

Primer

Cooperation in children

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Cooperation is central to what makes us human. It is so deeply entrenched in our nature that it can be seen at the heart of every culture, whether it takes the form of group hunting, shared child-rearing, or large-scale, multi-national institutions such as the UN. And yet in contrast to the constancy of other forms of cooperation in non-human animals, such as termite-mound building or honey bee dancing, the changing face of human cooperation makes it seem more fragile, and its mechanisms more elusive. As with other features of our behaviour, human cooperation is the product of both genetic and cultural evolution. Studying cooperation in children, in different cultural environments, and in contrast to other species, provides a valuable window into the ways in which these two forms of inheritance interact over development, and a chance to distil out its constitutive components.

Why is this important? Understanding the fundamental building blocks of cooperative behaviour may help us to understand what made us human. The ability of our ancestors to team up to bring down big game, thereby allowing increased energy intake, is thought to have been vital in the evolution of our large brains. And in a world in which globalisation and technological advancement is causing rapid change to the size of our social groups and how we interact with each other, an awareness of the psychological underpinnings of cooperation may be vital for society.

For many cooperative behaviours (helping, sharing) there is a darker counterpart (hindering, monopolisation). These may exist to thwart the enemy of cooperation in evolutionary terms — the problem of free-riders — nature’s benefit cheats that take the advantages without paying the costs. Understanding how best to shape children’s cooperative behaviour is therefore important, but interventions can produce unexpected results: for example, explicitly rewarding helping at some ages discourages it. In addition, as artificial intelligence starts to graduate from a practical tool to a cooperative partner, understanding how to achieve cooperative intelligence has significant practical implications.

In this primer we will give an overview of research that has aimed to elucidate how children develop the skills and motivations to cooperate, in the broad sense of helping others achieve their goals, working together to achieve joint goals, and sharing both resources and information.

Helping

Helping is one of the first cooperative behaviours to emerge in human infants, with most parents reporting that their toddlers start to help with tasks in the home shortly after their first birthday. But ‘helping’ to sweep the floor (Figure 1) or wash up dishes may just be a fun game from the infants’ perspective, so experimental tasks have been vital in assessing when, how and why infants really start to help. A typical paradigm, used initially by Warneken and Tomasello, requires children to do something to fulfil another’s goal and not their own — such as leaving a game to retrieve an experimenter’s pen that dropped out of his reach (Figure 2). Critically, the child’s tendency to act in the experimental condition is contrasted with a control condition, where the item is dropped on purpose and the adult no longer wants it. Children selectively help

the experimenter when he needs it from 14 months of age. Children therefore have the cognitive ability to help, namely to infer the goals of others, from at least their second year of life. As they get older they help in increasingly varied and complex ways, with a recent study by Sommerville and colleagues showing that by 18 months of age, helping is mediated by an analysis of simple costs and benefits, such as how heavy an item is and who is asking for it.

Are children intrinsically motivated to be helpful, or are they already showing the effects of parental encouragement? Several strands of evidence support an intrinsic helpful motivation. First, parental presence, encouragement and instruction do not influence helping rates in two-year-olds. In fact, rewards seemingly undermine their intrinsic motivation: reinforcing helping with rewards actually reduces subsequent helping behaviour. However, encouragement to help and reinforcement with praise do facilitate helping in 13- to 15-month-olds. Second, changes in sympathetic arousal levels, as measured by changes in pupil dilation, positively predict the likelihood and speed with which children help. This suggests that children are physiologically sensitive to the needs of others and helping is driven by a genuine concern for the person in need.

Vaish and colleagues provided further evidence that sympathetic concern influences helping behaviour from as early as 18 months. They found that children were more likely to offer help to an experimenter who had been harmed by another adult, for instance by having their prized possession taken or broken, compared to an experimenter who experienced a neutral event, even if the harmed individual maintains a neutral facial expression. Interestingly, selectivity increases with age and several studies have shown that by three years of age, children prefer to help those who have been previously helpful or avoid helping individuals who have previously caused or intended to cause harm to others. In summary, helping others to achieve

their goals is a robust, flexible behaviour in young children that becomes increasingly complex and selective with age.

Working together and sharing

After children can help partners achieve their goals, they start to be able to work with others to achieve joint goals. Although some simple forms of cooperative behaviour can emerge from individuals acting individually towards the same goal, more complex, strategic cooperation requires an understanding of the shared nature of collaborative activity.

