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Preschoolers' mutualistic conception of seeing is related to their knowledge of the pronoun "each other"

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ABSTRACT

Previous research has shown that young children deny being able to see an agent whose eyes are covered. The current study explored this phenomenon further. In Experiment 1, 3-year-olds denied that they could "see," but affirmed that they could "look at," a doll whose eyes were covered—indicating that they demand mutuality for seeing another but not for looking at another. In Experiment 2, 3.5-year-olds drew the same distinction between "see" and "look at" when facing a doll or a human. A strong correlation between children's knowledge of the reciprocal pronoun "each other" and their adherence to the mutuality demand was found. The results are discussed with respect to children's bias for second personal encounters and children's relational concept of persons.

> Let us take a piece of paper and scrawl on it any doodle of a face. Just a circle for the head, a stroke for the nose, another for the mouth. Then look at the eyeless doodle. Does it look unbearably sad? The poor creature cannot see. We feel we must "give it eyes"—and what a relief it is when we make the two dots and at last it can look at us!
>
> [—E. H. Gombrich (1950, p. 43)]

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In games of hide and seek, young children often attempt to make themselves invisible by covering just their eyes, leaving the rest of their bodies exposed. At first sight, this ineffective strategy seems to support the view that young children cannot distinguish between their and others' viewpoints and project their own visual constraints to those around them (derived from Piaget & Inhelder, 1956, although their concept of egocentrism is more complex)—"If I cannot see (you), you cannot see (me), either." We may call this the "ostrich fallacy" account.

But a line of studies contradicts this interpretation of children's poor hiding strategy. In these studies, children were simply asked whether another agent is visible to them. Flavell, Shipstead, and Croft (1980) found that preschoolers between 2 and 4 years of age deny that they can see someone whose eyes are covered. Children of this age affirm that they can see a figure when the figure's mouth (McGuigan, 2009) or legs (Bridges & Rowles, 1985; McGuigan & Doherty, 2006) but not when the head is occluded (Bridges & Rowles, 1985; McGuigan & Doherty, 2006) or the figure is facing away (McGuigan, 2009). Moreover, children consider it an effective stratagem when dolls cover their eyes to hide from others—which shows that the children do not regress into an egocentric mind-set in the "heat of the moment" when trying to hide (Russell, Gee, & Bullard, 2012, Experiment 3). None of these data are in line with the ostrich fallacy account because when a child is dyadically engaged, it is on the grounds that the *other cannot see the child* that she or he responds negatively. And when making a judgment about the efficacy of third persons' hiding strategies, there is no room for egocentric answers.

An alternative explanation one might endorse is that children consider an agent visible only when they see the agent's eyes—as if they were the "windows to the soul." Children seem to perceive the eyes as the part of the body that is most related to personhood (Starmans & Bloom, 2012), and young children grant that they see another's "body" but not "her" or "him" when another's eyes are covered (Flavell et al., 1980; Russell et al., 2012, Experiment 2). But even though eye visibility is necessary for young children to affirm another's visibility, it is not sufficient: preschoolers deny seeing someone whose eyes are open but who looks past them (Russell et al., 2012, Experiment 4).

The only interpretation that accords with all of these findings is that young children demand eye contact—"I see you (and you see me) only if we see each other!" This mutuality demand might fly in the face of adult common sense, but we believe that children's readiness for and bias toward second personal encounters together with auxiliary hypotheses (see General Discussion) can explain it. We claim that children's curious negative judgments testify to the significance that reciprocity has for them. From the beginning of their lives, infants are tuned to reciprocal encounters and turn taking. They have a preference for highly contingent social reactions (Watson, 1972), and a lack of responsiveness in face-to-face encounters irritates and frustrates them (the "still-face paradigm"; e.g., Cohn & Tronick, 1989). More than other great apes, human infants spontaneously engage in simple forms of turn taking and role taking (Tomasello & Carpenter, 2005).

