actions as driven by reasons, the linguistically mediated interaction with others becomes important, starting around 24–30 months. Talk about reasons for action makes reasons for actions and evaluations negotiable (Dunn & Munn, 1987). Children learn for example that eating chocolate is not good for dogs, while on the previous level they may have thought that it was. Children learn to defend their actions by providing sensible reasons. They realise that a chain of reasons must not only be coherent but must ultimately end in something intuitively desirable, or else it will not be convincing (Astington, 2001; Bartsch & Wellman, 1995).

The linguistic encoding of reasons makes them applicable to more abstract cases. Children learn to display commitment to joint activities (Warneken & Tomasello, 2007) and engage in cooperative games, in which normative (in-group) standards of behaviour are established (Rakoczy & Schmidt, 2013; Rakoczy, Warneken, & Tomasello, 2008; Schmidt, Rakoczy, & Tomasello, 2012). They learn to play a game in a particular way because of its constitutive rules. And so by 2 years children start to object to players not adhering to those rules (Rakoczy et al., 2008). Goals as objective reasons get underpinned by a social normative dimension ("You should do it this way, not that way").

Importantly, these three levels of teleology are based on an understanding of objective reasons as objective facts in the world. This constraint limits the child's reasoning about action when it comes to people having divergent views on what is the case and what is desirable. How children will overcome this limitation and conquer the field of subjective reasons will be addressed in the section Links to the brain. Until then we stay with objective reasons and turn back to the role of teleology in the evolution of human cooperation.

However, before we do so we briefly remind the reader of why an Aristotelian teleologist is naturally inclined to cooperate and why teleology saves embeddings of mental states. The reasons are

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[4] These two video clips demonstrate this difference between species most impressively: www.youtube.com/watch?v=AwrcsA_Ejwk; www.youtube.com/watch?v=lQOdNe004II.

two: (1) The objective desirability of goals gives everyone a reason to pursue it. Competency considerations, which regulate and explain who should get involved and contribute in which way, come second. (2) The general appeal of goals to everyone makes it unnecessary to posit shared goals in terms of embedded intentions. This saves having to assume embedded mental states to get cooperation off the ground.

The cooperative turn

Our central claim is that the cooperative turn in human evolution, ascribed to *Homo heidelbergensis* around 400,000 years ago by Tomasello (2014), consists of a change from understanding behaviour in purely causal terms (including teleology in Gergely and Csibra's terms) to understanding behaviour as action for reasons, i.e., teleology developed by Perner & Roessler (2010; Roessler & Perner 2013) along Aristotle's notion of teleological causation. We thus take a few examples from Tomasello's book in which he argues for the need for recursively embedded mental states to get cooperation and co-operative communication off the ground. We will show that the kind of cooperation described in these cases can be sustained by teleology without a need for recursion and embedding as in Tomasello's mentalist approach.

The general form of the difference between the mentalist and the teleological view emerges from the following considerations: On the mentalist view goals are seen as expressions of individual desires. A goal is only a goal of that particular person who desires it. It only incites that person to act. To co-operate on a task, consequently, the co-operators all need matching desires and a coordinating desire of wanting to cooperate. In contrast, on the teleological view goals are primary reasons for all to perceive and to give further reasons for action. Hence the teleologist expects everyone to contribute to the goal conditional on their competency. Since goals as primary reasons give everyone a reason to act, no attribution of individual desires is necessary. This generality of goals as reasons for all fulfils the basic coordinative function for joint action. No additional goal or desire to cooperate is needed. This makes teleology a very stable basis for cooperation since the cooperative kernel in form of public reasons is an unnegotiable part of it, whereas the mentalist view requires an additional desire to co-operate, which depends on the whim of each individual participant.

Moreover informational acts like pointing to a location have to be understood on the mentalist view as providing knowledge, and the pointing action as being driven by a desire to create knowledge. This view, as we will see, leads quickly to a complex of several embedded mental states. Teleology avoids this complexity. Informational actions can, for the basic cases, be understood as instrumental actions needed for other actions to be carried out. No mental state of knowledge or of a desire to provide knowledge need be attributed.

Five test cases from Tomasello

Our first example of the cooperative turn in human evolution serves to point out some common ground for teleology and mentalism.

Stag hunt

Tomasello (2014, pp. 31–38) writes: "The situation these early humans faced is perhaps best modelled by the stag hunt scenario from game theory (Skyrms, 2004). Two individuals have easy access to low-payoff 'hares' …, and then there appears on the horizon a high-payoff but difficult-to-obtain 'stag' … that can be acquired only if individuals abandon their hares and collaborate… In the original analyses of Schelling (1960) and Lewis (1969), coordinating in this way required some kind of mutual knowledge or recursive mind reading: for me to go, I have to expect you to expect me to expect you… Clark (1996) proposed, as a more realistic account, that humans simply recognize the 'common ground' they have with others (e.g., we both know that we both want to go for the stag) and that this is sufficient for making joint decisions toward joint goals… Our position is thus that human individuals are attuned to the common ground they share with others, and this does not always involve recursive mind reading …"

We strongly agree with Tomasello on this point. We do not engage in checking that our partner can see that we can see that he can see, etc., in order to establish mutual knowledge. Anything that is in the mutual visual field (Perner & Garnham, 1988) can be assumed to be shared knowledge. Teleology naturally also provides for common ground of goals as Tomasello put it above in mentalist terms: "we both know that we both want to go for the stag." He did not elaborate how such mutual knowledge about intentions can be established. Teleology can answer this. It achieves common ground by the fact that goals provide public reasons and to understand them no mentalising of the kind "we know that we want…" is needed.

