Stopping at Nothing: Two-Year-Olds Differentiate Between Interrupted and Abandoned Goals

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Abstract:
Previous research has established that goal tracking emerges early in the first year of life and rapidly becomes increasingly sophisticated. However, it has not yet been shown whether young children continue to update their representations of others’ goals over time. The current study investigates this by probing young children’s (24-30 months old) ability to differentiate between goal-directed actions that have been halted because the goal was interrupted, and because the goal was abandoned. To test whether children are sensitive to this distinction, we manipulated the experimenter’s reason for not completing a goal-directed action - his initial goal is either interrupted by an obstacle, or it is abandoned in favour of an alternative. We measure whether children’s helping behaviour is sensitive to the experimenter’s reason for not completing his goal-directed action by recording whether they complete the experimenter’s initial goal or the alternative goal. The results showed that children ($n=24$) helped complete the experimenter’s initial goal significantly more often after this goal had been interrupted than after it had been abandoned. These results support the hypothesis that children continue to update their representations of others’ goals over time by the age of two, and specifically that they differentiate between abandoned and interrupted goals.

Keywords:
- Goal attribution
- Social cognition
- Instrumental helping
- Prosociality
- Socio-cognitive development
1. Introduction

From navigating a busy street to organising a business meeting, there are many everyday contexts in which it is important to be able to attribute goals to other agents in order to predict their actions and to coordinate our actions and plans with them. This ability emerges early in the first year of life and rapidly becomes increasingly sophisticated. By three months of age infants expect agents to pursue goals that are consistent with their prior goal-directed behaviour (Kim & Song, 2015; Luo, 2011; Sommerville, Woodward, & Needham, 2005). By 12 months of age infants are sensitive to information about other agents’ internal states - such as preferences (Luo & Baillargeon, 2005; Spaepen & Spelke, 2007) and beliefs (Southgate, Senju, & Csibra, 2007; Southgate & Vernetti, 2014) - as well as external environmental constraints (Csibra, 2008; Liu & Spelke, 2017) in attributing goals. From early in the second year of life children also take verbal (Jin & Song, 2017) and non-verbal (Tauzin & Gergely, 2018) communication into account when attributing goals.

Accurate goal tracking requires us to continuously update representations of others’ goals over time – in particular because agents sometimes change their goals. For example, suppose that an agent has the goal of placing a book in a cabinet. She picks up the book, walks over to the cabinet, and begins to open the cabinet door – but then halts her action. In order to discern whether she still has the goal of putting the book in the cabinet, it is crucial to identify why she has halted her action. Environmental circumstances may have interrupted her goal by presenting her with an obstacle (e.g. she may have noticed that she cannot open the cabinet door without a key, and that she must therefore set the book down while going and getting the key). Alternatively, she may have changed her mind, abandoning the goal of placing the book in the cabinet (e.g. she may have been attracted by the cover of the book and decided that she would like to open it and read it). Only in the latter case should the goal that we attributed to this agent (of putting the book in the cabinet) be updated; in the former case she has merely halted the action momentarily because of an obstacle.

Most of the research on goal attribution in early childhood implements experimental scenarios in which the target agent’s goal remains constant. Little is therefore known about whether young children continue to update their goal attributions over time. This is a significant gap: the ability to update our goal representations is crucial for many aspects of social cognition, supporting action prediction, coordination in joint action, and flexible prosocial behaviour, in particular instrumental helping. Reconsider the above example: if the agent’s goal of placing the book in the cabinet was interrupted by an obstacle (the lock), she would be
grateful if a friend were to help by retrieving the key for her. Alternatively, if she has abandoned the goal, it would not be helpful at all if her friend blindly persisted in helping her. Depending on why the initial goal-directed action was halted, then, it may or may not be appropriate to persist in contributing to that goal. It is therefore important that children track others’ goals over time and update their representations of others’ goals, and in particular, that they distinguish between interrupted goals and abandoned goals. Research investigating whether young children are fluent in making this distinction would therefore deepen our theoretical understanding of the development of goal attribution and flexible prosocial behaviour.

