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PAPER

What's mine is mine: twelve-month-olds use possessive pronouns to identify referents

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Abstract

This research investigated 12-month-olds' ability to use person-specific language to determine to which of several absent things a person is referring. Infants were introduced to two experimenters who played separately with a different ball. One researcher asked infants to retrieve her object when both balls were hidden. Infants selected the correct object when researchers used the pronoun my, *but failed to do so when* the *was used. The present research provides the first evidence of 12-month-olds' comprehension of possessive pronouns and indicates that infants use person-specific language to resolve reference.*

Introduction

One challenge infants face during conversation is identifying which of several objects a speaker is talking about. Such a challenge may arise when a speaker refers to a familiar object (and there are multiple exemplars present) or a novel object (and there are again multiple possible referents present). One way that children can solve this multiple referents problem is to keep track of what another person knows. The basic principle here is that speakers are likely to name or request objects that they have had contact with. For example, if a speaker asks for 'the ball', when multiple balls are present, one strategy is to choose the ball that the speaker had played with previously. This prior contact establishes that the person knows about the object.

Research on adults' pragmatic competence suggests that the endpoint of this skill is the ability to track mutual knowledge (e.g. that speaker A knows that speaker B knows that speaker A knows that speaker B knows … about the red ball; Clark & Marshall, 1981). The ability to recognize that oneself and another person know about the same referent depends on a processing-intensive set of meta-cognitive abilities that may be outside of infants' reach (and may not be necessary for adults either; e.g. Pickering & Garrod, 2004). However, before babies recognize what things are mutually known, they may determine what other individuals know about using more modest strategies that involve keeping track of a person's physical and verbal co-presence with referent objects (see O'Neill, 1996, for a similar proposal).

Monitoring physical co-presence involves noticing the object a person has had some sort of physical contact with. In most circumstances, physical contact also involves perceptual contact. That is, infants may be able to track what objects a person touches or sees to determine what they know about. Several studies have revealed that 1-year-old infants likely use both physical and perceptual contact as a cue to whether someone knows about objects (e.g. Liszkowski, Carpenter & Tomasello, 2007; Luo & Baillargeon, 2007; Luo & Beck, 2010; Onishi & Baillargeon, 2005; Surian, Caldi & Sperber, 2007; Tomasello & Haberl, 2003). As one example, success in looking time studies investigating infants' false belief understanding requires that they keep track of whether an actor sees an object being hidden or moved (Onishi & Baillargeon, 2005; Surian *et al.*, 2007). In addition, in Tomasello and Haberl (2003) 12-month-olds inferred which object would be *new* for an experimenter based on whether she was in the room (and could see the objects) when the object was introduced. They then used the newness of the object to select it for her when she made a request. Similarly, in Luo and Baillargeon (2007) 12.5-month-olds inferred that an actor preferred one object over another only when the actor had previously touched (or could see) the target objects.

Other research has revealed that infants who are a few months older can also keep track of what people know via physical co-presence in more challenging circumstances – such as when there are multiple objects that are not visually available during requests (Saylor & Ganea, 2007; Southgate, Chevallier & Csibra, 2010). All together, this research suggests that infants can use an

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actor's physical and perceptual contact with objects to determine what she knows about.

Noticing relationships between people and objects using verbal co-presence involves tracking what people *say* about objects. In the studies reviewed above, when the researchers talked about the objects, their speech may have just reinforced the information gleaned from physical co-presence. That is, there was nothing specific about what they said that helped to establish person-specific links to objects. For example, in Tomasello and Haberl (2003) the researcher reacted with excitement upon seeing the new object (by saying 'Wow! Cool!' when looking at an array of several old objects and the new object) and in Saylor and Ganea (2007) the two researchers commented on the general activities *infants* rather than themselves engaged in with an object. The Liszkowski *et al*. (2007) study included variation in emotional tone (neutral versus positive), but did not find clear evidence that 12-month-olds use this variation to determine whether they knew about an unattended event. Hence, one remaining question is whether infants use language that establishes a person-specific link to an object to determine to which of several objects a person is referring.

