



PAPER

Collaborative partner or social tool? New evidence for young children's understanding of joint intentions in collaborative activities

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Abstract

Some children's social activities are structured by joint goals. In previous research, the criterion used to determine this was relatively weak: if the partner stopped interacting, did the child attempt to re-engage her? But re-engagement attempts could easily result from the child simply realizing that she needs the partner to reach her own goal in the activity (social tool explanation). In two experiments, 21- and 27-month-old children interacted with an adult in games in which they either did or did not physically need the partner to reach a concrete goal. Moreover, when the partner stopped interacting, she did so because she was either unwilling to continue (breaking off from the joint goal) or unable to continue (presumably still maintaining the joint goal). Children of both age groups encouraged the recalcitrant partner equally often whether she was or was not physically needed for goal attainment. In addition, they did so more often when the partner was unable to continue than when she was unwilling to continue. These findings suggest that young children do not just view their collaborative partners as mindless social tools, but rather as intentional, cooperative agents with whom they must coordinate intentional states.

Introduction

People pool their efforts in collaborative activities because it enables them to achieve ends that are beyond the means of any one individual. People also like to engage with others in a variety of non-instrumental collaborative activities such as social games. Philosophical accounts highlight that such collaborative activities differ fundamentally from other types of social interaction because they are based on joint goals and joint intentions (Bratman, 1992; Gilbert, 1990; Pacherie, 2003; Searle, 1990, 1995; Tollefsen, 2005; Tomasello, Carpenter, Call, Behne & Moll, 2005). Roughly speaking, the notion of a person acting merely with an individual intention in the form of 'I intend to do x by means of y', or recognizing another person's individual intention ('You intend to do x by means of y'), is sufficient to explain engagement in social interactions such as competition, parallel play, instrumental helping, or imitation. However, when two individuals engage in a collaborative activity, monitoring individual intentions is not sufficient; the partners also have to be aware that they are pursuing a joint goal, which both jointly intend to achieve in the manner of 'We

intend to do x together by means of me doing y₁ and you doing y₂'.

Most recently, it has been proposed that the ability to form joint intentions is a species-unique capacity that is fundamental for human cognitive development and explains many of the differences between humans and their closest evolutionary relatives (Tomasello *et al.*, 2005). This difference is clearly apparent in children 3 years of age and older who go beyond joint goals and actually create with others normatively constituted joint commitments in a way that other primates do not. For example, Hamann, Warneken and Tomasello (in press) found that 3-year-olds remain committed to following through in a joint activity until both partners have received their rewards (even when one partner, by accident, gets hers first), whereas Greenberg, Hamann, Warneken and Tomasello (2010) found that in a similar situation chimpanzees did not remain committed after receiving their reward. Further, Gräfenhain, Behne, Carpenter and Tomasello (2009) found that when 3-year-olds form explicit joint commitments with others verbally, they expect the other to live up to them in a way that they do not without such a commitment. Moreover,

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they themselves feel the need to acknowledge or even 'apologize' if they have to break off from an explicitly formulated joint commitment with a partner.

But with younger children the situation is not so clear. Already during the first year of life infants engage in dyadic and triadic play, adjust their behavior to that of another person in games with a turn-taking sequence and defined roles (such as peek-a-boo), and act jointly in simple problem-solving tasks and social games – but only if they are scaffolded by an adult (Eckerman & Peterman, 2001; Hay, Payne & Chadwick, 2004; Ratner & Bruner, 1978; Ross, 1982). During the second year of life, children become progressively more adept and active partners in joint activities, and by their second birthday they display skillful coordination even in novel situations with peers (Brownell & Carriger, 1990, 1991; Brownell, Ramani & Zerwas, 2006; Eckerman, Davis & Didow, 1989; Howes, 1987).

