18-month-olds comprehend indirect communicative acts

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\section*{Abstract}
From soon after their first birthdays young children are able to make inferences from a communicator's referential act (e.g., pointing to a container) to her overall social goal for communication (e.g., to inform that a searched-for toy is inside; see Behne, Carpenter, & Tomasello, 2005; Behne, Liszkowski, Carpenter, & Tomasello, 2012). But in such cases the inferential distance between referential act and communicative intention is still fairly close, as both container and searched-for toy lie in the direction of the pointing gesture. In the current study we tested 18- and 26-month-old children in a situation in which referential act and communicative goal were more distant: In the midst of a game, the child needed a certain toy. The experimenter then held up a key (that they knew in common ground could be used to open a container) to the child ostensively. In two control conditions the experimenter either inadvertently moved the key and so drew the child's attention to it non-ostensively or else held up the key for her own inspection intentionally but non-communicatively. Children of both ages took only the ostensive showing of the key, not the accidental moving or the non-ostensive but intentional inspection of the key, as an indirect request to take the key and open the container to retrieve the toy inside. From soon after they start acquiring language young children thus are able to infer a communicator's social goal for communication not only from directly-referential acts, but from more indirect communicative acts as well.

\section*{1. Introduction}
Human communication is constituted by a communicator's intentions and a recipient's inferences (Grice, 1989; Sperber & Wilson, 1995; Tomasello, 2008). Prototypically, a communicator directs the recipient's attention to some referential situation, and then, to recover the social intention or goal behind her communicative act, the recipient must infer why she has done so. For example, using language, I may say to you “Bill’s car is parked outside”. The referential situation is clear, but some common ground is necessary for you to infer why I want you to know this fact – why I think this information might be relevant for you. Similarly, using a pointing gesture, I may direct your attention out the window to Bill’s parked car, and this creates exactly the same indeterminacy about my intentions (with perhaps some additional ambiguities concerning exactly what I am pointing out to you). While in these examples the communicator referred the recipient’s attention directly to the object his social intention is about, in indirect communication the communicator’s intentions need to be inferred from her reference to some fact that only vaguely
relates to that intentions. The recovery of what the communicator wants the recipient to do, know, or share in this more complex process involves more inferential steps compared to the examples above using direct reference.

To comprehend communicative acts (be it directly-referencing or indirect communication), recipients need to have an understanding of goals and intentions and they need to be sensitive to a communicator’s attention and ostensive signals. In the developmental literature, comprehension of a communicator’s attention has been found in gaze-following studies with 4- to 6-month-old children (Farroni, Mansfield, Lai, & Johnson, 2003; Grossmann et al., 2008; Grossmann, Johnson, Farroni, & Csibra, 2007; Senju & Csibra, 2008). These same studies found that children only followed the interactor’s gaze when it was preceded by a mutual look. That suggests that children as young as 4 months understand ostension, that is, that the mutual look indicates that the child is the recipient of a communication and that the communicator will do something interesting (e.g., looking at an interesting object). Moreover, 6-month-old children already understand that persons have goals, that is, that a person is trying to do something for a reason (Woodward, 1998) and 9-month-olds understand that someone not giving them a toy might be unwilling rather than unable to do so, that is, that persons have intentions and the children react accordingly (Behne, Carpenter, Call, & Tomasello, 2005). Moreover, children at this age differentiate between goals, actions and perceived outcomes of a person’s behaviour and imitate only those actions that yielded favourable outcomes in a study (Meltzoff, 2007). Thus, infants display the cognitive abilities required to comprehend communicative acts before their first birthday.

Behne, Carpenter, and Tomasello (2005; see also Behne, Liszkowski, Carpenter, & Tomasello, 2012) have also demonstrated that 12- to 18-month-old children have the ability to follow an adult’s pointing gesture to a referential situation and then infer the reasons for her communicative behaviour, that is, her social goal. For example, in the context of a hiding-finding game, they pointed for children to an opaque container. The children in their studies inferred from this communicative act that the sought-for toy must be inside the container. Importantly, children did not make such an inference if the adult simply protruded her finger out in a similar manner but non-communicatively (i.e., without engaging the child ostensively via eye contact).