Research on 17–18-month-old infants' understanding of beliefs suggests that this may be possible at older ages. In particular, toddlers expect actors to change their false beliefs about the location of objects after being told where something really is (Song, Onishi, Baillargeon & Fisher, 2008). In the realm of knowledge states there is additional evidence that 15- and 18-month-olds can use language to establish links between people and objects. In particular, Ganea and Saylor (2007) found that infants could determine which of several objects a speaker was referring to with the indefinite pronoun *it* by using her past speech about the object. In this study, a researcher first searched in a room for a missing object (e.g. by saying 'I can't find my cup', while looking under pillows and behind chairs) to establish her verbal co-presence to the referent. In other words, because she talked about it she must know about it. After appearing to give up, she remembered where to find the cup and led infants into an adjacent room where there was a table with two objects on it (a shoe and a cup). The researcher asked infants to retrieve the lost object by saying, 'Can you get it for me?' To figure out what 'it' meant infants had to remember what the researcher had talked about previously. Both age groups were able to do so.

In the current study we ask whether infants also use person-specific language at a younger age and in a more challenging communicative context. In particular we ask whether babies at 12 months use person-specific language to determine to which of two absent objects a person is referring. Maintaining a person-specific link to an absent object may require infants to think about the object because the object is perceptually unavailable at the time of the request. If the objects were present, infants could succeed by simply matching the person to the object they had been seen with previously, without any consideration to the language used.

One piece of language-based information that infants may have access to in support of such person–object representations is the use of the personal pronoun *my*. The meaning of *my* is person specific – it changes based on who uses the term. For example, if two individuals use the term *my* to refer to two different objects, the term highlights a unique relationship between each person and each object. Mastery of this linguistic complexity may be related in a more global way to infants' understanding of persons, as infants' production of possessive pronouns in the middle of their second year has been linked to role-reversal imitation, prosocial behaviors, and self-recognition (Carpenter, Tomasello & Striano, 2005; Hay, 2006; Lewis & Ramsay, 2004).

This previous evidence suggests that infants produce personal pronouns such as *my* and *mine* between the ages of 15 and 18 months, but there is scant information about when babies begin to *comprehend* personal pronouns. There is some indication that possessive pronouns are available in speech directed at 3- to 10-month-olds, thus making it possible that 12-month-olds will have access to their communicative function (Rabain-Jamin & Sabeau-Jouannet, 1989). Our study will provide evidence of the emergence of infants' comprehension of the pronoun *my*. Infants' ability to use *my* to determine to which of several things a person is referring will also demonstrate that they use person-specific language to resolve reference.

To investigate these skills, we used a variant of the Saylor and Ganea (2007) procedure. Each infant met one experimenter who showed the infant his/her ball and then engaged the infant in play with the ball. Next, the first experimenter left and infants met a second experimenter who had a different ball but engaged in the same kind of play. During the test phase, one researcher asked infants to retrieve a ball when both objects were hidden from view. To succeed, infants had to use information about which ball the researcher knew about based on their experience during the initial play period.

Previous research using a similar procedure has revealed that 14-month-olds select the correct ball when the definite article *the* is used throughout the procedure (Saylor & Ganea, 2007). The term *the* signals that a unique referent – that has been shared between speaker and listener – should be selected. However, because use of *the* does not explicitly highlight a relationship between people and objects, its function may be less transparent for younger infants. For this reason, we asked whether person-specific language could facilitate their ability to use physical co-presence when establishing the link between people and objects. In particular, we compared their responding in a condition where the researchers used the pronoun *my* when referring to the ball to their responding when the researchers used the definite article *the*. Twelve-month-old infants may be more likely to select the correct ball in the *my* condition if they are able

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to use person-specific language to solve the multiple referents problem.

Study 1

Method

Participants

Participants were 48 infants ranging in age between 12 months, 9 days and 13 months, 25 days (M = 12 months, 28 days; 23 females). Data from eight infants were excluded for experimenter error (4), parental interference (2) and non-responsiveness (2). Infants in both studies were full-term at birth, had intact hearing, were developing normally, and had language input that comprised 95% or more English. Infants and their parents were recruited by phone from a database of families interested in research participation.