But these studies were all concerned with children's ability to coordinate and communicate with their partner, without addressing the question of joint intentions. A recent study attempted to assess whether children view their own and the partner's action as being part of a collaborative activity with joint intentions. Warneken, Chen and Tomasello (2006) proposed that children's responses to the interruption of the activity by the partner (first devised by Ross & Lollis, 1987) can be used to measure their understanding of joint intentions. Specifically, they found that children at 18 and 24 months of age would try to re-engage a partner who suddenly interrupted the joint activity, and this was taken as evidence that children viewed the partner's interruption as a violation against the collaborative nature of the activity (see also Warneken & Tomasello, 2007, for 14-month-old infants).

However, it is questionable whether this behavior alone is sufficient to claim that children had formed a joint intention with the other for two reasons (and indeed some research has found that some nonhuman primates in some situations will try to instigate a recalcitrant human partner or conspecific to resume a social activity; Hirata & Fuwa, 2006; Pika & Zuberbühler, 2008; Tanner & Byrne, 2010). First, children might not have been reacting to the partner's intention at all, but only to the behavioral outcome – that he stopped acting. Second, because the partner's participation was necessary for the child to execute her own actions, the children may have simply wanted the other person to continue because they wanted to continue their own individual action. That is, they might have viewed the other as a mere social tool instrumental in bringing about their own individual goal.

Therefore, more research is needed to unravel whether when young children try to re-engage a recalcitrant partner, they actually respond to the (un)cooperative intention or whether they focus only on the other's failure to continue. In addition, it is still unclear whether they view the other as an intentional collaborative

partner or just a social tool. No study has used age-appropriate paradigms to address these issues in toddlers. Therefore, the current studies addressed two questions. Do toddlers take into account the other person's intention to collaborate? And: Do they view the other as a genuine collaborative partner or a 'social tool' that is necessary for their own individual goal-fulfillment?

In the current experiments, we engaged toddlers in collaborative games and the experimenter then unexpectedly interrupted her play for a brief amount of time similar to previous studies. To address the first question, we had an adult interrupt her joint activity with young children, and we varied the partner's intention leading to the interruption, that is, whether the partner interrupted the activity because she was unwilling or unable to continue (adapting a method first used with children by Behne, Carpenter, Call & Tomasello, 2005). If children take into account the partner's intention leading to the interruption, they should act differently in these two conditions. In particular, we would expect that children are more likely to support (help and communicate with) the partner to continue in the unable condition (as the partner presumably maintained their joint goal to play together) than in the unwilling condition (as the partner broke off from the joint goal). Alternatively, if children pay attention only to the behavioral outcome of the experimenter's actions (the behavioral effect of her actions being absent during interruptions), support should occur equally often in both conditions, no matter whether the experimenter interrupted because she is unable or unwilling to continue.

To address the second question about the experimenter being viewed as a collaborator or social tool, we compared tasks in which the child's and the experimenter's actions were either causally related (the experimenter's engagement was physically necessary for the child to perform her action; two tasks from Warneken *et al.*, 2006) with social games in which the actions were causally unrelated (partners did not have to act jointly but could do so, e.g. by coordinating their actions with the help of a synchronizing element like a rhyme or launching a car simultaneously; two tasks from Gräfenhain *et al.*, 2009). The social tool hypothesis predicts that irrespective of the experimenter being unwilling or unable to continue, attempts to support the partner should be more likely in tasks with causally related actions because only in these tasks is the other person's participation necessary for an individual goal-fulfillment. The collaborative partner hypothesis, on the other hand, makes the opposite prediction: Children should differentiate between the unwilling and unable condition and facilitate the person's participation equally in games with causally related or unrelated actions, as in both kinds of task the goal is to interact jointly, even though it would be physically possible for individuals to perform their own individual act without the other's involvement.