Liebal, Behne, Carpenter, and Tomasello (2009) noted that the children in Behne et al.’s (2005a) study may have chosen the pointed-to container simply because, while searching, they had their attention drawn to it (and the non-communicative control condition did not succeed in directing attention in the required manner). In their study they thus pointed on different occasions to the same toy in the same manner but in the context of different types of common ground (e.g., one experimenter pointing to a toy in the context of their joint cleaning-up activity vs. a new adult just entering the room pointing to the toy). 18-month-old children did not simply use their own situation egocentrically to decide what to do with the object their attention was drawn to; they interpreted an adult’s social goal differently for the same communicative act depending on their common ground with that particular adult.

However, in both of these previous studies the “distance” between the adult’s referential intention (to draw attention to the container with the toy or to the remaining stray toy) and her social goal (to suggest where the child should search or what toy she should next clean up) was fairly small, since the child’s attention was drawn to the object directly.

In the current study we wanted to test young children’s inferential abilities in a more challenging way, that is, with a greater inferential distance between the adult’s referential intention and her social goal, using more indirect communicative acts. Thus, we set up a situation in which we drew children’s attention to an object fairly far removed from the communicator’s actual social goal and the relevance inference (going from the referred-to object to what the communicator actually wanted the child to do) therefore required several inferential steps.

Comprehension of indirect communicative acts of this type has so far only been tested in older children using verbal paradigms (Bucciarelli, Colle, & Bara, 2003; De Villiers, Coles-White, & Carpenter, 2009; Loukusa, Leinonen, & Ryder, 2007; Schulze, 2013; Schulze, Grassmann, & Tomasello, 2013; Verbuk & Shultz, 2010). The youngest children who have shown comprehension of indirect verbal communication were three years of age (Schulze et al., 2013). In this study, 3-year-old children understood that a person telling them that they had no milk for breakfast implicated (in this context) that she would rather eat a roll. Here, again, the child’s attention was drawn to a referent (here, the milk) that only indirectly related to the communicator’s social goal (to be given the roll for breakfast) and the child had to infer this relation using her world knowledge and the situational common ground.

Based on the hypothesis that human cooperative communication has the same intentional-inferential structure whether it is in the linguistic or gestural modality (Tomasello, 2008), we hypothesized that significantly younger children, specifically 18- and 26-month olds, should be able to appropriately infer a communicator’s social goal in highly indirect communicative acts relying on the gestural mode.

Moreover, the necessity of ostension in communication has recently been challenged (Butler & Markman, 2012; Moore, Mueller, Kaminski, & Tomasello, 2014). In their studies, Butler and Markman (2012) as well as Moore et al. (2014) compared communicative (ostensive) acts to intentional, but non-ostensive acts and furthermore to accidental ones. Both studies found that 2- to 3-year-old children made the same inferences in the ostensive-intentional and the non-ostensive, intentional condition, but not in the accidental condition, while 4-year-olds in Butler & Markman’s study then differentiated between ostensiveness and intentionality. However, both studies acknowledge the fact that children and experimenter ostensively and cooperatively communicated with each other before the experimental condition which might have led the younger children to believe that the communicative situation was still ongoing during the experimental variation.
Thus, we developed a novel paradigm that (1) tested infants' comprehension of indirect communicative acts (in which the relation between referential intention and social goal is ambiguous) and (2) tested which of the above mentioned features lead children to make inferences in communication. We thus included (a) an ostensive-intentional condition, (b) a non-ostensive, intentional condition which was additionally marked as accidental (to overcome the shortcomings in Moore et al., 2014 and Butler & Markman, 2012) but was in all other aspects perceptually identical to the ostensive-intentional one and (c) a truly accidental condition.