Although we are not aware of any research directly addressing this issue, some previous research provides reason to believe that a proficiency in making the distinction between goal abandonment and goal interruption may emerge at a very early age. One groundbreaking study by Behne et al. (2005) demonstrated that 9-month-olds distinguish between a scenario in which an experimenter is unable to pass an object to the child (e.g. because s/he has dropped the object, or because she cannot open the lid of a transparent container), and a scenario in which the experimenter is unwilling to pass the object. Crucially, the experimenter first establishes a routine of passing objects to the child, so when she stops this routine on test trials (either because she is unable or unwilling to continue), she can be characterized either as having been interrupted or as having abandoned the routine of passing objects – although the experimenter never interrupts or abandons a specific goal-directed actions once she has begun it, i.e. within a trial. While there has not been any other research directly bearing upon children’s understanding of goal abandonment, there is substantial research which establishes that young children understand goal interruption. Most notably, by 18 months children instrumentally help an agent who encounters an obstacle while pursuing a goal (Drummond, Paul, Waugh, Hammond, & Brownell, 2014; Hepach, Vaish, Grossmann, & Tomasello, 2016; Hepach, Vaish, & Tomasello, 2012; Liszkowski, Carpenter, Striano, & Tomasello, 2006; Liszkowski, Carpenter, & Tomasello, 2008; Svetlova, Nichols, & Brownell, 2010; Warneken & Tomasello, 2006). Moreover, Warneken, Gräfeinhain, and Tomasello (2012) showed that 21- and 27-month-olds respond differently to an experimenter who is unwilling to continue playing than to one who is willing but who has merely been interrupted (by dropping a toy). Finally, one study by Martin & Olson (2013) has shown that 3 year-olds help in a manner that is sensitive not just to an adult’s immediate request but to their more distal goal (i.e., they decline to pass an adult a requested object if that object is not actually helpful in light of the adult’s distal goal).
Taken together, these findings indicate that children understand when an agent maintains a goal despite the presence of an external obstacle which prevents the immediate completion of the goal, and that they can use this information to guide their helping behaviour. None of them, however, directly address the question of whether young children understand when an agent has taken up a goal and then subsequently abandoned it for a different goal. The current study addresses this question.

Because there is evidence that children understand goal interruption, and are motivated to instrumentally help when an agent’s goal is interrupted, an instrumental helping paradigm presents an ideal context in which to probe young children’s ability to distinguish between interrupted and abandoned goals. In addition, the use of an instrumental helping paradigm enables us to contribute to the literature on prosocial behaviour in early childhood.

If children can differentiate between goal interruption and goal abandonment, and use this information to guide their actions in instrumental helping tasks, then we should expect them to exhibit this ability by the age of two years old. At ages younger than two years old we would not expect this: there is evidence suggesting that children younger than two years of age struggle to appropriately help when there are multiple helping affordances, or when cues for an agent’s goal are ambiguous or absent at the moment when help is solicited (e.g., Hepach, Vaish, Grossmann, & Tomasello, 2016; Hobbs & Spelke, 2015; see also Krogh-Jespersen, Liberman, & Woodward, 2015; Waugh & Brownell, 2017).

To test this hypothesis, we developed an instrumental helping paradigm in which we manipulated why the experimenter (E) did not complete a goal-directed action. On test trials E began to place a toy into one of two boxes (initial location), but did not complete this action. In the abandoned goal condition, E indicated that he had changed his mind, and would prefer to place the toy in the other box (alternative location). In the interrupted goal condition, E encountered a physical obstacle which prevented him from reaching the initial box. Despite this, he continued to maintain the initial goal (i.e. his goal was still to see the toy placed in the initial location).