Materials

Stimuli. Infants were shown two different colored balls (one was red and the other was blue). The balls were kept in opaque sandbox buckets matching the balls in color. All parents reported before the experiment that their infants understood the label *ball*.

The researchers who played E1 and E2 were paired together so that they were distinctive from each other. Each pair included one male and one female experimenter. The researcher who played E1 or E2 was counterbalanced across infants.

Room set-up

Infants were tested in a small room with cabinets along the back wall. When infants were introduced to the test objects, two colored buckets were placed 5 feet apart on the cabinets in a set spatial position (e.g. the red bucket was to the right of the blue bucket). The buckets were within infants' view during the entire session. Parents were asked to sit directly across from the cabinets equidistant from the buckets. Infants were free to roam around the space. For a portion of the experimental session (the test phase) parents were asked to hold their infant on their lap. During the test phase, the colored buckets were placed on the floor in their set spatial position 5 feet away from the infant and parent (e.g. the red bucket was placed on the right and the blue on the left). The buckets were 5 feet apart when on the floor.

Procedure and design

Infants were randomly assigned to either the *neutral* or *my* condition. In the *neutral* condition (M age = 12 months, 29 days; 13 females, 11 males), the researcher used the pronoun 'the' before the word 'ball' throughout the procedure. In the *my* condition (M age = 12 months, 27 days; 10 females, 14 males) she used the word 'my' before the word 'ball' throughout the procedure. Otherwise the conditions were identical. The researchers made every effort to ensure that the pace and intonation of their speech was the same across conditions. The procedure is described using the pronoun 'my'.

The session was divided into two phases: ball introduction and test. During the ball introduction phase, E1 and E2 showed infants one of the balls during separate play sessions. At the start of the ball introduction phase the two researchers were in the room with infants. E2 left the room, so she would be out of sight when E1 introduced her ball. E1 approached the cabinet and reached into the bucket containing her ball (e.g. the blue bucket on the left), extracted the ball and said 'Here's my ball!' She then sat on the floor and played with the infant for 1 minute. The buckets remained out of reach, on the cabinets, during the entire ball introduction phase.

During the 1-minute-long play period, E1 rolled, bounced and threw the ball according to infants' interests. In doing so, she said the label ball five times as she commented on infants' actions (e.g. 'Are you throwing my ball? Can you give me my ball?'). At the end of the minute of play, E1 retrieved the ball from the infant, approached her bucket and put the ball inside while saying, 'My ball goes here.' At this point, E2 appeared and E1 left the room (leaving her bucket and ball on the cabinet). E2 repeated the ball introduction phase for her ball (e.g. the red ball on the right). Infants thus saw each experimenter paired with one of the balls for 1 minute and heard each experimenter label her ball seven times (five times during the play period and once each as she was taking the ball out of the bucket and putting it away). At the end of the ball introduction phase, E1 returned and the test phase began.

Test phase. The test phase began when one experimenter (usually E1) asked parents to hold their infant on their lap until they were asked to release the infant. E1 and E2 then appeared briefly together (to ensure that infants remembered that there were two researchers), and E2 left the room. E1 moved her bucket down from the cabinet onto the floor in the same spatial position it had been on the cabinet. After doing so, she lifted the ball out of the bucket and before replacing it said, 'My ball goes right here' and left the room. E2 repeated the steps with her ball and left the room as well. E1 and E2 then appeared together briefly. One researcher left the room, and the other researcher sat in front of the buckets facing the infant, called their name and said 'Where's my ball?' After the request, parents were asked to release their infant. E1 looked forward at the parent until infants responded (to avoid biasing their selection with a head movement). Once infants made their selection E1 clapped and said thank you.

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Which ball served as the target and the side the target appeared on was counterbalanced across participants. In addition, E1 and E2 asked infants to retrieve the ball during the test phase equally often across participants.

Most infants immediately went toward one of the buckets to retrieve a ball. When infants would not approach the buckets, the experimenter who asked the question repeated her request twice. If infants still did not respond she pushed the buckets toward the infant while repeating her request an additional time. This occurred for seven infants in the *neutral* condition and nine infants in the *my* condition. A 2×2 χ^2 clarified that there was no relationship between infants choosing the correct ball and whether the buckets were moved closer to them or not, $\chi^2(1) = .26$, $p = .61$.