2. Study 1

2.1. Method

2.1.1. Participants

Sixty 26-month-old German-speaking children participated in this study. The mean age of the children was 2;2,20 (range 1;11,5–2;5,0; 30 boys and 30 girls). Five additional children had to be excluded from the final sample since they did not cooperate in the warm-up (three children) or test (one child) and because of experimenter error (one child). The children's parents had previously agreed to their children participating in studies on children’s social-cognitive development.

2.1.2. Materials

The child and an experimenter (E1) were sitting at a child-sized table and played a jigsaw-puzzle that required several animal-depicting pieces to be put in jigsawed holes that themselves depicted the same animals. E1 and a second experimenter showed the child that the pieces for the puzzle could be found in a container that was located behind her (approximately 120 cm away to her right and behind) at another child-sized table. The container was locked and required a key to open the lock of a latch. The key was a wooden disc with a square hole that matched a square knob on the front side of the container. Having retrieved all available pieces, the child and E1 went back to the table and put them into the puzzle. It then turned out that one piece (always the cow) was missing.

2.1.3. Design

Children's comprehension of indirect communicative acts was assessed in three between-subjects conditions with one trial per child. In the test condition, E1 ostensively showed the key to the child by establishing eye-contact and holding the key in front of the child (Ostensive Condition). In two control conditions we tested whether children’s actions were actually driven by a comprehension of communicative intentions. In one control condition, E1 inadvertently pushed the key in the direction of the child while pointing to the game so that the child accidentally became aware of the key (Accidental Condition). In a second control condition, E1 let the key fall down, picked it up and held in front of the child while inspecting the key quizzically but completely ignoring the child (Intentional Condition). Thus, Ostensive Condition and Intentional Condition looked very similar to one another and the key was equally salient in both conditions, the only difference being the presence or absence of communicative intentions towards the child.

2.1.4. Procedure

The children were tested in a separate room at their day-cares. Children sat at a child-sized table on the right side of their main interlocutor (E1). On their right side behind them was another table with the container on top, a second experimenter (E2) was sitting next to the container. When the child felt comfortable, E1 presented a jigsaw-puzzle. The pieces used with the puzzle had to be retrieved from a container. To familiarize the children with the locked container and the key, E2 demonstrated how to use the key and open the container’s latch and made sure the child tried to use the key herself. Then the experimental variation followed. All sessions were videotaped.

2.1.4.1. Familiarization

E1 introduced a jigsaw-puzzle depicting animals. In order to engage the child, E1 and the child talked about each animal, named it and pointed to the pictures in the puzzle. E1 then noticed that they had no pieces to put in the puzzle, saying the German equivalent of “Everything is empty here. But I think the pieces are over there in the container (pointing in the direction of the container). Let’s go over and get them.” In order to familiarize the children with the opening-mechanism, E2 showed them that the container was locked and how they should use a key to unlock the container and open a latch, saying: “Look, the container is locked. We need this key (showing her the key) and the key fits onto this lock. Do you want to try yourself? (E2 waited for the child to try fitting the key onto the lock). And now we need to turn the key (E2 and the child turned the key together) and now the latch is open (E2 opened the latch).” Children were excluded from analyses if they refused to use the key in the warm-up and thus did not have sufficient experience with the opening-mechanism (three children).

E1 then said: “Look, the pieces are in there, let’s take them out”. The child and E1 then retrieved all puzzle-pieces, locked the container and went back to the table where the child then subsequently put the pieces into the puzzle. During this interaction, E2 (unbeknownst to the child) placed another puzzle-piece (always the piece depicting the cow) into the container and locked the container. When the child was finished putting the pieces into the puzzle, E1 noticed that one piece was missing, said so and called the child’s attention by saying her name ("Oh, there is one piece missing! [Name of the child]!").

2.1.4.2. Experimental variation – Ostensive Condition

Having called the child, E1 ostensively showed her the key. That is, she held the key at the child’s eye-height, looked at the key, then at the child, back at the key and then placed the key in front of the child.