Because we were interested in the cognitive underpinnings of helping behaviour, not the motivation, we sought to maximize the number of trials on which children would try to help. Accordingly, E asked the child to help, without specifying which box was his current goal. We measured where children helped to place the toy, i.e. whether they helped to place the toy into the box that was E’s initial goal (initial location), or whether they helped to place the toy in the other box (alternative location). In order to appropriately help E, children had to continue to update their representation of E’s goals and to distinguish between abandoned and
interrupted goals (i.e. it was not sufficient to notice that E had halted his initial goal-directed action). If children differentiate between these causes of E not completing his initial action, we should expect their helping behaviour to differ between the two experimental conditions. We therefore predicted that children would help place the toy in the initial location more often in the interrupted goal condition than in the abandoned goal condition.

The hypotheses, sample size, methods, exclusion criteria, analyses, and pilot data were pre-registered before data collection, and can be accessed at: https://osf.io/4k2h9/?view_only=1a1ba0a24a8c4f1fb3ffe98a553d25d1. All aspects of the study were carried out in accordance with the pre-registered protocol unless otherwise stated.

2. Method

2.1 Participants
Using the simr package in R (Green & MacLeod, 2016), it was determined that a sample size of 20 would provide power of at least 90% for detecting a medium-sized effect, as observed in a pilot study (see supplementary material SM1) for our primary analysis. After beginning data collection but prior to commencing data coding, we modified the design to counterbalance the last location referred to by E on test trials; this change necessitated an adjustment of the target sample size to twenty-four, because we were then counterbalancing three factors (see the Design section). Twenty-four participants were thus included in the final sample (8 females, average age: 26;28, range: 25;02-30;00). Additionally, 19 participants were tested and excluded from final analysis according to pre-registered drop-out criteria (see the Coding and drop-out criteria section below). Specifically, seven participants were excluded who helped to place toys in the same box on each test trial, and 12 participants were excluded because they did not complete at least two trials in each condition due to fussiness (7), shyness (1), or taking too long to help E on too many test trials (4). All participants were recruited from a database of families in the Department of Psychology at the University of BLINDED and from nurseries in the surrounding area. The majority of participants came from middle class backgrounds and were Caucasian.

2.2 Materials/apparatus
Participants sat 1.65m away from the apparatus (see Figure 1) on their caregiver’s lap. The apparatus consisted of two coloured boxes, yellow and green (each 35cm x 20cm x 65cm, and each with a white barrier on the inside), with coloured tubes that run into these boxes (70cm
long, 8cm in diameter). Placing the toy in either box requires that the toy be dropped into the appropriate tube. The boxes are separated by a white barrier (35cm x 95cm). A small transparent box sits in between this barrier and the participant, which is where E places the toy after asking for the participant's help. The toys are small cubes (5cm x 5cm x 5cm) that are each equally coloured green and yellow.

Figure 1: Apparatus from the perspective of participants (note that E’s face has been pixelated for blinded review). The box and tube on the left are yellow, and those on the right are green.

A plank runs along the ground between the two boxes, though participants are unable to see this because of the white barrier. The bottom of the tubes rest on this plank, and moving this plank rotates the tubes. This rotation (along with the barriers on the inside of the boxes) prevents E from reaching one of the tubes (see Figure 2).
2.3 Design
We implemented a within-subjects design, with participants performing eight test trials in total. To control for order effects of condition, the eight trials were split into two blocks of four: Block 1 (interrupted goal, abandoned goal, interrupted goal, abandoned goal), and Block 2 (abandoned goal, interrupted goal, abandoned goal, interrupted goal). The order of blocks, E’s initial goal location, and whether the final location referred to by E was E’s goal by the end of each trial, was counterbalanced.

2.4 Procedure
Participants were tested individually in laboratories at the University or else at nurseries. Caregivers gave informed written consent, and participants received a gift for taking part. Sessions lasted approximately 20-minutes. The experiment was conducted in accordance with the Declaration of Helsinki, and was approved by the Humanities & Social Sciences Research Ethics Sub-committee (HSSREC) at the University of Warwick (approval number: 01/16-17), as part of the ERC-funded project ‘[679092]’.
The apparatus and procedure were validated in a separate study with adults (see supplementary material SM2). Caregivers were present and played a largely passive role in test trials, with two exceptions: They were instructed to draw the participant’s attention to E (‘Look at what E is doing’) if participants were not watching E, and to encourage shy participants to help without giving specific instructions as to which box to help place the toy in (‘Can you help E? Can you put it where E wants it?’).