Coding

Infants were given a score of 1 if they retrieved the ball the requesting experimenter played with during the test session, or if they pointed at the container housing the object. Only four infants (one in the *neutral* condition and three in the *my* condition) pointed as their main response. Responses were coded on-line by the requesting experimenter. A second coder, naïve to which experimenter played with which ball, checked the sessions where the camera afforded a clear view of the infants' head and eyes during the test phase. The coders disagreed on only four of the 41 codeable cases (90% agreement). They resolved their disagreements via discussion. The experimenter's judgments were used in the analyses below.

A coder transcribed the sessions and counted the words and ball references produced by each researcher. The number of words and ball references produced by the requesting (*neutral*: *M* words = 70.43, *M* ball = 7.39; *my*: *M* words = 74.90, *M* ball = 7.38) and non-requesting experimenters (*neutral*: *M* words = 72.04, *M* ball = 7.26; *my*: *M* words = 80.05, *M* ball = 7.24) did not differ in either condition (paired *t*s ≤ .91, *ps* ≥ .37) or across conditions (independent sample *t*s ≤ 1.47, *p*s ≥ .15).

In addition, to evaluate whether the requesting experimenter cued infants to the location of the object during the request phase, we made coding tapes of the researcher asking for the ball during the request phase while omitting infants' selection of the object, when the original videotape provided a clear view of the experimenter's behavior (resulting in 22 codeable sessions for the *neutral* condition and 18 for the *my* condition). A naïve coder guessed which ball the requesting experimenter was asking for during the request phase 45% of the time (10 of 22 sessions) in the *neutral* condition and 61% of the time (11 of 18 sessions) in the *my* condition (neither proportion was different from chance by a binomial test, *ps* ≥ .12). A 2×2 χ^2 tests of association revealed that the coder's ability to correctly guess which ball the researcher was asking for was *not* related to which ball the infants ultimately selected in either the *neutral* ($\chi^2(1) = 1.47$, $p = .23$) or the *my* ($\chi^2(1) = 1.61$, $p = .21$) condition. These findings demonstrate that the experimenters were not cueing infants to select one ball over the other during the request phase.

Results and discussion

In the current study, we asked whether 12-month-olds use person-specific language to determine to which of two absent objects a speaker is referring. As predicted, infants were more likely to find the correct ball in the *my* condition (17 of 24 infants) than the *neutral* condition (9 of 24 infants), $\chi^2(1) = 5.37$, $p = .02$. The number of infants selecting the correct ball in the *neutral* condition was not different from chance ($p = .15$, binomial test). In contrast, the number of infants selecting the correct ball in the *my* condition was greater than chance ($p = .003$, binomial test).

Summary

Taken together, these findings suggest that 12-month-olds use person-specific language in the form of the possessive pronoun *my* to determine to which of several referents a speaker is referring.

Study 2

Babies in Study 1 had access to two sources of information about the location of the absent referent – the color of the buckets (which matched the color of the balls) and the spatial position of the objects (one object always appeared on the right and the other always appeared on the left). In the current study, we ask how robust 12-month-olds' ability to use person-specific information is by removing the color of the buckets as a cue to the location of the referents. Babies in this study only participated in a version of the *my* condition in which yellow buckets instead of colored buckets were used. If infants can still locate the speaker's referent in this condition it would provide additional evidence that they are representing the speaker's referent object, rather than merely associating the person with her object and its location.

Method

Participants

Participants were 24 infants ranging in age between 12 months, 6 days and 13 months, 29 days (*M* = 12 months, 28 days; nine females).

Materials, procedure and design

The *yellow my* condition was the same as the Study 1 *my* condition except that yellow buckets instead of buckets

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matching the colors of the balls were used throughout the procedure.

Coding

Responses were coded as in Study 1. Six of 24 infants retrieved the requested ball only after the buckets were moved within reach and four of 24 infants responded with a point to the referent object. As in Study 1, there was no relationship between whether the buckets were moved closer to the infants and their selection of the correct object, $\chi^2(1) = .07$, $p = .79$.