Experiment 1

Method

Participants

Participants were $N = 24$ children of 27 months of age ($M = 27$ months, range 26.2 to 28.1 months; nine girls, 15 boys) from heterogeneous socioeconomic backgrounds, recruited via the birth records of a medium-sized urban city in Germany. They were all individually tested in a child laboratory in sessions lasting approximately 30 minutes, accompanied by a parent who remained passive in a corner of the study room. Three additional children were excluded because of fussiness (two) and problems with the videotaping (one).

Design

We employed a 2×2 design with Condition (unwilling vs. unable) and Type of task (causally related vs. unrelated) as within-subject factors. Each child was tested in all four tasks, two administered in the unwilling condition and the two other tasks in the unable condition. We systematically varied the assignment of tasks to conditions between subjects, so that across subjects each task was equally often used in the unwilling and unable condition. The order of the four tasks and the two different roles per task were counterbalanced using a Latin square design. For each child, the two conditions alternated, with half of the subjects starting in the unwilling condition.

Tasks

The four tasks are illustrated in Figure 1. In two of the tasks, the two actions were causally related (the experimenter's engagement was physically necessary for the child to perform her action) and in the two other tasks the actions were causally unrelated (players could but did

not have to act jointly to create the effect or retrieve a toy).

Rabbits (causally unrelated actions). Players clap their hands twice saying, 'Rabbit...', and at 'hop', they repeatedly press their respective lever with a small colored sponge, making a rabbit appear (box 60 by 50 cm, 45 cm high).

Trains (causally unrelated actions). Players lead their respective toy trains up a ramp saying 'Up...', and at 'down', they let it roll down the ramp (80 cm long, ramps 35 cm apart).

Elevator (causally related actions). The goal of this task is to retrieve an object from the inside of a vertically movable cylinder. In order for one player to take the object out from one side of the apparatus (role A), the other player has to push up the cylinder from the other side (role B). One person cannot succeed with this task individually because transparent screens prevent reaching to the opening while pushing the cylinder up.

Double tube (causally related actions). Two 75-cm-long tubes were mounted on a box in parallel, and on a 20-degree incline. One player sends a wooden block down one of the tubes from the upper side (role A) and the other person catches it at the other end with a tin can (role B).

Procedure

The procedure closely matched that of Warneken *et al.* (2006). The only critical difference was how Experimenter 1 (henceforth E1) initiated the interruption periods depending on condition. Thus, each task started with a demonstration phase in which E1 and E2 demonstrated the game or problem-solving task (for details see Warneken *et al.*, 2006). After the demonstration phase, E1 invited the child to participate and played with the child for two subsequent trials in which she performed her role appropriately (i.e. no hesitation, interruptions, or mistakes). If children performed successfully in these two trials of a given task, two additional trials followed. These trials were characterized by an interruption period and had two phases: First, E1 started to perform her role, but then either expressed that she was unwilling to continue or she was unable to do so. Subsequently, in either condition she would be inactive for 10 s (timed by E2), just looking down at the apparatus without addressing the child. After this 10 s interruption period, she resumed performing her role. For a given task, trials 3 and 4 were always of the same condition (either unwilling or unable). Specifically, this meant that in trials 3 and 4 of the *trains task*, E1 moved her train to the top of the ramp and then either accidentally knocked it over so that it dropped on the ground next to the ramp, exclaiming 'Oh, whoops!' (*unable condition*) or she placed it in the same location on the ground on purpose,

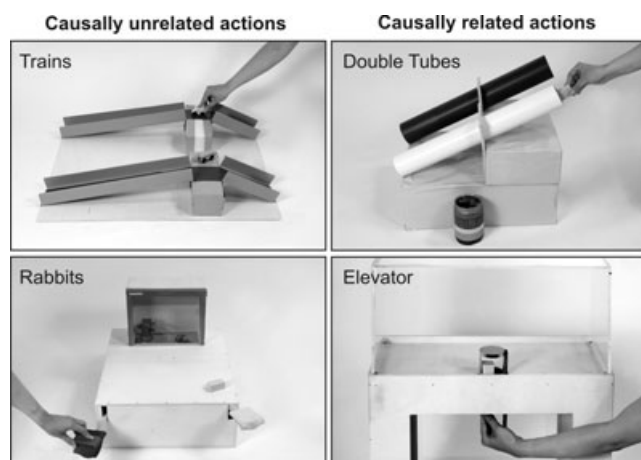


Figure 1 Apparatus with causally unrelated (left) and related actions (right).