2.1.4.3. Experimental variation – Accidental Condition

Having called the child, E1 pointed to the jigsaw-puzzle and while
stretched her arm for the pointing gesture she accidentally pushed the key into the direction of the child so that it eventually was placed in front of the child. During pointing, E1 did not look at the child or the key but at the empty place in the puzzle.

2.1.4.4. Experimental variation – Intentional Condition Having called the child, E1 let the key (which she had held in her hand out of the child’s sight) fall down. To mark the dropping of the key as accidental and also to interrupt the previous communication, E1 exclaimed “Oops”. She then picked the key up and held it at the child’s eye-height, looked at it quizzically and then placed the key in front of the child. During that and for an additional phase of about 10 seconds she completely ignored the child.

2.1.4.5. Response-phase The child’s response time was 30 seconds long, after about 10 seconds E1 asked: “So what do we do now” or else interacted with the child (for instance, if the child said “The cow is missing”, E1 would repeat this). If the child went to the table with the container, E2 would be there to help her if required (e.g., if the child tried to open the container with the key but failed to turn the key; if the child did not notice that she had already unlocked the container, E2 pushed the latch only a little bit to indicate its openness). The trial was finished when the child had put the final piece into the puzzle. If the child would not try to retrieve the piece from the container within response-time, E1 finished the trial by directly encouraging the child to go to the container and get the piece.

2.1.5. Coding and reliability

We coded whether the child went to the container while taking the key with her, tried to open the container using the key and the latch, retrieved the missing piece and placed it in the puzzle. Such a behaviour may count as comprehension of the communicator’s specific social goal (glossed as, “Get the missing piece”) in the Ostensive Condition. If children failed at any of the above mentioned stages, their behaviour did not count as wanting to retrieve the puzzle piece in order to play the game.

Moreover, we coded whether the child used the key in any way, that is, when the child’s behaviour was as mentioned above and also when she used the key for other means (e.g., with the container’s lock but did not open the container or tried to use the key with the game). Such a behaviour may count as comprehension of a more general communicative and referential intention (glossed as, “I’m communicating about the key, therefore use the key”). Some children at first tried to use the key with the game and only secondly tried to open the container. In these cases, we coded both behaviours.

Furthermore we coded whether the children actually saw the key during the experimental variation of the three conditions and whether they saw that the experimenter was not communicating with them in the Intentional Condition.

An independent, blind coder coded a random sample of fifteen children. Inter-coder agreement was 100% (Cohen’s Kappa = 1.000) for all four measures mentioned above.

2.2. Results

Preliminary analyses revealed no gender effects. Moreover, all children saw the key during experimental variation.

For statistical analyses the dependent variable was how often children tried to open the container using the key and retrieved the missing puzzle-piece in order to continue the on-going game in each of the three conditions (see Table 1).

A Pearson Chi-Square-test revealed that children’s behaviour differed across conditions ($\chi^2(2) = 8.352, p = 0.015$). Post-hoc comparisons revealed that the Ostensive Condition significantly differed from the Accidental Condition ($\chi^2(1) = 6.667, p = 0.010$) as well as from the Intentional Condition ($\chi^2(1) = 5.013, p = 0.025$). That is, the children retrieved the missing puzzle piece most often in the experimental Ostensive Condition compared to the two control conditions.

Since Ostensive and Intentional Condition were perceptually very similar and the key in both conditions equally salient with the crucial difference between both conditions being that the experimenter ostensively communicated with the child in the former condition but explicitly not communicated with the child in the latter control condition, we performed a second analysis that only included those children who actually saw the conditions’ manipulation of communicative intentions (see Table 2).

A Fisher’s Exact Test revealed that our previous observation of significant differences in children’s performance in both conditions becomes even more pronounced ($p < 0.001$; Fisher’s Exact Test, 2-sided).

Furthermore we wanted to know whether children overall produced more action with the key when it was shown to her (Ostensive Condition) than in the other two control conditions (see Table 3). This includes all cases of key-use with the container’s lock (even if the child eventually did not open the container) as well as well trying to use the key with the puzzle.