Sessions in which a clear view of the infants' head and eyes were available were subject to reliability coding. The reliability coder disagreed with the experimenter's judgments on only two of 21 cases (91% agreement). Additionally, the requester's and non-requester's total number of words (requesting $M = 71.05$, non-requesting $M = 67.29$) and ball references (requesting $M = 7.24$, non-requesting $M = 7.10$) were not significantly different paired *t*s (21) ≤ 1.18, *ps* ≥ .25.

A naïve coder was at chance levels (47%, 10 out of 21 sessions) in selecting the object that the experimenter was asking for, and the coder's ability to choose which ball the researcher was asking for was unrelated to which object infants ultimately chose, $\chi^2(1) = 1.53$, $p = .21$.

Results

Infants in the current study rose to the challenge presented in this more difficult version of the *my* condition in which the color cue was removed – 17 of 24 infants ($p < .003$, binomial probability) chose the ball the requesting experimenter previously played with.

General discussion

The present study revealed that 12-month-olds use person-specific language in the form of the possessive pronoun *my* to determine to which of several referents a speaker is referring. In addition to providing the first evidence of 1-year-old infants' comprehension of possessive pronouns, this research indicates that they use others' verbal behaviors to solve the multiple referents problem. Infants may thus be using language to guide inferences about others' mental states. In the current study, they may use language to determine what someone knows about.

Infants' ability to use possession to determine a speaker's referent in the current task is all the more surprising because they had to keep track of two people and two objects in a context where the referent objects were absent when the request was made. In addition, the meaning of *my* changed based on who was using it, suggesting that infants may have generated multiple meanings of the lexical item within a single session. Remarkably, they were able to do so even when an informative color cue was removed in Study 2.

Twelve-month-olds failed to resolve on referents in the absence of person-specific language. This contrasts with previous research indicating that 14-month-olds succeed when the definite article *the* is used (Saylor & Ganea, 2007). One implication is that babies understand pronouns relating to possession of objects before they understand definite articles like *the* that indicate a relationship between people and objects without explicitly highlighting the person–object relationship. It is possible that babies have learned that possession matters, and when they hear pronouns like *my* they increase their attention to objects and persons in the environment. Determining how infants' allocation of attention is influenced by the use of different grammatical markers represents a fascinating future direction.

Infants' inability to use the physical co-presence of the person and the objects in the *neutral* condition to interpret the researcher's request was also somewhat surprising. Previous research with 12-month-olds suggests that they can make quite sophisticated inferences about what another person knows based on their prior experiences (Liszkowski *et al*., 2007; Tomasello & Haberl, 2003). The demanding nature of the task in this research – with two experimenters and two objects – may have curtailed infants' ability to hold the multiple relationships in mind. Additional research with 14-month-old infants has shown similar limitations in infants' skills. In particular, Liebal, Behne, Carpenter and Tomasello (2009) revealed that 14-month-olds have a less robust set of person tracking skills than do 18-month-olds. In particular, older infants used their experiences with *two* people to interpret an adult's ambiguous point toward an object, but younger infants were only able to interpret the meaning of ambiguous points when they interacted with a single adult.

One interesting possibility is that infants' ability to resolve reference (via physical or verbal co-presence) interfaces with their representational capacities, such that they fail to show robust abilities to resolve reference when their memory is taxed (e.g. Ganea, 2005; Ganea & Saylor, 2007, under review). The use of possessive pronouns in this research may have offered infants a way of storing information about persons and objects in an individuated format (with each object linked more strongly to a particular person). Previous research on 14-month-olds' working memory capacity during a search task offers support for this possibility – when meaningful labels (e.g. *dax* and *blicket*) were used rather than articles (*this* and *that*) infants were able to keep track of more hidden objects. The authors argue that the labels allowed babies to parse large sets of objects into several smaller groups (Feigenson & Halberda, 2008).

Infants in the present study used the possessive pronoun *my* to determine to which of several things a person was referring. Infants' ability to solve the multiple referents problem via specific linguistic cues suggests a role

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for language in supporting early social cognitive development. In particular, these new language learners may generate representations of people using both what others do and say.

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