Object-choice task

Our next example moves to communication where higher order thoughts are deemed to be necessary. In the object-choice task (Tomasello et al., 1997), subjects see that one of a series of containers is being baited but cannot see which one. Chimpanzees need many learning trials to be able to appreciate a helpful cue, like pointing at or marking the baited container, whereas even children as young as 2 years pick up the cue quite quickly. Tomasello (2014, p. 57) explains this with the human propensity for attributing recursively embedded mental states which chimpanzees lack: "In the object choice task, for example, the recipient infers that the communicator intends that she knows that the food is in that bucket – a socially recursive inference that great apes apparently do not make."

A full understanding by the recipient of the communicator's pointing is even more complicated on the mentalist view. Without explicit learning the recipient has to infer or know from previous experience that the communicator wants her to reach her goal, i.e., get the bait. Because he knows that she cannot see where the bait is, he knows that she needs to know that in order to pick the correct container. Since he wants her to find the bait, he provides knowledge by pointing to the baited container.

The teleologist recipient, in contrast, perceives what is needed, namely, her getting the bait. She cannot however get it (because she does not know where it is). She interprets the communicator's act of pointing as instrumental for reaching the goal, i.e., to get her to look under the indicated container. No inference of mental states, not to mention recursively embedded states, is needed to make sense of the communicator's helpful gesture.

Banana in the tree

"The basic problem is that what the communicator wishes to point out to the recipient – his communicative intention – is a whole fact like situation, for example, that there are bananas in the tree, or that there are no predators in the tree. But the act of pointing – the protruding finger – is the same in all cases. The puzzle is how does one point out for a recipient different situations in the same perceptual scene? The key to this puzzle is that the participants in a communicative interaction mutually assume the relevance of the communicative act for the recipient …, and this relevance is always in relation to something that is in our common ground… Independent of communication, a situation is relevant to you for your own individual reasons. But for me to direct your attention to that situation successfully in communication, you must know that I know it is relevant for you (Tomasello, 2014, p. 54)."

From the vantage point of teleology, each participant has to understand what the goal is, e.g., to collect bananas. If there are some bananas up the tree, one needs to get them. If my partner is closer to them, it is best if he gets them rather than I do (competency). If he does not show the right behaviour indicating that he is going to pick them, then I have to direct his attention to the bananas by pointing. My partner, as teleologist, will interpret my pointing as an instrumental act in pursuing our goal (one of our goals) and, therefore, direct his attention to where I point.

Since teleology is based on everyone acting in a way for which there is reason to do so, there is no need to concern oneself with what the other wants, or knows, and not whether the other knows that I know what is relevant for him. If there is a reason to pick the banana, then my partner will do so unless competency limitations prevent him from doing so. I then have to take action to overcome these limitations if possible.

The predator has gone

"Another dimension of this process is that only 'new' situations are communicatively relevant, since currently shared situations need not be pointed out. And so, in the example from above, after the predator left the banana tree I pointed to the banana tree with the intention to indicate the situation of the predator's absence, which you readily discerned. How could I intend and you infer predator absence when the presence of the bananas is also highly relevant? Because the presence of the bananas was already in our current common ground, and so me pointing out this situation to you would be superfluous. If I am going to be helpful, I must point out situations that are new for you, or else why bother. And so, in human cooperative communication, both communicators and recipients mutually assume in their common ground chat communicators point out for recipients situations that are both relevant and new (Tomasello, 2014, p. 55)."

Teleology is very much with Tomasello's emphasis of the importance of relevance. Seeing the reasons for action is teleology's way of bringing relevance into the picture. However, we see no need in this example for the communicating partners to concern themselves with what is and is not in the common ground. So, we are on a foraging trip and you have seen the bananas but hesitate to approach them. No wonder since there was a predator nearby. I see the predator leaving, but you still do not approach the bananas because you have not looked up there where the predator had been. So I make you look there. You understand that I am pointing because of the predator and not the bananas because it was the predator that kept you from going for the bananas. So my pointing is to take away your fear of the predator and not direct you to the bananas.

The cleaning up game

"Perhaps surprising, even young infants are skilful at keeping track of the common ground they have with specific other individuals and using that to determine relevance in both the comprehension and production of pointing gestures. For example, Liebal, Behne, Carpenter, & Tomasello (2009) had a one-year-old[5] infant and an adult clean up together by picking up toys and putting them in a basket. At one point the adult stopped and pointed to a target toy, which the infant then cleaned up into the basket. However, when the infant and adult were cleaning up in exactly this way, and a second adult who had not shared this context entered the room and pointed toward the target toy in exactly the same way, infants did not put the toy away into the basket; they mostly just handed it to him, presumably because the second adult had not shared the cleaning up game with them as common ground. (Tomasello, 2014, p. 55)."