Gaze is special and is the ideal locus for the mutuality demand because it uniquely allows persons to recognize one another instantly and simultaneously. Soon after birth, infants prefer open eyes over closed eyes (Batki, Baron-Cohen, Wheelwright, Connellan, & Ahluwalia, 2000) and direct gaze over averted gaze (Farroni, Csibra, Simion, & Johnson, 2002). Although mutual gaze mostly sparks antagonistic behavior or flight in animals (Emery, 2000; Exline, 1971) and retains this potential in humans (Chen, Minson, Schöne, & Heinrichs, 2013), eye contact plays a pivotal role in cooperative interpersonal encounters (Cook, 1982; Kleinke, 1986).

Across numerous cultures, the very first game that infants and toddlers play—peekaboo—revolves around mutual gaze (Fernald & O'Neill, 1993; Martini & Kirkpatrick, 1981). After establishing eye contact, an adult and a child take turns in "breaking" the eye contact by covering their eyes or turning away. The "reunification" in mutual gaze is suspensefully anticipated and experienced as an upshot or success. In these games, adults often pretend as if the child were invisible when the child's eyes are occluded. Adults routinely claim that they fail to see the child and ask "Where is [name of child]?" or "Where are you?" when eye contact is lost, followed by an excited and relieved "There she [or he] is!" or "There you are!" when the eyes meet again. Thus, young children's mutuality constraint in person perception might, at least partially, be a by-product of what adults suggest as being true in these instances.

Our second personal account holds that for children, seeing a person or an agent is a "bipolar act" much like giving; it is successful only if the other takes or receives it—otherwise it remains a mere offer. When their gaze is not reciprocated, young children can only relate to the other as an object in space (testified by children's affirmation that they can see the other's body and head; see Flavell et al., 1980) but not as a *person*. Relating to a person instead of an object implies mutual addressability and recognition—"I see you only if we see each other."

Importantly, children's denial of another's visibility implies that children must grasp the connotation of success, upshot, or achievement of the verb "see." The philosopher Ryle (1954/2002) referred to "see" as a *detection* verb. Like "find" or "spot," it declares a terminus or marks the successful end point of one's looking behavior. "Look," in contrast, is an *inspection* verb that denotes the activity of orienting one's visual attention in a particular direction. It relates to "see" in the way that "search" relates to "find" or "aim" relates to "hit." Because it is up to the observer where he or she orients attention, "look" admits the imperative mood and adverbs of volition or care (e.g., to look at something carefully; see Hacker, 2013; Sibley, 1955). "See" admits neither because the implied success depends partly on factors outside of the looker's control (e.g., good viewing conditions). Wierzbicka (1996) noted that preschoolers use "look" as "wanting to see"—suggesting that they grasp these semantic differences, including the connotation of upshot that only "see" carries.

Based on these considerations, we hypothesized that preschoolers limit their mutuality demand to "seeing" and are more inclined to deny that they can "see" than "look at" an agent whose eyes are covered. They should equally affirm being able to see and look at inanimate objects that are partially occluded—because the mutuality demand can be applied only to objects that can reciprocate gaze (i.e., agents).

To test this prediction, we presented 36-month-olds with agents (dolls) and objects (e.g., a toy truck). The agents' eyes and salient features of the objects (e.g., the truck's headlights) were covered. Children were asked whether they could look at and see the agents or objects. It was predicted that children would affirm seeing the agents less often than they would affirm any of the other three questions. Thus, an interaction between the verb used (look vs. see) and the object of perception (agent vs. object) was predicted.

Experiment 1

Method

Participants

Participants were 16 (8 female) 36-month-olds ($M = 35.83$ months, range = 34.02–37.80). They were recruited from a database of parents who had volunteered to have their children participate in a study on child development. Preestablished criteria for participation were that children had no known physical or mental disabilities, were born full-term or late preterm ($\geqslant$37 weeks gestation), and understood English (all by parental reports). Half (8) of the participants were White, 1 was African American, 1 was Asian, and 6 were "other." One additional child was tested but excluded from the analyses because she refused to engage with the experimenter and the objects. According to parental reports, all children were familiar with and used the terms "look" and "see." Children were tested individually in a quiet testing room ($\sim$360 $\times$ 360 cm) at the university's child research laboratory.