Some evidence suggests that one-year-old children already recognise (and relish the fact) that they are acting jointly and will, for example, re-engage a collaborative partner if they interrupt their part in joint play, or flexibly take the role of another in a joint activity. Experiments have also shown that young children can take their partner's perspectives and intentions into account when collaborating. This is what one of the central researchers in this field, Michael Tomasello, has called engaging in 'shared intentionality'. Fundamental to this is joint attention, which is evident at around nine months of age when infant and caregiver start to coordinate and share attention about an object or event in the world, by alternating gaze between one another and the object of interest, whilst exchanging communicative signals such as smiles and, later, pointing gestures. Tomasello and his collaborators contend that shared intentionality is both a crucial point of contrast between humans and other great apes and at the very core of uniquely human forms of cooperation, such as the construction of social norms and institutions, that rest on this kind of 'we' mentality (for example, we agree that a certain type of paper is money). Interestingly, children already enforce norms, such as the right way to play with a toy, from the tender age of three.

Despite the early emergence of shared intentionality, there is developmental change in children's cooperative abilities enabling them to succeed in increasingly complex tasks. Three-year-olds are more successful than younger children at tasks that involve role-switching when working with peers, and age also brings the ability to flexibly shift between one's own perspective and that of a partner. Such flexibility has been probed in economic games such as the 'Stag Hunt', whereby if a large reward or 'stag' is available, it pays the players to abandon their smaller individual rewards or 'hares' and work together. Success depends on carefully monitoring the partner to see what they will do next, and five- to six-year-old children succeed in these paradigms by using communication to achieve coordination.

It is difficult to test younger children on such a set-up, and so the question of what develops to allow for this sophisticated coordination is still an open question. One possibility is Theory-of-Mind: tasks that require different actions or contrasting perspectives for the two actors are more challenging than those in which there is alignment. An interesting contention of Tomasello's is that engaging in joint activity helps children to construct their Theory-of-Mind skills over development, through the experience of shifting perspectives between self and partner. Another possibility is increased ability to take stock of the situation itself: other cognitive abilities such as analogical and causal reasoning, and executive function, undergo significant development well into school age, allowing children to solve more complicated problems both singly and in pairs.

Finally, an important component of any collaboration is sharing the spoils. Three- to five-year-olds prefer equitable distributions of rewards after working with others, and will reject uneven offers and even punish those that take more than their fair share if they have the chance, but in situations where a child holds resources, sharing those with others can be challenging in

early childhood. Two- to four-year-old children seem to need an explicit cue from their partner, such as an outstretched hand or a verbal request, to facilitate sharing. More complex influences on sharing resources that are well-documented in adults, such as reputation management, have not been found until children are five years old, but from this age, sharing can be used strategically, with children more likely to give resources to others when being observed by a familiar classmate or teacher than a stranger. In contrast to the challenge of sharing resources, children are highly motivated and adept at sharing *information* with others from a very young age. As early as 12 months, children point informatively to share information about the location of a hidden object with an experimenter.

Born that way?

Across human societies, economic games with adults have shown that although certain aspects of cooperation, such as punishment of selfish behaviour, seem to be universally present, there are important cultural influences on other aspects, such as reciprocity. At what age and how such cultural factors influence the development of cooperation is heavily debated. Those in favour of a 'natural tendency' view posit that helping and sharing are extremely robust and emerge irrespective of the social environment of the child. In support of this view, some cross-cultural studies indicate helping at 18 months old occurs at similar rates across different cultures. In contrast, those in favour of a 'social interactionist' view posit that humans' natural tendency to act prosocially can be reduced or enhanced at an early age by social experience and parenting practices.

Kartner and colleagues recently found that infants raised in Dehli, India helped experimenters at higher rates than those raised in Germany. This difference in behaviour mapped

onto a systematic difference in socialisation practices, with more opportunities to help in the family, less praise for helping and more punishment for ignoring help requests found in Indian than German families. Diary studies indicate that helping demonstrated in the lab, even as early as 14 months, likely builds on a substantial history of praise that infants have already accrued from helping events at home. More longitudinal data from a diverse set of cultures are needed to gain a better understanding of how the social environment and parental practices in the infants' first year of life influence the emergence of helping and sharing in the second year of life, but so far the data suggest that cultural differences impact the degree of cooperative tendencies in early childhood, but not their presence.

Uniquely cooperative?