During warm-up participants were acquainted with the boxes and toys, as well as helping to place the toys into the boxes via the tubes. After warm-up, caregivers were asked to sit on a chair with the participant on their lap, whilst E sat in between the two boxes (behind the barrier).

2.4.1 Familiarisation phase
There were six familiarisation trials in which participants were acquainted with helping E, the obstacle that E encounters in the interrupted goal condition (i.e. the rotation of the tubes), and the fact that E sometimes abandons his initial goal. In two of these trials E began to place a toy in one of the boxes, but then decided instead to place the toy in the alternative box. In the next two trials E began to place the toy in one of the boxes, before encountering an obstacle (i.e. the tubes rotated such that he could no longer reach his desired tube). In the two remaining familiarisation trials, the rotation of the tubes moved E’s desired tube closer to him. In all trials, E then asked the participant for help in placing the toy in E’s desired box, and placed the toy on the transparent box in front of the white barrier separating the participant from E. The participant was given no specific feedback about where they placed the toy; wherever they placed the toy, E thanked them and clapped, and asked them to sit with their caregiver again.

2.4.2 Test phase
There were eight test trials in total (4 per condition). The number of times that E referred to each box, and the time E spent looking at each box, were kept constant in each test trial, though the type of reference, gesture, and facial expression made towards each box differed depending on whether this was E’s current goal. Each test trial consisted of 3 phases: (i) establishing E’s initial goal, (ii) establishing that he is not going to complete the initial goal-directed action, and (iii) participants helping E.

(i).

At the beginning of each trial, in both conditions, E used gesture and verbal reference to indicate his initial goal: ‘Where will I put it [the toy]? In the green box [or yellow; this was
counterbalanced]…? No [E shakes his head and frowns towards the green]. I want this in the yellow box [E nods and smiles towards the yellow box]’. Once E’s initial goal (in this example the yellow box) was established he began the action of placing the toy in the tube connected to the yellow box.

(ii).

In the interrupted goal condition, E’s goal-directed action was not completed because the tubes rotated (E rotated them surreptitiously), such that E was unable to reach the tube connected to the yellow box. E unsuccessfully reached towards the yellow tube for several seconds, bumping into the barrier on the inside of the yellow box (see Figure 2). E then explained that: ‘I want it [the toy] in the yellow box [E nods and smiles at the yellow box], but I cannot reach now! I can only reach the green box, but I do not want it there [E touches the green box with the toy, and frowns].’

In the abandoned goal condition, E did not complete the initial action because he changed his mind: ‘Actually, I do not want this in the yellow box anymore [E frowns and shakes his head at the yellow box]. Ah, now I want this in the green box [E touches the green box with the toy, and nods and smiles].’ In this condition, the tubes did not rotate.

(iii).

Both conditions ended with E saying: ‘You can walk anywhere. Can you help me put it where I want it?’. E placed the toy onto the transparent box that is in front of the white barrier separating the participant and E, at which point the caregiver was instructed to set the participant down directly in front of them.

If the participant did not initiate the helping behaviour, E repeated this request. E then signalled to the caregiver to encourage the participant to come forward. Throughout this period E maintained eye contact with the participant and smiled encouragingly. The participant was given no specific feedback about where they placed the toy – E thanked the participant (regardless of which box the participant helped place the toy into), and encouraged them to return to their caregiver’s lap. Once they had done so and settled down, the next trial commenced.

2.5 Coding and drop-out criteria

For each trial, we coded where participants helped to place the toy (initial location vs alternative location). We then coded how participants helped E, distinguishing between two types of helping behaviour: placing the toy in one of the boxes, or moving one of the tubes closer to E. Since the latter occurred only 7 times in total, and since we consider the two helping types to
be equivalent, we collapsed these two helping types in the analyses. We also coded response type (i.e. whether participants’ helping behaviour was correct or incorrect): In the interrupted goal condition the correct helping location is the initial location, whilst the correct helping behaviour in the abandoned goal condition is the alternative location.