accompanied by 'Well, no' (*unwilling condition*). Equivalently, in the *double tube task*, depending on her role, the can or the cube slipped out of her hand and fell to the ground by accident (*unable*) or she put it on the ground on purpose (*unwilling*). In the *rabbits task*, it was either E1 or E2 who displaced E1's tool which was used to play the game: While E1 was turned away looking at her watch, E2 approached the scene and took away E1's sponge from the apparatus, putting it on the floor clearly visible to the child about 2 meters away from the apparatus (*unable*) or E1 herself took the sponge, putting it in the same location and returning to the apparatus (*unwilling*). In the *elevator task*, before E1 withdrew her hand for the 10 s interruption period, in the *unable* condition she either had problems retrieving the toy from the cylinder because it was stuck as she three times tried to pull it out with one finger (*unable, role A*) or she tried to push the cylinder up effortfully one centimeter but dropped it three times because it was stuck (*unable, role B*). In the *elevator unwilling condition*, she poked her finger into the cylinder three times, just spinning the object around inside in a playful manner but not retrieving it (*unwilling, role A*) or she three times playfully lifted and dropped the cylinder (*unwilling, role B*).

In each task, the child acted on one side of the apparatus for four trials (i.e. two regular and two interruption trials). Child and experimenter then switched roles in tasks with causally related actions or sides in tasks with causally unrelated actions and were tested in another four trials (two regular trials and two interruption trials). Thus, if a child participated in all trials of a task, then she was tested in the following order of trials of that task: 2 × regular, 2 × interruption, switch side, 2 × regular, 2 × interruption. All interruption trials within a task were of the same condition (i.e. either unwilling or unable). Thus, each child was tested in up to 16 regular and 16 interruption trials across all four tasks.

Coding

All behavioral coding was done from digital video. The interruption periods were parsed out using the software

INTERACT so that coders were unaware of the respective condition and the child's performance before and after the interruption period. Verbalizations were transcribed and analyzed separately (see Table 1 for details). Inter-rater agreement was $\kappa = .86$ for nonverbal interaction and $\kappa = .83$ for verbal interaction. These constituted our main dependent measures as they concerned how children interacted with the partner.

In addition, we coded children's *action on the apparatus* by differentiating three types of behavior: *Disengagement*, in which a child performed goal-irrelevant actions without returning to the goal of the game (such as climbing on the apparatus, playing with the objects in different ways) or left the apparatus altogether; *Continue*, in which the child performed her own action only (such as pushing the handles of the rabbit apparatus down) and/or both her own and the partner's action (such as lifting the elevator on one side and trying to reach around the barrier to perform the retrieval role simultaneously); *Waiting*, in which the child did not act on the apparatus and was ready to continue to perform her role. For this coding schema measuring children's action on the apparatus, one summary code was given per interruption period. If children displayed more than one of the behaviors, we selected the behavior that occurred for the majority of time. Inter-rater reliability was $\kappa = .75$.

Preliminary analyses

Each child participated successfully in virtually all tasks, so that their responses to interruptions by the partner could be assessed in on average $M = 14.6$ of 16 possible interruption periods (range 9 to 16 trials). We used individual mean proportions as dependent measures (e.g. dividing the number of interruption trials with nonverbal encouragement by the total number of interruption trials administered per child).