Tomasello claims that engaging in cooperative communication of the type just mentioned requires that the infant is able (1) to represent the other's perspective on the situation (p. 56), and (2) to implicitly make inferences about her partner's intentions on a higher recursive level (e.g. "He intends that I know that p") (p. 59), and that the infant is able to evaluate her own behaviour from the perspective of how other agents will evaluate it (p. 58). Following Tomasello to engage in cooperative communication of the mentioned type, the one-year (!!!) old infant must on a prelinguistic level be equipped with very sophisticated mindreading abilities like for example "I think that my partner thinks that I think that p" (p. 59).

From a teleological perspective, no mindreading abilities need to be involved: The goal in the cleaning up game is to pick up toys and putting them in a basket. If the partner in that activity points to an item, it is interpreted as an instrumental action for that goal, i.e., as directing me to take care of this item. If someone who has not been part of the game points to one of the toys, then his pointing is less likely to have the same instrumental function, since he has not shown any activities in pursuit of the cleaning up goal. He may direct me to hand him the toy as newcomers often do. Therefore children more often hand that person the toy rather than clear it away.

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[5] The children in that study were in fact 14 and 18 months old.

Can a teleologist communicate intentionally?

If teleology supports cooperation, its support would be seriously limited if it did not also support intentional communication. A standard requirement for intentional communication is Grice's (1957) conditions for non-natural meaning (taken from Moore, 2015, with reference to Neale, 1992; and Sperber & Wilson (1986/1995):

A speaker S non-naturally means something by an utterance x if and only if, for some hearer (or audience) H, S utters x intending:

1 H to produce a particular response r, and
2 H to recognise that S intends (1).

In response to strong mentalistic claims that grasping communicative intent requires entertaining something as complex as a fourth order meta-representation (Sperber, 2000), some authors argue for less complexity (Breheny, 2006; Moore, 2015). As an example, Moore (2015) refers to the situation of one person (Speaker) pointing to the ground to indicate to her partner (Hearer) that there may be tubers under the ground, for which they could dig. Moore points out that following Grice's definition; S need not represent to herself that she intends to inform H about her request. It is enough that S is able to direct H's attention to her act of pointing or to direct his gaze towards the ground, etc. (Moore, p. 26). This still leaves us with a recursively embedded mental state to capture condition (2): "INTENDS[6] (H to <u>recognise</u> that (S <u>intended</u> (to produce r))." Moore further argues that an infant, not yet able to entertain such a complex mental state, can nevertheless partake in an act of communication if suitably scaffolded by an adult listener, who is able to entertain the required complex mental states.

Unfortunately this option is not open to us for claiming that two *Home heidelbergensis*, who are claimed to be basic teleologists, are able to engage in intentional communication, since none of them can scaffold for the other. Fortunately, there is a way to incorporate intentional communication on Grice's definition within teleology. We need first to ascertain how a teleologist can intend to make someone recognise something, in particular, an intention. Intentions are those things that make an action an intentional action. For teleology these are the reasons for acting. On the most fundamental level reasons are objective events in the world. The way to make someone recognise an event is to direct his attention to that event, e.g., by pointing to it. The alert mentalist may smell a rat at this juncture: is not directing someone's attention to an event the same as giving him knowledge of the event? And knowledge is a mental state. In response we can say that directing someone to an event is indeed a good way of providing knowledge, but being directed to an event is not a propositional attitude like knowledge. It is a relation between the person and an event in the world, not a relation between the person and a proposition. Apperly & Butterfill (2009) have coined the term "encountering," defined as "a relation between the individual, an object, and a location, such that the relation obtains when the object is in the individual's [visual] field" (p. 962). Instead of inferring from such encounters, as a mentalist would, that the individual now knows where the object is, the teleologist just takes notice that such an encounter has taken place and also knows that such encounters play a causal role in individuals' ability to act according to reasons. So by "directing" an individual to an event or state of affairs, we mean to make the individual encounter the event or state of affairs in question. Hence, nothing mental need enter at this point (also see the section Object-choice task).

Grice's condition can thus be rephrased in teleological terms:

... S utters x because he has reasons to

1 get H to produce r
2 direct H to S's reasons for (1)

This shows that intentional communication, on Grice's criterion, need not be beyond the teleologist.

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[6] With INTENDS in capitals we articulate the state that S must be in, which is not represented by S. Underlined mental states are those that S has to represent.

To illustrate the use of our reformulated criterion, we apply it to Moore's example of looking for tubers again: The recognised goal of the two hunter-gatherers is to collect tubers. The needed instrumental actions are to dig for tubers in a spot that promises to have tubers. To get a partner to dig for them one has to bring those tuber-promising spots into the partner's visual field. A good means to achieve this is to point to such a spot when my partner is looking at me.