A Pearson Chi-Square-test found that the children’s behaviour differed significantly between conditions ($\chi^2(2) = 11.313, p = 0.003$). Post-hoc analyses showed that the children inferred that they should do something with key most often in the Ostensive Condition (Ostensive vs Accidental: $\chi^2(1) = 10.417, p = 0.001$; Ostensive vs Intentional: $\chi^2(2) = 7.033, p = 0.008$).

2.3. Discussion

Our results indicate that at 26 months, children recognize a communicator’s communicative intention and, based on that recognition, they infer the communicator’s social goal in indirect communication. That is, not only

| Table 1 |
|---|---|---|---|
| Retrieval | No retrieval |
| **Ostensive Condition** | 12 | 8 |
| Accidental Condition | 4 | 16 |
| Intentional Condition | 5 | 15 |
did the children play with the key when their attention was drawn to it – which could be taken as evidence for their comprehension of a more general, directly communicated social and referential intention (glossed as, “Use the key”). They also, more importantly, worked out what specifically they should do about the key. Namely, the two-year-olds in this study correctly inferred the experimenter’s social goal (glossed as, “Get the missing puzzle piece for our game”). They did so most often in the Ostensive Condition. Since the communicator referred the children’s attention to a key but actually wanted them to do something about a hidden toy in a container, this study shows that 26-month-old children are able to comprehend more complex, indirectly-referring communicative acts.

Moreover, with respect to the ongoing debate about the necessity of ostensive signals in communication comprehension (Butler & Markman, 2012; Moore et al., 2014), our study adds important and novel evidence that two-year-olds differentiate between ostensively communicated, intentional, and accidental actions.

Because 26-month-olds did well in this study, we wanted to investigate children’s inferential abilities in indirect communication at a lower age, and so we tested 18-month-old children in Study 2. Since these younger children had problems completing the puzzle-game, we changed the game but kept the same underlying logic of the experiment.

3. Study 2

3.1. Method

3.1.1. Participants

Sixty 18-month-old German-speaking children participated in this study. The mean age of the children was 1;6;3 (range 1;5;2–1;6;29) with an equal number of boys and girls. 12 additional children had to be excluded from the final sample since they did not cooperate in the warm-up (seven children), could not walk independently (one child) or because of parent’s interference (one child) or experimenter error (three children). The children’s parents had previously agreed to their children participating in studies on children’s social-cognitive development.

3.1.2. Materials and design

Materials and design were the same as in Study 1 with the exception that (instead of the puzzle game) in this Study we used a ping-machine – a cardboard box that required small cubes to be pushed down a slide in order to make a funny noise. The cubes were collected in a small bowl. All sessions were videotaped.

3.1.3. Procedure

The children were tested in the child lab. The location of child, experimenters, and position of the container were the same as in Study 1; the parent sat behind the child to her left. In the familiarization phase, E1 and the child took turns using the ping-machine until no more cubes were available. E1 then said the German equivalent of “There are no more cubes. But I think there are some more over there in the container (pointing in the direction of the container). Let’s go over and get them.” Except for the differences due to the different game played in Study 2, familiarization with the opening mechanism, further play, experimental variation and response-phase were the same as in Study 1.

3.1.4. Coding and reliability

We used the same coding criteria as in Study 1.

An independent, blind coder coded a random sample of fifteen children. Inter-coder agreement was 100% (Cohen’s Kappa = 1.000) for all four measures mentioned above.

3.2. Results

Preliminary analyses revealed no gender effects. Moreover, all children saw the key during experimental variation.

For statistical analyses the dependent variable was how often children tried to open the container and retrieved the cubes in order to continue the on-going game in each of the three conditions (see Table 4).

A Fisher’s Exact Test revealed that children’s behaviour differed across conditions \(p = 0.006; \) Fisher’s Exact Test, 2-sided). Post-hoc comparisons using Pearson Chi-Square-tests found that the Ostensive Condition significantly differed from the Accidental Condition \(\chi^2(1) = 8.533, p = 0.003\) as well as from the Intentional Condition \(\chi^2(1) = 6.144, p = 0.013\). That is, the children retrieved the missing puzzle piece most often in the experimental Ostensive Condition compared to the two control conditions.