All sessions were recorded using digital video recorders. Coding was carried out by a naïve research assistant. Coders assessed: helping location (initial location vs alternative location), response type (whether participants’ helping behaviour was correct or incorrect), and trial exclusion (whether individual trials should be dropped from analysis, for any of the reasons listed below). A second naïve research assistant coded a random 6 participants (25%) for reliability (helping location: Cohen’s $\kappa = .90$ (95% CI: 0.81, 1.00), $p < .001$; helping type: Cohen’s $\kappa = .66$ (95% CI: .40, .92), $p = .001$; response type: Cohen’s $\kappa = .87$ (95% CI: .78, 1.00) $p < .001$; trial exclusion: Cohen’s $\kappa = .58$ (95% CI: .32, .86), $p = .001$).

2.5.1 Participant drop-out criteria

Pilot testing revealed that some children had a strong preference for one of the colors, and always placed the toys in the box with that color. For this reason we decided to exclude participants who helped to place the toy in only one of the two boxes on all test trials (indicating that they have a preference for a particular box which overrides any motivation to help E). We also excluded participants who did not complete at least two trials out of four in each condition.

2.5.2 Trial exclusion criteria

A trial was excluded if any of the following criteria were met: (1) If caregivers instructed the participant as to which box to help place the toy into, (2) if there was a delay longer than 15 seconds between E finishing his script (or the participant being let go by their caregiver, whichever happened last) and the participant helping to place the toy into either one of the boxes, (3) if participants were not watching when E halts his goal-directed action or during the experimental manipulation (i.e. the dialogue specified in (ii)). If this occurs, E called the participant by their name and tried again. If the participant still did not pay attention, the trial was excluded, and E moved on to the next trial.

3. Results

3.1 Data screening
Of the 24 participants included in our analysis, 16 test trials were excluded (7 in the abandoned goal condition and 9 in the interrupted goal condition) due to a delay of longer than fifteen seconds between E’s initial request for help and participants’ helping. This left 176 test trials for further analysis (89 in the abandoned goal condition and 87 in the interrupted goal condition). In 169 of these test trials participants helped E by placing the toy into one of the boxes (87 in the abandoned goal condition, 82 in the interrupted goal condition), and in the remaining 7 trials participants helped by moving one of the tubes closer to E (2 in the abandoned goal condition and 5 in the interrupted goal condition). We collapsed these helping types for further analysis.

**3.2 Initial vs alternative goal location**

To investigate whether participants differentiated between abandoned and interrupted goals we used helping location - whether children helped to place the toy in the location that E was initially trying to place it, or in the alternative location. Children helped place the toy in the initial location on 35% of abandoned goal condition-trials, and in 64% of interrupted goal condition-trials (see Figure 3).
Figure 3: The proportion of trials on which participants helped E to place the toy in the initial location, with 95% confidence intervals of the means adjust for within-subject design (Cousineau, 2005; Loftus & Masson, 1994; Morey, 2008). Jittered dots represent individual participants' performances in a given condition, with light grey lines connecting each participant’s performance across conditions.

To test whether the cause of E not completing his initial goal-directed action had an effect on helping behaviour, we used the functions `wilcox.test` and `wilcoxonPairedR` of the R package `rcompanion` (Mangiafico, 2016) to run a paired Wilcoxon signed-rank test. We used Wilcoxon test for comparing proportions across conditions throughout the article because proportions do not meet the assumptions of t-tests. (As we had proposed in the pre-registration, we also ran generalised linear mixed effect modelling for the data throughout the study. See Supplementary Materials for the results, which are the same as for the Wilcoxon test. We report the results of the Wilcoxon test here because it is more familiar to readers and because it is simpler to report). For each participant, we calculated the rate of helping E by placing the toy in the initial location per condition. The median rate of helping place the toy into E’s initial goal location was 33% in the abandoned goal condition and 75% in the interrupted goal condition. The median proportion of participants who placed the toy into E’s initial goal location was significantly higher in the interrupted goal condition than the abandoned goal condition ($V = 160, p = .009, r = 0.54$).