So I point to the promising location because I have reason to

1 get my partner to dig for tubers at that spot
2 direct my partner to the reason for (1)

The critical question here is how I can direct my partner to *the reason for (1)*, i.e., to get her to dig for tubers at the indicated spot. This is possible because as a teleologist I can (tacitly) rely on my partner interpreting every one of my actions as actions for a reason. Hence my reason for directing my partner to the promising spot was to also direct her to the (my, our) reason to dig for tubers at this spot. This also makes clear why my pointing has non-natural meaning. It non-naturally means "dig there for tubers" because it only means that if recognition of the reasons for my pointing and our joint enterprise are taken into account. Without the reasons my pointing would not have much meaning or, at best, the natural meaning, "look there."

From the discussion in this section, one might have formed the impression of teleology as a wonder drug for mutual understanding. This impression is correct for mutual understanding in the context of cooperation. The teleologist, however, has to pay for this cooperative advantage, which works well in the circle of other teleologist individuals, with problems adjusting to individuals with unfamiliar interaction patterns or competitive opponents.

Limits of teleology

Teleology, as we conceive of it, is based on objective fact. Those whose actions are not intelligible as a response to the objective aspects of our world and objective values will be seen not just as unsuitable partners for cooperation but also as opaque and alien, which in turn may block the extension of natural empathic responses to them. In this way, teleology may foster not only cooperation but also, simultaneously, marginalisation (see Roessler & Perner, 2015 for further discussion).

To overcome these limitations the teleologist needs to capture the realm of subjectivity. At least two options are here available. One can acquire a belief–desire psychology along the lines of the theory theory: a body of knowledge about the conditions under which sentient beings develop certain beliefs and desires and about the way in which desires and beliefs interact to make agents act in certain ways. On this option we lose the intuition that people act for reasons. As an alternative, to eat the cake and have it, Roessler & Perner (2013) suggested that belief is understood as a counterfactual perspective on the world within which teleological reasoning can still be applied ("teleology-in-perspective"). For instance if we recall the false belief test (Wimmer & Perner, 1983) in which Mistaken Max did not witness his mother moving his chocolate to a new location, one can reason counterfactually: "if the chocolate were still where Max thinks it is, he would have good reason to look for it in that (now empty) location."

This theory led to an interesting developmental prediction with a strong Piagetian flavour of a developmental stage which binds together progress in diverse domains. Around 4 years when children pass the false belief test, they become able to understand many different perspective tasks (see Perner & Roessler, 2012 for review). So they should also become able to understand at this age people having different views on the desirability of goals (telic perspective taking). For competitive games it is necessary to understand that people can act rationally for good reasons when they pursue incompatible goals. Player A considers her winning desirable, while player B considers player A's winning as undesirable. A teleologist can only accept one of these goals as objectively desirable, hence could only understand the moves of one person as acting for good reasons. It follows that children up to 4 years cannot appreciate competitive games as a rational, worthwhile enterprise. When they become able to understand differences in perspective, they can understand what each player has good reasons to do within each player's perspective. With this they move from objective reasons to subjective reasons.

Priewasser, Roessler, & Perner (2013) tested this by having children play a bead collecting game and giving them a false belief test. On each move of the bead game a player cast a die and was allowed to collect as many beads as the number on the die. Whose stack of beads reached the top first would win. Children were repeatedly told that they can take the beads from a free resource or from another player's stack of earned beads (a competitive move). Children who failed on the false belief test, hence were not able to conceive of different perspectives, were very reluctant to poach other children's beads. They did so occasionally when other players had poached their beads, but seemed not to see any rational point in these competitive moves.

Also the findings from Gerald Gratch's (1964) study on the penny hiding game fit this developmental transition. From 3 to 6 years children changed from showing no signs of competitive spirit to becoming intensely competitive. Several studies reported developmental correlations between the penny-guessing game and the false belief tasks (Baron-Cohen, 1992; Chasiotis, Kiessling, Hofer, & Campos, 2006; Hughes & Dunn, 1997, 1998). Unfortunately, these studies only analysed the hand-guessing behaviour for indicators of deceptive abilities (or a mix of combative spirit and deception). Hence the reported correlations with false belief understanding provide no convincing evidence that understanding competition relates to understanding perspectives in the false belief task. Priewasser (2009), however, found that children's appreciation of competition in the penny hiding game emerged in parallel with passing the false belief test between 3.5 and 5.5 years.

Priewasser, Perner, & Roessler (2015) zeroed in more sharply on the factor responsible for young children's lack of appreciation of competitive games by investigating understanding of sabotage. To understand acts of sabotage, children have to be able to understand one agent's goal in order to know what she will do, and they have to understand the other agent's goal in order to understand that he will interfere with his opponent's action because that action goes against his goal. Since the two agents' goals are diametrically opposed, a teleologist cannot make sense of this situation. The teleologist needs to think of each agent's goal within different telic perspectives. Again the data confirmed that this ability emerged with children's ability to represent different perspectives in the false belief test. Interestingly, producers of commercial games do not market competitive games with sabotaging or thwarting moves for children younger than about 4 or 5 years (Priewasser & Perner, 2015).