Since Ostensive and Intentional Conditions were perceptually very similar and the key in both conditions equally salient with the crucial difference between both conditions being that the experimenter ostensively

<table>
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<tr>
<th>Table 2</th>
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<td><strong>Number of children who retrieved the missing puzzle piece and saw the experimental manipulation per condition.</strong></td>
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<td><strong>Ostensive Condition</strong> &amp; Retrieval &amp; 12</td>
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<th>Table 3</th>
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<td><strong>Number of children who produced any key-related action independent of the outcome intended by E1.</strong></td>
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<td><strong>Action produced</strong> &amp; Retrieval &amp; 17</td>
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<td><strong>Number of children who retrieved the missing puzzle pieces per condition.</strong></td>
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<tr>
<td><strong>Ostensive Condition</strong> &amp; Retrieval &amp; 9</td>
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communicated with the child in the former condition but explicitly not communicated with the child in the latter control condition, we performed a second analysis that only included those children who actually saw the conditions’ manipulation of communicative intentions (see Table 5).

A Fisher’s Exact Test again revealed significant differences in children’s performance in both conditions \( p = 0.012 \); Fisher’s Exact Test, 2-sided).

Furthermore we wanted to know whether children produced more action with the key when it was shown to her (Ostensive Condition) than in the other two control conditions (see Table 6). This includes all cases of key-use with the container’s lock (even if the child eventually did not open the container) as well as well trying to use the key with the pling-machine.

A Pearson Chi-Square-test found that the children’s behaviour differed significantly between conditions \( \chi^2(2) = 6.624, p = 0.036 \). Post-hoc analyses show that the children inferred that they should do something with key most often in the Ostensive Condition (Ostensive vs Accidental: \( \chi^2(1) = 4.800, p = 0.028 \); Ostensive vs Intentional: \( \chi^2(2) = 6.144, p = 0.013 \)).

### 4. General discussion

We tested 18- and 26-month-old children’s comprehension of indirect communicative acts by referring their attention to one object (a key) that related to the communicator’s actual social goal (getting toys in order to continue the game) only indirectly. We found that infants as young as 18 months not only understood the direct reference of the communicator’s gesture (glossed as, “Here’s a key, use the key”) but they also, importantly, inferred the gesture’s indirect relation to the communicator’s social goal (glossed as, “Here’s a key, get some more toys for our game”).

They did so most often in the Ostensive Condition (when the experimenter held up the key in front of the child, made eye-contact and alternated her gaze between the key and the child). Contrastingly, holding up and looking at the key but ignoring the child (Intentional Condition) as well as accidentally pushing the key in front of the child (Accidental Condition) did not encourage the child to act with the key in the same amount. Thus, only the ostensive act of showing the key was understood as an implicit request to get some more toys from the locked container. By referring the child’s attention to the key (but not at the container directly), the experimenter gave only indirect evidence for her actual request and the child’s subsequent task was to work out what the experimenter wanted her to do.

Our children’s comprehension of indirect communicative acts cannot be attributed to past experience: We developed a novel key (dissimilar to conventional keys) to control for children’s knowledge of keys. However, since common ground is necessary for any comprehension of communication (Clark, 1996; Sperber & Wilson, 1995; Tomasello, 2008), we also introduced the key and the locked container which the key opened to the child. Thus, the children in our study may have simply copied our previous action at the container. That however, should have led to the same reaction (retrieval of the toys from the locked container) across all conditions. But that was not the case: Only when they were “indirectly requested” to get more toys from the container in the Ostensive Condition did they do so.