This indicates that participants differentiated between goal abandonment and goal interruption in their helping behaviour. However, the results of the foregoing analysis do not rule out the possibility that the effect found here may be driven by participants being more accurate in their helping in one of the conditions than in the other. Indeed, it appears from Figure 3 that children were particularly likely to place the toy at the initial location in the interrupted condition, raising the possibility that the difference between conditions may have been driven by some children perseverating on the initial location. If this was the case, we should expect children to have been more accurate in the interrupted condition than in the abandoned condition. We therefore also tested whether participants were more likely to help E correctly in one of the conditions as compared to the other.

### 3.3 Correct vs incorrect helping behaviour

Children correctly helped E in 65% of abandoned goal condition trials, and 63% of interrupted goal condition trials. To test whether the results of the main analysis were driven by
participants helping correctly significantly more in one condition in comparison to the other condition, we used the functions \texttt{wilcox.test} and \texttt{wilcoxonPairedR} of the \textit{R} package \textit{rcompanion} (Mangiafico, 2016) to run a paired Wilcoxon signed-rank test. The median rate of correct helping was 67\% in the abandoned goal condition and 75\% in the interrupted goal condition. The results indicated that participants were not significantly more likely to help E correctly in one condition as compared to the other ($V = 74.5, p = .943, r = -0.02$).

Finally, to determine whether participants helped correctly above chance (50\%) in each condition, we compared the proportion of trials with correct helping against 50\% with two one-sample Wilcoxon signed-rank tests using the functions \texttt{wilcox.test} and \texttt{wilcoxonOneSampleR} of the \textit{R} package \textit{rcompanion} (Mangiafico, 2016). Correct helping differed significantly from chance in both the abandoned goal condition ($V = 127, p = .008, r = 0.53$) and the interrupted goal condition ($V = 157, p = .023, r = 0.38$).

\section{Discussion}

We test whether two-year-old children differentiated between interrupted and abandoned goals in an instrumental helping task. The results reveal that children’s helping behaviour differed significantly between the abandoned goal condition and the interrupted goal condition – though it is worth noting that the difference may be driven by a minority of the participants responding very strongly to the manipulation (see \textit{Figure 3}). The results also reveal that participants correctly helped the experimenter above chance in both conditions, though they did not find either condition easier than the other. This rules out the possibility that the difference between conditions may have been driven by some children perseverating on the initial location – i.e. if this were the case, we should expect children to have been more accurate in the interrupted condition than in the abandoned condition. Taken together, these results support the hypotheses that two-year-olds continue to update their representations of others’ goals over time, and that they understand both goal abandonment and goal interruption.

Importantly, these results cannot be explained by learning effects from the first condition that children encountered on test trials (Brooks, 2012) because we implemented a block design for the eight test trials, counterbalancing order of blocks between subjects. Similarly, because we counterbalanced which box E referred to last, we can rule out the possibility that children were simply placing the toy in the box that E last referred to before asking for help. Moreover, the difference in children’s behaviour between the two conditions
cannot have been due to children’s colour preferences either (Marshall, Stuart, & Bell, 2006), since those children who helped to place all of the toys in only one of the boxes were excluded prior to analysis.

The current study contributes to two distinct bodies of previous research. First, the study builds upon research investigating goal tracking in early childhood. This research typically implements scenarios in which the target agent’s goals remain constant over individual test trials (Cannon & Woodward, 2012; Csibra, 2008; Liu & Spelke, 2017; Southgate & Vernetti, 2014; Woodward, 1998). Our findings extend that research by changing the target agent’s goals not only between test trials, but also sometimes within test trials.