Another source of evidence for children starting to use teleology-in-perspective at this age comes from the pioneering work by Shultz & Shamash (1981) and follow-up studies that reported children's difficulty distinguishing intentions from desires (see reviews by Astington, 1999, 2001). The latest study by Schult (2002) included children as young as three years. They had to toss bean bags into three different coloured buckets, some of which contained a ticket for a prize. For each toss they had to indicate which bucket they intended to hit. On some trials they hit the intended bucket, on others they missed it; on some, they won a prize, on others, they did not, resulting in four different combinations. Four and five year olds were remarkably accurate in answering all types of questions. The three year olds, on the other hand, had serious problems with questions about their intentions, in particular when satisfaction of their intention (hit particular bucket) contrasted with satisfaction of their desire (win a prize).

This difficulty follows from our assumption of 3-year olds being limited to basic teleology without understanding perspective. They have no problem knowing what they want, i.e. the desirable goal of the action, (winning the prize) and whether they got it or not. They also understand intentions to hit a particular bucket, though only insofar as there are *objective* reasons for such an intention. Consider now a case of bad luck, where they hit a certain bucket without getting a prize. To understand that they hit the bucket intentionally, children have to understand that they did have a reason for hitting that bucket, despite the fact that doing so turned out *not* to be conducive to reaching their goal. Under the teleological interpretation, it is unsurprising that young children have problems under these kinds of circumstances. Correct judgement of these cases only becomes possible when one understands that one acted on the assumption that the prize might be in the bucket one was aiming for. Since in the critical cases this assumption has turned out to be false, the intentionality of the intended action can only be understood if one can understand it in terms of the perspective of that assumption.

Taken together these findings indicate that conflicting desires and hypothetical desires motivating an action that turns out to be unsuccessful are understood at the age at which children understand false beliefs. There is, thus, no evidence that desires in general are understood any earlier than beliefs

as Wellman (1990; 2014; Gopnik & Meltzoff 1997) propagated. The relevance of desires as objective goals and true beliefs of objective facts is understood early. How subjective views on goals (subjective desires) and on facts (beliefs) modulate action is understood around 4 years.

Teleology-in-perspective preserves the insight that people act for good reasons, at least what from their perspective appear to be good reasons. As an alternative, one may overcome the limits of basic teleology by switching to a theory of mind, which may have great advantages in other respects. For one, a theory of mind would outstrip teleology as a tool of cold minded social intelligence for Machiavellian fitness. This makes it well suited to the tastes of psychopaths manipulating their conspecifics without being plagued by any empathic considerations (Keysers, 2011). There is also some evidence from brain imaging supporting this possibility.

Links to the brain

Distinguishing theory of mind as a purely causal understanding of the mind from teleology (including teleology-in-perspective) as an understanding of agents' reasons for acting has some affinity to a distinction drawn by Robbins & Jack (2006). They added to Dennett's (1981) physical stance – for analytic and empirical reasoning – and intentional stance – for predicting and manipulating behaviour – the *phenomenal stance*, which we adopt when reflecting on our own as well as the experiences of others. Jack (2013, figure 2) links these three stances to two opposing (anticorrelated) neural networks. Analytic, empirical reasoning activates the task-positive network (TPN), while phenomenal contemplation engages the default-mode network (DMN)[7]. Interestingly, concern about perspective differences, which reflect differences in phenomenological access, is also located in the left inferior parietal lobe as part of the DMN. Prediction and manipulation of intentional actions (intentional stance) relates to the phenomenal mind as well as to the movements of the physical body and, therefore, engages both networks.

From our theoretical point of view, we would say that for explaining the physical world and intentional behaviour one needs causal reasoning based on the TPN. Understanding reasons is based on first person insight into the world and involves, what Jack calls the phenomenal stance based on the DMN. For predicting and manipulating behaviour, what one needs depends on how one approaches the task. For teleology one needs insight into reasons (the DMN) as well as causal reasoning (the TPN). If one relies on purely causal reasoning (theory theory), TPN suffices.

Robbins & Jack (2006, p. 72) already pointed out that separating the phenomenal from the intentional stance helps "to explain the profile of psychopaths as 'social predators,' incapable of friendship or love" (Hare, 1993). From our position, psychopaths use theory theory unencumbered by the empathic consequences of teleology. They also lack moral sentiments and principles as a natural consequence that they lack insight into reasons. Reliance on theory theory without teleology should only activate the TPN without the need for the DMN. Indeed, there is evidence that individuals with Machiavellian thinking show greater activation of TPN during social cognition (Bagozzi et al., 2013).