That such a request (the communicator’s social goal) was made had to be inferred from the ostensive showing of the key, which put a kind of pressure to act on the child. That is, the ostensive signals in this condition made the communicative act public or wholly overt between experimenter and child and this creates “not just expectations of cooperation but actual social norms, whose violation is unacceptable” (Tomasello, 2008, S. 92; see also Sperber & Wilson, 1995). Thus, the children recognized the pressure to cooperate conveyed through the experimenter’s ostensive communication and their natural reaction was to ask themselves why the communicator would show her the key and gaze at her and the key in turns. The child then saw the unlocking of the container as a relevant possibility of what the experimenter presumably wanted her to do. Of course, we cannot ascertain whether the children really put themselves in the communicator’s shoes and worked out her intentions in the way we believe them to do. However, children at the age of 18 months (and younger) have been found to understand a communicator’s intentions and believes (e.g. Behne, Carpenter, Call, et al., 2005; Behne, Carpenter, & Tomasello, 2005; Buttlemann, Carpenter, & Tomasello, 2009; Carpenter, Akhtar, & Tomasello, 1998; Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998; Kovacs, Teglas, & Endress, 2010; Meltzoff, 1995; Onishi & Baillargeon, 2005; Woodward, 1998). Moreover, the pattern of our findings (retrieving toys in the Ostensive Condition but not so much in the control conditions) points in the direction that a deeper analysis of the experimenter’s actions must have taken place in the test condition.

### Table 5

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<tr>
<th>Condition</th>
<th>Retrieval</th>
<th>No retrieval</th>
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<tbody>
<tr>
<td>Ostensive Condition</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Intentional Condition</td>
<td>0</td>
<td>12</td>
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### Table 6

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<th>Condition</th>
<th>Action produced</th>
<th>No action</th>
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<tbody>
<tr>
<td>Ostensive Condition</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Accidental Condition</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Intentional Condition</td>
<td>11</td>
<td>9</td>
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</table>
goal of helping the child to find a toy. Not so much later, at 18 months, infants also use indirect communicative acts to make such relevance inferences. Now, infants not only understand why a communicator is pointing to a container (because a toy is hidden in this location) but also why a communicator is showing her a tool (because it can be used to open a container where a toy is hidden).

Moreover, since success in our studies is based on this quite elaborated inference on a communicator's social goal and communicative intention, our findings cannot be explained in terms of low-level mechanisms that could account for children's success in earlier studies in which the children might have either interpreted the communicator's behaviour egocentrically (they searched for a toy and the communicator's gesture directed their attention to one location as in Behne, Carpenter, & Tomasello, 2005; Behne et al., 2012; Gräfenhain et al., 2009) or associated the experimenter and the game on a low-level basis (Liebal et al., 2009). The children in our studies did not egocentrically use the key for finding another toy or playing with the key in general, but only did so when they were “indirectly requested” to do so.

Thus, recognizing the communicative intention (that someone communicates for your benefit) starts off an inferential process that eventually leads to the computation of the communicator's social goal (what she wants the recipient to know, do, or share). Without communicative intention, much less inferences follow: The children in our studies made the appropriate inference only because they saw the ostensive showing of the key – but not the accidental moving or the intentional but non-ostensive inspection of the key – as a communicative act. Our findings cannot be attributed to increased attention to the key in the Ostensive Condition since, firstly, all children saw the key in all conditions (most actually played with it), and secondly, the Intentional Condition explicitly controlled for salience. A comparison between both conditions yields significant results: The intentional but non-communicative inspection of the key did not trigger children's search for relevance and comprehension of social goals as much as the ostensive, communicative showing of the key.

While Butler and Markman (2012) and Moore et al. (2014) found 3-year-olds to make similar inferences in ostensive and intentional conditions, we found ostension to be the key factor in starting communication interpretation. Both Butler and Markman as well as Moore and colleagues noted that the children in their studies may not have recognized that the previous communication was disrupted and thus still saw the intentional action in their studies as communicative. Since we controlled for that assumption in our Intentional Condition we were able to further differentiate between ostensiveness and intentionality.

Thus, our findings not only further clarify the role of ostensiveness in communication, they also provide the first evidence that 18-month-old children with little productive language display inferential abilities in indirect nonverbal communication.

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