Furthermore, our findings contribute to research on early prosocial behaviour. Most previous research probing the emergence of instrumental helping behaviour presents children with only one goal affordance during test trials, and children are typically faced with a helpee whose goals do not change during test trials (e.g., Barragan & Dweck, 2014; Cirelli, Wan, & Trainor, 2016; Dahl, Satlof-Bedrick, Hammond, Drummond, Waugh, & Brownell, 2017; Dunfield & Kuhlmeier, 2010; Hepach, Haberl, Lambert, & Tomasello, 2017; Kenward & Gredebäck, 2013; Over & Carpenter, 2009; Warneken & Tomasello, 2006) – though, as noted earlier, Martin & Olson (2013) have shown that 3 year-olds help in a manner that is sensitive to the distinction between an adult’s proximal and distal goals. Our findings extend this research by revealing that two-year-olds are able to help appropriately in dynamic social settings in which an agent’s goals sometimes changes. Moreover, the current study provides new impulses for research investigating the cognitive and motivational underpinnings of prosocial behaviour in early childhood. For example, our findings are relevant for research exploring the hypothesis that the identification of an agent’s goal leads young children to take up that goal as their own, and accordingly to be motivated to complete unfinished actions (Paulus, 2014; Michael & Székely, 2019). This is because, as Michael and Székely state, this hypothesis leads to the prediction “that an infant would continue helping […] if an agent were to become distracted, lose interest or otherwise abandon the goal” (Michael & Székely, 2019, p. 181). By establishing that two-year-olds understand goal abandonment, the current study provides a basis for testing this prediction (It must be noted however that the current study was not designed to this prediction: in the current study, E takes up a new goal after abandoning the original one, so children’s failure to complete the original goal-directed action may be due to their having taken up the new goal). Research along these lines would clarify whether “helping” behaviour in early childhood can be interpreted as a behaviour driven by the child's altruistic
motivation (Warneken & Tomasello, 2006) or as a behaviour motivated by a goal that has now become the child's own.

Our findings also raise new questions about how children track the goals of others. As in most previous research on goal tracking, this study used multiple cues to indicate E’s goals: gestural cues (Sodian & Thoermer, 2004), verbal cues (Jin & Song, 2017), goal-directed actions (Kim & Song, 2015; Luo, 2011; Sommerville et al., 2005), gaze and emotional cues (Phillips, Wellman, & Spelke, 2002), and external constraints (Csibra, 2008; Liu & Spelke, 2017). Future research should investigate how these different cues are integrated, and which ones children prioritise at different ages.

A further avenue for future research is how children’s understanding of goal abandonment relates to social learning. Children infer the value of goals on the basis of the costs that agents are willing to invest in the pursuit of those goals (Jara-Ettinger, Gweon, Tenenbaum, & Schulz, 2015; Liu, Ullman, Tenenbaum, & Spelke, 2017), but what do children infer about the value of goals which agents abandon? For example, they may interpret goal abandonment as stronger evidence that the goal is not worth pursuing, as compared to the case in which the goal was never adopted in the first place. To what extent do children generalise such inferences about the values of goals towards other goals of similar types (Csibra & Gergely, 2009; Gergely & Csibra, 2005; Martin, Shelton, & Sommerville, 2017; Spaepen & Spelke, 2007)? For example, if children observe an agent abandoning the goal of acquiring an apple and infer that that goal is not valuable, will they extend this to the goal of acquiring other apples, or other fruits? And do children infer long-standing psychological states, e.g., preferences, on the basis of goal abandonment (Hamlin, Wynn, & Bloom, 2007; Luo, Hennefield, Mou, van Marle, & Markson, 2017; Michael & Christensen, 2016; Sommerville & Crane, 2009)?

For the development of flexible social cognition and prosocial behaviours (such as instrumental helping), it is important to be able to update representations of others’ goals over time, and to differentiate between abandoned and interrupted goals. The current findings provide the first evidence that children as young as two years of age have these abilities.
Declaration of Conflicting Interests

The authors certify that they have no affiliations with or involvement in any organisation or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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