There is good evidence that both chimpanzees and bonobos possess one of the key cognitive skills needed to cooperate with others: understanding others' goals. They can identify the goal of a human experimenter and help them to achieve it, though the role of intrinsic motivation, as opposed to a history of reward for doing so, is debated. Chimpanzees and bonobos also help conspecifics: for example, by transferring a tool that a partner needs to open a device, releasing out-of-reach rewards and opening doors so their partner could access food, in all cases without personal gain. In these studies, however, chimpanzees only tended to provide help in response to requests or attention-getting behaviours from their partners, and their understanding of the consequences of acting — namely that only the partner would benefit — was not always established. In contrast, bonobos helped proactively, in the absence of cues from their partner and even helped unfamiliar individuals to access out-of-reach rewards, showing more similarities to human behaviour. Unlike 18-month old infants, however, none of the other four great apes

species preferentially helped a groupmate who had just experienced harm, indicating that mediation of helping by concern for others may be unique to humans.

Chimpanzees team up in the wild to hunt, and share the spoils (Figure 3), but the notion that they understand the roles played by different members of the team, and the joint nature of the venture, is highly controversial. Even the motivations underlying meat sharing may be 'selfish', with some data suggesting individuals share to reduce harassment and begging which allows them to maximise their own consumption of the carcass. In lab settings, cooperation in chimpanzees is highly dependent on the social relationship between partners, but tolerant pairs can succeed in working together. Alicia Melis and colleagues have, in a series of studies, found evidence that chimpanzees understand the role of the partner: for example, they wait for or recruit a partner when one is needed, and provide the tool the partner needs for their part of the job. Unlike children, however, they prefer to work alone in these experiments, and only work together until their own goal is met, not until the joint task is completed. Their coordination in the 'Stag Hunt' situation is more fragile than that of children, and breaks down when partners cannot easily see one another. Just how 'joint' their joint action is, compared to human children, remains to be determined. Just as with the comparison between younger and older children, the difference in performance on these complex cooperative tasks could have many possible causes. However, the relative paucity of social tolerance between individuals undoubtedly plays a role.

To date, one sharp point of contrast between young children and other apes is the tendency to share information, at least with humans. Although chimpanzees will readily point to the location of a hidden tool that can be used to deliver them rewards, they do not inform the experimenter of the location of a tool that can only be used to benefit the experimenter, unlike informative human infants. It has been suggested that chimpanzees lack the cognitive ability of

joint attention described above, which underpins such informative communication, but no systematic study of joint attention between conspecifics exists. Interestingly, chimpanzees seem to communicate more helpfully with conspecifics, with recent field experiments showing they produce alarm calls intentionally and preferentially to individuals with less knowledge of the danger.

Work with other apes has thus revealed similarities but also differences compared to human children, particularly in the tendency to care for others' welfare, and in the tendency to jointly engage with others. Future work needs to continue to increase the ecological relevance of the testing situation for non-human apes, as the evidence is most compelling when individuals are interacting with members of their own species and factors such as the relationship between partners in terms of dominance and friendship are considered.

Conclusion

Children are remarkably cooperative from a very young age. From their first birthday children recognise the goals of others and show an inclination to help, and they seem to delight in sharing attention and information with others. It seems highly plausible that from these early foundations, uniquely human forms of cooperation (based on communication and norms) are built — but the increase in complexity occurs in parallel with many other developments in communication and ways of thinking about others and the world. The work to disentangle the crucial ingredients and the interactions among them is ongoing and here the key will continue to be comparison, across individuals, cultures, and species, to uncover which skills hang together over ontogeny and phylogeny.

Further reading

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Figure 1. Early attempts at 'helping' adults with household chores.

It can be difficult to ascertain the motivation of the child to engage in these behaviours, so controlled experiments are needed to probe the understanding of others' goals and motivation to

help them achieve their goals. Photograph courtesy of Joanna Bryn-Weitzel and reproduced with the permission of Boonham-Knight.

Figure 2. Helping an experimenter meet her goal.

Retrieval of items that an experimenter needs to complete their task and that have fallen out of the experimenter's reach has been extensively used to test helping behaviour in both young children and apes. Photograph courtesy of Joanna Bryn-Weitzel and reproduced with the permission of Boonham-Knight.

Figure 3. Sharing the spoils.

Chimpanzees from Kanyawara community sharing colobus monkey carcass after a successful hunt. Photographs taken by Katie Slocombe.

In Brief:

Humans cooperate on a scale seen nowhere else in nature. In this primer, Slocombe and Seed describe how studying cooperation in children - and making comparisons across cultures and with other primate species - is revealing the cognitive and motivational building blocks of human cooperation.