Preliminary analyses showed that there was no effect of condition or task type on children's action on the apparatus, a finding we do not discuss further as it is orthogonal to our research question (Disengagement: M

Table 1 Coding categories of two different classes of behavior

Behavior	Description
Nonverbal encouragement	<i>Offering gesture</i> Child hands over object to the experimenter with an outstretched arm or places it in front of her.
	<i>Referential gesture</i> Child looks at the experimenter and points towards the experimenter's tool or side of the apparatus with the index finger or the whole hand.
Verbal behavior	<i>Verbal encouragement</i> Child encourages the experimenter verbally with a neutral or positive facial expression and tone of voice ('You too?' 'Again, please').
	<i>Verbal protest</i> Child commands the experimenter to continue with a negative facial expression or tone of voice ('No!' 'Come on!').
	<i>Other verbalization</i> Drawing the partner's attention to the apparatus ('Look, there'), mimicking ('Whoops'), or describing the apparatus ('There is a rabbit') or her own action ('I am lifting it').

Note: Each of the two classes of behavior was coded independently. For each class, we coded whether any of the described behaviors occurred at least once during an interruption period.

= 19%, *SEM* = 3% of trials; Continue: *M* = 43%, *SEM* = 3%; Waiting: *M* = 38%, *SEM* = 4%.

Given our hypotheses, we were particularly interested in children's interactions with the experimenter. For statistical analyses, we collapsed the two types of gesture (referential or offering object), as these are both conceptualized as nonverbal encouragement and because separate analyses would not pay attention to the fact that in three tasks children could produce referential or offering gestures (or both), whereas in the elevator task there was no object to offer. We conducted stepwise analyses by first looking at nonverbal interactions alone, and then in a second analysis including relevant verbal behaviors (forming a category that encompassed referential gestures, offering gestures and clear verbal encouragement). Preliminary analyses of the data revealed that there was no significant effect of gender, order of tasks or order of conditions on any of these dependent measures. There were also no differences between tasks within a given task type (causally related vs. unrelated actions) on any of these measures.

Results and discussion

To address the question whether children differently interact with a partner who stopped acting because she was unwilling or unable to continue, we first compared the mean percentage of trials with nonverbal encouragement attempts such as offering the play object or referential gestures across conditions (irrespective of whether they were accompanied by verbalizations or not). As can be seen in Figure 2, these nonverbal encouragement attempts occurred significantly more often in the unable condition

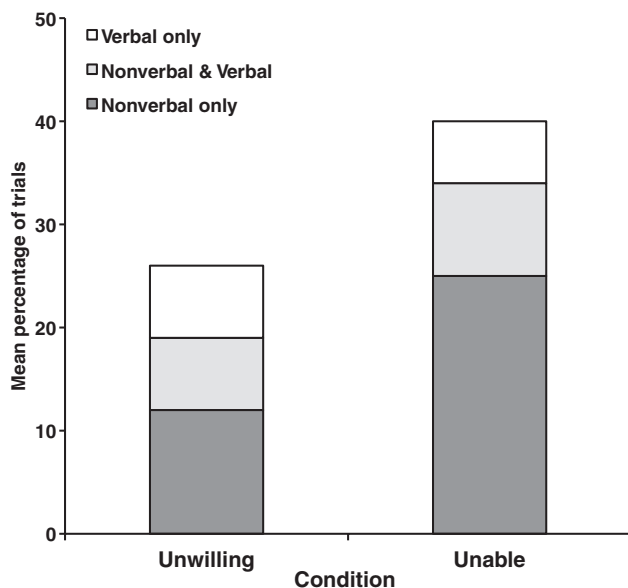


Figure 2 Interruption trials in which 27-month-old children encouraged the experimenter nonverbally, verbally, or both verbally and nonverbally in Experiment 1. Bars represent mean percentage of trials.