Conclusion

The thrust of this paper was to argue that the "cooperative turn", which hypothetically may have emerged in *Homo heidelbergensis* around 400,000 years ago, has its main roots in the evolution of teleological reasoning in *Homo*. This new form of reasoning emerges in the transition from understanding behaviour as following causal regularities to understanding behaviour as actions for good reasons. In contrast to the mentalistic assumption that reasons are internal mental states, we argue that they are, on a fundamental level, objective and public facts in the world. While mentalistic explanations assume that understanding actions as intentional actions presupposes an understanding of internal mental states, the teleological approach argues that intentional actions are those for which there are observable good reasons that justify the behaviour. The teleological approach therefore rejects the claim that

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[7] The TPN gets its name from the fact that its parts tend to be more active when working on a task then when resting, while the DMN shows the opposite pattern.

understanding others as acting for reasons requires understanding them as mental agents with individually different perspectives. We have shown that this theoretical framework can account for the difference in cooperativeness between young children and our evolutionary relatives and a development in stages – Piagetian in flavour – from a purely cybernetic understanding of behaviour to understanding objective reasons, to finally subjective reasons for acting.

Acknowledgments

References

Anscombe, G. E. (1957). *Intention*. Cambridge, England: Cambridge University Press.
Apperly, I. A., & Butterfill, S. A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review*, *116*, 953–970.
Astington, J. (2001). The paradox of intention: Assessing children's metarepresentational understanding. In B. Malle, et al. (Eds.), *Intentions and intentionality* (pp. 85–104). Cambridge, MA: MIT Press.
Astington, J. W. (1999). The language of intention: Three ways of doing it. In P. D. Zelazo, J. W. Astington, & D. R. Olson (Eds.), *Developing theories of intention: Social understanding and self-control* (Vol. 1 – Book, 1 – Section, pp. 295–315). Mahwah, NJ: Erlbaum.
Bagozzi, R. P., Verbeke, W. J. M. I., Dietvorst, R. C., Belschak, F. D., van den Berg, W. E., & Rietdijk, W. J. R. (2013). Theory of mind and empathic explanations of machiavellianism: A neuroscience perspective. *Journal of Management*, *39*(7), 1760–1798.
Baron-Cohen, S. (1992). Out of sight or out of mind? Another look at deception in autism. *Journal of Child Psychology and Psychiatry*, *33*, 1141–1155. http://doi.org/10.1111/j.1469-7610.1992.tb00934.x.
Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind*. Oxford: OUP.
Bischof-Köhler, D. (1988). Über den Zusammenhang von Empathie und der Fähigkeit, sich im Spiegel zu erkennen. *Schweizer Zeitschrift Für Psychologie, 47*, 147–159.
Brand, M. (1984). *Intending and acting*. Cambridge: MIT Press, A Bradford Book.

Bratman, M. (1992). Shared cooperative activity. *Philosophical Review*, *101*(2), 327–341.

Breheny, R. (2006). Communication and folk psychology. *Mind & Language*, *21*, 74–107. doi:10.1111/j.1468-0017.2006.00307.x.

Campos, J., & Stenberg, C. (1981). Perception, appraisal and emotion: The onset of social referencing. In M. E. Lamb & L. R. Sherrod (Eds.), *Infant social cognition* (Vol. 1–Book, 1–Section, pp. 273–314). Hillsdale, NJ: Lawrence Erlbaum Associates.

Charles, D. (2012). Teleological causation. In C. Shields (Ed.), *The Oxford handbook of Aristotle*. Oxford: OUP.

Chasiotis, A., Kiessling, F., Hofer, J., & Campos, D. (2006). Theory of mind and inhibitory control in three cultures: Conflict inhibition predicts false belief understanding in Germany, Costa Rica and Cameroon. *International Journal of Behavioral Development*, *30*, 249–260. http://doi.org/10.1177/0165025406066759.

Churchland, P. M. (1984). *Matter and consciousness: A contemporary introduction to the philosophy of mind*. Cambridge, MA: MIT Press, A Bradford book.

Clark, H. (1996). *Uses of language*. Cambridge: Cambridge University Press.

Csibra, G., & Gergely, G. (1998). The teleological origins of mentalistic action explanations: A developmental hypothesis. *Developmental Science*, *1*, 255–259. doi:10.1111/1467-7687.00039.

Davidson, D. (1963). Actions, reasons, and causes. *Journal of Philosophy*, *60*, 685–700. doi:10.2307/2023177.

Dennett, D. (1981). Intentional systems. In *Brainstorms: Philosophical essays on mind and psychology* (pp. 3–22). Cambridge: MIT Press.

Dunn, J., & Munn, P. (1987). Development of justification in disputes with mother and sibling. *Developmental Psychology*, *23*, 791–798.

Falcon, A. (2015). Aristotle on causality. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy (Spring 2015 Edition)*. <http://plato.stanford.edu/archives/spr2015/entries/aristotle-causality/>.

Gergely, G., & Csibra, G. (2003). Teleological reasoning in infancy: The naive theory of rational action. *Trends in Cognitive Sciences*, *7*, 287–292. doi:10.1016/S1364-6613(03)00128-1.

Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months of age. *Cognition*, *56*, 165–193. doi:10.1016/0010-0277(95)00661-H.

Goldman, A. I. (2006). *Simulating minds: The philosophy, psychology, and neuroscience of mindreading*. Oxford: Oxford University Press.

Goldman, A. I. (2009). Replies to Perner and Brandl, Saxe, Vignemont, and Carruthers. *Philosophical Studies*, *144*(3), 477–491. doi:10.1007/s11098-009-9358-x.

Gopnik, A., & Meltzoff, A. N. (1997). *Word, thoughts, and theories*. Cambridge, MA: A Bradford Book, The MIT Press.

Gordon, R. (1995). Folk psychology as simulation. In M. Davies & T. Stone (Eds.), *Folk psychology*. Oxford: Blackwell.

Gordon, R. M. (1986). Folk psychology as simulation. *Mind & Language*, *1*, 158–171. doi:10.1111/j.1468-0017.1986.tb00324.x.

Gowlett, J., Gamble, C., & Dunbar, R. (2012). Human evolution and the archaeology of the social brain. *Current Anthropology*, *53*, 693–722.

Gratch, G. (1964). Response alternation in children: A developmental study of orientations to uncertainty. *Vita Humana*, *7*, 49–60.

Grice, H. P. (1957). Meaning. *Philosophical Review*, *66*, 377–388. doi:10.2307/2182440.

Hare, R. (1993). *Without conscience: The disturbing world of the psychopaths among us*. New York: Guilford Press.

Heal, J. (1986). Replication and functionalism. In J. Butterfield (Ed.), *Language, mind, and logic* (Vol. 1 – Book, 1 – Section, pp. 135–150). Cambridge: Cambridge University Press.

Heider, F. (1958). *The psychology of interpersonal relations*. New York: Wiley.

Hornik, R., Risenhoover, N., & Gunner, M. (1987). The effects of maternal positive, neutral, and negative communications on infant responses to new toys. *Child Development*, *58*, 937–944.

Hughes, C., & Dunn, J. (1997). "Pretend you didn't know": Preschoolers' talk about mental states in pretend play. *Cognitive Development*, *12*, 381–403.

Hughes, C., & Dunn, J. (1998). Understanding mind and emotion: Longitudinal associations with mental-state talk between young friends. *Developmental Psychology*, *34*, 1026–1037. http://doi.org/10.1037/0012-1649.34.5.1026.

Hyman, J. (1999). How knowledge works. *The Philosophical Quarterly*, *49*(197), 433–451.

Jack, A. I. (2013, Uncorrected Proof). A scientific case for conceptual dualism. To appear. In J. Knobe, T. Lombrozo, & S. Nichols (Eds.), *Oxford studies in experimental philosophy* (Vol. 1). Oxford, UK: Oxford University Press.

Keysers, C. (2011). *The empathic brain: How the discovery of mirror neurons changes our understanding of human nature*. Oxford, UK: Social Brain Press.

Lewis, D. K. (1969). *Convention: A philosophical study*. Cambridge, MA: Harvard University Press.

Liebal, K., Behne, T., Carpenter, M., & Tomasello, M. (2009). Infants use shared experience to interpret pointing gestures. *Developmental Science*, *12*, 264–271.

Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology*, *31*, 838–850. doi:10.1037/0012-1649.31.5.838.

Merola, I., Prato-Previde, E., & Marshall-Pescini, S. (2012). Dogs' social referencing towards owners and strangers. *PLoS ONE*, *7*(10), e47653. http://doi.org/10.1371/journal.pone.0047653.

Moore, R. (2015). Gricean communication and cognitive development. Unpublished manuscript, Humboldt University Berlin.

Neale, S. (1992). Paul Grice and the philosophy of language. *Linguistics & Philosophy*, *15*, 509–559.

Perner, J. (2004). Wann verstehen Kinder Handlungen als rational? In H. Schmidinger & C. Sedmak (Eds.), *Der Mensch – ein "animal rationale"? Vernunft – Kognition - Intelligenz* (Vol. 1-Book, 1-Section, pp. 198–215). Darmstadt: Wissenschaftliche Buchgemeinschaft.

Perner, J., & Brandl, J. L. (2009). Simulation à la Goldman: Pretend and collapse. *Philosophical Studies*, *144*, 435–446. doi:10.1007/s11098-009-9356-z.

Perner, J., & Garnham, A. (1988). Conditions for mutuality. *Journal of Semantics*, *6*, 369–385. doi:10.1093/jos/6.1.369.

Perner, J., & Roessler, J. (2010). Teleology and causal reasoning in children's theory of mind. In J. Aguilar & A. Buckareff (Eds.), *Causing human action: New perspectives on the causal theory of action* (pp. 199–228). Cambridge, MA: Bradford Book, The MIT Press.

Perner, J., & Roessler, J. (2012). From infants' to children's appreciation of belief. *Trends in Cognitive Sciences*, *16*(10), 519–525. doi:10.1016/j.tics.2012.08.004.

Perner, J., Zauner, P., & Sprung, M. (2005). What does "that" have to do with point of view? The case of conflicting desires and "want" in German. In J. W. Astington & J. Baird (Eds.), _Why language matters for theory of mind_ (Vol. 1 – Book, 1 – Section, pp. 220–244). New York: Oxford University Press.

Piaget, J. (1936). _The origin of intelligence in the child_. London: Routledge and Kegan Paul.