(nonverbal only or nonverbal with verbalization: *M* = 33% of trials; *SEM* = 6%) than in the unwilling condition (*M* = 19%, *SEM* = 4%), $F(1, 23) = 5.71, p < .05, \eta_p^2 = .20$. This was confirmed using nonparametric statistics (Wilcoxon signed-rank test: 14 positive, 6 negative ranks, 4 ties, $p < .05$). The same results were obtained when in a next step we included cases of verbal encouragement, which increased the overall rate of encouragement, but not the pattern: children were more likely to encourage (nonverbally and/or verbally) in the unable condition (*M* = 39%, *SEM* = 6%) than the unwilling condition (*M* = 26%, *SEM* = 4%), $F(1, 23) = 4.29, p = .05, \eta_p^2 = .16$. Thus, children were more likely to try to encourage a partner to continue who was unable rather than unwilling to collaborate.

To address the second question, whether children see the other player as a genuine collaborative partner or as a mere social tool, we included the type of task (causally related or unrelated actions) into analyses. There was no significant effect of type of task when looking at nonverbal encouragement irrespective of verbalizations (causally related: *M* = 25%, *SEM* = 4%, unrelated: *M* = 27%, *SEM* = 6%; $p > .70$). The same was true when including cases of verbal encouragement (causally related: *M* = 34%, *SEM* = 5%, unrelated: *M* = 31%, *SEM* = 6%; $p > .70$). Thus, children were equally likely to try to encourage the partner to play a game even when the partner's action was not causally necessary for the child to continue her own action.

In addition to these cases of encouragement, another potentially interesting behavior is protests. It cannot be expected that young children will protest frequently when interacting with an unfamiliar adult experimenter – one reason why in studies on protest in young children puppets are often used (Rakoczy, Warneken & Tomasello, 2008). However, even though protests were rare overall, all protests that we observed occurred exclusively in the unwilling condition (in *M* = 6%, *SEM* = 3%; none in the unable condition). On a group level, this was expressed in a trend comparing the two conditions, $F(1, 23) = 3.47, p = .075, \eta_p^2 = .13$ (with no effect of task type). On an individual level, six children protested at least once, all of them exclusively in the unwilling condition. This result should obviously be interpreted with caution because our adult–child constellation is not ideal if one were to choose protest as the main dependent measure. Nevertheless, it might deserve further attention in future studies.

Taken together, these analyses demonstrate that children were actually responsive to the intention causing the partner to interrupt the activity. Children were more likely to encourage her by, for example, picking up the object she had accidentally dropped rather than giving it to her when she had displaced it on purpose. In addition, the finding that this effect was the same in tasks in which actions were causally related or unrelated speaks in favor of the collaborative partner hypothesis that children view the other person as an intentional collaborative partner rather than a social tool to get the work done.

This finding indicates that already at 27 months, children represent others as collaborative partners when interacting with them. However, it still remains an open question whether the earliest forms of collaboration can be characterized in this way, namely in children in the second half of the second year, when they are just beginning to skillfully collaborate with others. This was addressed in a follow-up study using the same tasks and a slightly adapted procedure with a young sample of children at 21 months of age.

Experiment 2

Method

Participants

Participants were $N = 24$ children of 21 months of age ($M = 21$ months, range 21.1 to 21.9 months; 12 girls, 12 boys), recruited and tested in the same way as children from Experiment 1. Seven additional children were excluded because of parental interference (one), fussiness (two), or because they did not engage in the collaborative tasks and thus no interruption periods could be administered (four).

Procedure, design, and tasks

We used the same design and the same tasks as in Experiment 1. The only procedural difference to Experiment 1 was that interruption periods in either condition lasted 15 instead of 10 seconds. Piloting had shown that due to their limited locomotor abilities, 10 seconds was too short for 21-month-olds to react appropriately to the experimenter's behavior (e.g. to pick up the misplaced sponge in the Rabbit task or the cars in the Train task).