Priewasser, B. (2009). Das Verständnis für die Subjektivität von "Glauben" und "Wollen" im kompetitiven Spiel. Unpublished diploma thesis, Department of Psychology, University of Salzburg.

Priewasser, B., & Perner, J. (2015). _For what age are competitive board games recommended by commercial companies?_ (in preparation).

Priewasser, B., Perner, J., & Roessler, J. (2015). _Children's understanding of reasons to sabotage_. (submitted).

Priewasser, B., Roessler, J., & Perner, J. (2013). Competition as rational action: Why young children can't appreciate competitive games. _Journal of Experimental Child Psychology_, _116_, 545–559.

Rakoczy, H., & Schmidt, M. F. H. (2013). The early ontogeny of social norms. _Child Development Perspectives_, _7_(1), 17–21. doi:10.1111/cdep.12010.

Rakoczy, H., Warneken, F., & Tomasello, M. (2008). The sources of normativity: Young children's awareness of the normative structure of games. _Developmental Psychology_, _44_(3), 875–881.

Raz, J. (1999). Explaining normativity: On rationality and the justification of reason. _Ratio_, _XII_, 354–379.

Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month-olds. _Developmental Psychology_, _33_(1), 12–21.

Robbins, P., & Jack, A. I. (2006). The phenomenal stance. _Philosophical Studies_, _127_, 59–85.

Roessler, J., & Perner, J. (2013). Teleology: Belief as perspective. In S. Baron-Cohen, et al. (Eds.), _Understanding other minds_ (3rd ed.). Oxford: Oxford University Press.

Roessler, J., & Perner, J. (2015). Pro-social cognition: Helping, practical reasons and 'theory of mind'. _Phenomenology & the Cognitive Sciences_ (in press).

Scanlon, T. (1998). _What we owe to each other_. Harvard University Press.

Schelling, T. C. (1960). _The strategy of conflict_. Cambridge, MA: Harvard University Press.

Schmidt, M., Rakoczy, H., & Tomasello, M. (2012). Young children enforce social norms selectively depending on the violator's group affiliation. _Cognition_, _124_(3), 325–333. doi:10.1016/j.cognition.2012.06.004.

Schult, C. A. (2002). Children's understanding of the distinction between intentions and desires. _Child Development_, _73_, 1727–1747. http://doi.org/10.1111/1467-8624.t01-1-00502.

Searle, J. (1983). _Intentionality_. Cambridge: Cambridge University Press.

Shultz, T. R., & Shamash, F. (1981). The child's conception of intending act and consequence. _Canadian Journal of Behavioral Science_, _13_, 368–372.

Skyrms, B. (2004). _The stag hunt and the evolution of sociality_. Cambridge: Cambridge University Press.

Sorce, J. F., Emde, R. N., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year olds. _Developmental Psychology_, _21_, 195.

Sperber, D. (2000). Metarepresentations in an evolutionary perspective. In D. Sperber (Ed.), _Metarepresentations. A multidisciplinary perspective_ (Vol. 1 – Book, 1 – Section, pp. 117–137). Oxford: Oxford University Press.

Sperber, D., & Wilson, D. (1986/1995). _Relevance: Communication and cognition_. Oxford: Blackwell.

Stiner, M. C., Barkai, R., & Gopher, A. (2009). Cooperative hunting and meat sharing 400-200 kya at Qesem Cave, Israel. _Proceedings of the National Academy of Sciences of the United States of America_, _32_, 13207–13212.

Tomasello, M. (2014). _A natural history of human thinking_. Cambridge, MA: Harvard University Press.

Tomasello, M., Call, J., & Gluckman, A. (1997). Comprehension of novel communicative signs by apes and human children. _Child Development_, _68_(6), 1067–1080. doi:10.2307/1132292.

Warneken, F., & Tomasello, M. (2007). Helping and cooperation at 14 months of age. _Infancy_, _11_(3), 271–294.

Wellman, H. M. (1990). _The child's theory of mind_. Cambridge, MA: MIT Press, A Bradford Book.

Wellman, H. M. (2014). Making minds: How theory of mind develops. Unpublished manuscript, University of Michigan.

Willatts, P. (1999). Development of means-end behavior in young infants: Pulling a support to retrieve a distant object. _Developmental Psychology_, _35_(3), 651–667.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. _Cognition_, _13_, 103–128. doi:10.1016/0010-0277(83)90004-5.

Wobber, V., Herrmann, E., Hare, B., Wrangham, R., & Tomasello, M. (2014). Differences in the early cognitive development of children and great apes: Cognitive development in humans and great apes. _Developmental Psychobiology_, _56_(3), 547–573. http://doi.org/10.1002/dev.21125.

Woodward, A. L. (1998). Infants selectively encode the goal object of an actor's reach. _Cognition_, _69_(1), 1–34.

Woodward, J. (2003). _Making things happen: A theory of causal explanation_. Oxford: Oxford University Press.

Zahn-Waxler, C., Radke-Yarrow, M., & King, R. A. (1979). Child rearing and children's prosocial initiations toward victims of distress. _Child Development_, _50_, 319–330.