Coding and preliminary analyses

The coding schema and procedure were the same as in Experiment 1, resulting again in very good inter-rater agreement: nonverbal encouragement, $\kappa = .85$; verbal interaction, $\kappa = .74$, and action on the apparatus $\kappa = .76$. All 24 children participated successfully in the majority of trials, so that their responses to interruptions by the partner could be assessed in on average $M = 11.8$ of 16 possible interruption periods (range seven to 16 trials). Preliminary analyses showed that there was no effect of task type or condition on the way in which children acted on the apparatus (Disengagement: $M = 18\%$, $SEM = 3\%$ of trials; Continue: $M = 43\%$, $SEM = 4\%$; Waiting: $M = 40\%$, $SEM = 5\%$).

Preliminary analyses yielded no significant effect of gender, order of tasks or order of condition on any of the dependent measures reported below. As we had a directional hypothesis based upon Experiment 1, we used one-tailed tests.

Results and discussion

The results closely matched those of Experiment 1. That is, a first analysis of variance revealed that infants encouraged the experimenter nonverbally to continue more often in the unable condition (nonverbal only or nonverbal with verbalization: $M = 32\%$ of trials; $SEM = 6\%$) than in the unwilling condition ($M = 17\%$ of trials; $SEM = 5\%$, $F(1, 23) = 3.47$, $p < .05$, $\eta_p^2 = .13$, see Figure 3). This was confirmed using nonparametric statistics, with a main effect of condition, Wilcoxon signed-rank test, 13 positive, 4 negative ranks, 7 ties, $p < .05$. The same pattern emerged when including verbal encouragement (there were only three instances in which children communicated verbally only, without nonverbal encouragement). Thus, children were more likely to encourage nonverbally and/or verbally in the unable condition than the unwilling condition (unable: $M = 33\%$, $SEM = 7\%$, unwilling: $M = 19\%$, $SEM = 5\%$); $F(1, 23) = 3.14$, $p < .05$, $\eta_p^2 = .12$, confirmed by a Wilcoxon signed-rank test (13 positive, 4 negative, 7 ties, $p < .05$).

Moreover, as with the older age group, there was no effect of type of task for nonverbal encouragement irrespective of verbalizations (causally related actions: $M = 25\%$, $SEM = 5\%$, causally unrelated: $M = 26\%$, $SEM = 7\%$; $p > .90$). The same result was obtained including the few verbal encouragement attempts (causally related: $M = 27\%$, $SEM = 5\%$, causally unrelated: $M = 27\%$, $SEM = 7\%$; $p > .90$). Protests were absent on the whole (only one child protested once).

Thus, even the younger infants were more likely to try to encourage a partner to continue who was unable rather than unwilling to continue playing and were

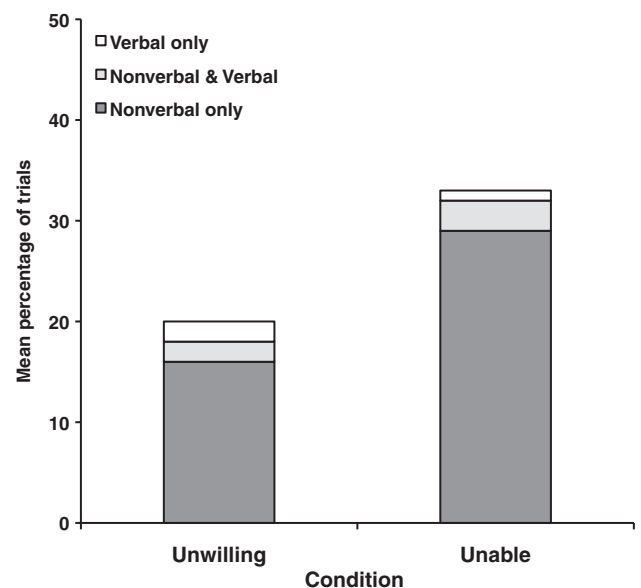


Figure 3 Interruption trials in which 21-month-old children encouraged the experimenter nonverbally, verbally, or both verbally and nonverbally in Experiment 2. Bars represent mean percentage of trials.

equally likely to do so in social games that they could choose to turn into an individual activity.

General discussion

The current study demonstrates that toddlers are responsive to their partner's intention when collaborating with them. Even when the behavioral outcome was the same during an interruption period (the partner stopped acting), they responded differently depending on whether the partner did so because she was unwilling or unable to continue. Thus, this finding fills a major gap in work on young children's collaboration because previous experiments failed to determine if children take into account another person's intention when interrupting a joint activity. This result is not expected by the social tool hypothesis, but provides support for the collaborative partner hypothesis.

Even if children are responsive to the other's intention, it could still be argued that they use the other instrumentally for their own individual goal, by drawing upon their understanding of the other's intention to manipulate them for their own ends. Specifically, children might have realized that the best strategy to deal with an unable partner is to help her, whereas this is futile when dealing with an unwilling partner – but this is only done in the service of their own individual goal to perform their own individual action. This social tool hypothesis thus predicts that children produce re-engagement attempts predominantly in tasks with causally related actions, in which they need the other to execute their own individual action. However, the second major finding of the study does not support this hypothesis: Children re-engaged a partner to the same extent whether or not her participation was required for individual goal attainment.

In sum, both the difference between the unwilling and the unable conditions and the non-difference between tasks with causally related versus unrelated actions are incongruent with the social tool hypothesis and congruent with the collaborative partner hypothesis.

One further alternative explanation for the difference between the unwilling and the unable conditions is that children did not respond differently in the two conditions based upon an assessment of the partner's reason leading to the interruption, but merely some superficial behavioral cues of the partner. For example, they might have responded merely to overt cues such as objects falling to the ground versus being placed on the ground, triggering different kinds of responses in the child. However, it must be pointed out that the differential effect of the partner being unwilling or unable held across a variety of tasks with different closely matched conditions. Specifically, whereas in the train task the unwilling and the unable conditions differed along the dimension of a purposeful refusal versus an accident, in the rabbits task conditions differed depending on who had misplaced the object (the play partner in the unwilling condition or the second

experimenter in the unable condition), and in the elevator task the unable condition was a continuous failed attempt, paired with solitary play in the unwilling condition. In addition, some 27-month-old children showed another specific type of behavior indicative of their differentiating understanding of the situation as they protested against the experimenter's interruption exclusively in the unwilling condition. These episodes thus also support the finding that children more than merely reacted to superficial behavioral cues. Overall then, the superficial behavior constituting the differences between conditions was highly variable across tasks, with the common denominator being only that they all expressed either the partner's unwillingness or inability to continue.

The current findings thus show that when toddlers react to an interruption of a collaborative task, they respond to the behavior of their collaborative play partner (and the intention leading to that interruption) instead of merely reacting to a behavioral outcome that prevents them from continuing their own individual action. This becomes apparent when toddlers are engaged in an activity that is explicitly marked as collaborative as in our current experiments where toddlers seem to actively monitor their collaborative partner's psychological states and adapt their own behavior accordingly. However, when young children have to differentiate and remember whether or not such a collaborative activity had been established in the first place (by a joint commitment to play together versus the absence of such a prior commitment), they seem to have more difficulty as they tend to encourage the partner to continue even in the absence of a prior joint commitment (Gräfenhain *et al.*, 2009) and are equally likely to help a peer whether the task is framed as a collaborative or an individual problem-solving activity (Hamann *et al.*, in press).

Altogether, this study is the first to establish that young children are not only able to engage in joint activities with others, but they view these interactions as genuinely collaborative activities with joint goals and intentions. When approaching 2 years of age, children are able to engage in various kinds of collaborative activities in which they flexibly adapt their individual intentions and actions towards their partner's intentions and actions based upon an intention to act jointly. However, the understanding of the explicitly normative aspects of collaborative activities such as prior joint commitments and obligations appear to emerge only somewhat later in development.

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