Materials

A soft colored ball (33 cm in circumference) was used as a warm-up toy. For the *Agent* condition, three different dolls or plush animals were used. These were a female baby doll referred to as "Lisa the baby" (33 cm high $\times$ 18 cm wide $\times$ 9 cm deep), a Curious George doll referred to as "George the monkey" (38 cm high $\times$ 18 cm wide $\times$ 10 cm deep), and a plush fox referred to as "Max the fox" (23 cm high $\times$ 15 cm wide $\times$ 13 cm deep). The experimenter and the child performed a particular action with each agent using the following props. They fed the baby with a pink plastic bottle (9 cm high and 2.5 cm in diameter), combed the monkey with a purple comb (13 cm long $\times$ 5.5 cm wide), and gave the fox water from a black bowl (6 cm high and 13 cm in diameter).

For the *Object* condition, a green toy garbage truck (11.5 cm high × 20 cm long × 9 cm wide) with a removable garbage load and painted-on headlights, a wooden toy house (23 cm high × 15 cm long × 15 cm deep) with a door and two windows, and a wooden toy clock (8 cm high and 23 cm in diameter) with removable numbers and large flexible hands were used. Fig. 1 shows a subset of the stimuli.

Design

A within-participants design was applied. Half (8) of the children received the Agent condition first, and the other half received the Object condition first. Each child was asked the "look" question and the "see" question for the three agents and the three objects, thereby leading to a total of 12 trials. The order of the questions remained the same for the 6 trials of the first condition (e.g., "look" question first for the agents) and was reversed for the 6 trials of the second condition (e.g., "see" question first for the objects). In the test question, the experimenter referred to the three agents by their common nouns (the monkey, the baby, and the fox) or proper names (George, Lisa, and Max) in the temporal order of common noun–proper name–common noun or proper name–common noun–proper name. The objects were always referred to by the common nouns truck, house, and clock. The order of objects and agents within conditions was quasi-randomized, with each child receiving one of four preestablished orders.

Procedure

Parents were encouraged to observe the procedure on video from an adjacent room. If a child demanded that the parent be in the testing room with her or him (which was the case for 3 children), the parent was positioned behind the child. The child was seated at a table (71 cm high × 91 cm wide × 91 cm deep), with the experimenter sitting 90° to the left of the child at a distance of approximately 75 cm. Before the actual experiment began, the experimenter and the child played with a ball for 1 to 2 min to acclimate to the situation. No perceptual predicates, including "look" and "see," were used during this warm-up phase. The experimenter withdrew the ball and started the experiment in the following way, depending on the condition.

In the Agent condition, the experimenter showed the child the first doll, exclaiming, "This is my friend [proper name, e.g., 'George'], [common noun, e.g., 'the monkey']!" The experimenter then said that George would like to get his hair combed (or Lisa would like to get fed/Max would like some water) and handed the child the comb (or bottle/bowl). The child then performed the corresponding action and combed the monkey (or fed the baby/gave the fox water). After the child finished—the activity lasted roughly 30 to 60 s—the experimenter removed the prop and placed the doll at the center of the table, approximately 60 cm in front of the child. The experimenter said "I'll put my hand here like this!" and placed the fingers of her right hand (with her thumb "tucked in" behind the fingers)

Fig. 1. Selection of the stimuli used in Experiment 1.

over the doll's eyes so that they were no longer visible. The experimenter then asked, "Right now, can you look at/see [common noun/proper name of agent]?" She repeated the question verbatim up to two times if no response followed after 5 s. She then asked the second question using the other predicate (e.g., see). After the child responded, the experimenter removed the doll and repeated the procedure mutatis mutandis with the second and third dolls.

In the Object condition, the experimenter brought out the first object and exclaimed, "This is a [common noun, e.g., 'truck']!" She pointed out that the truck (or house/clock) carries garbage (or has a door/numbers). The child then performed the corresponding action and offloaded the garbage (or walked to the door of the house with her fingers as the experimenter had modeled for her/removed and replaced the clock's numbers). After the child was finished approximately 30 to 60 s later, the experimenter centered the object on the table. She said "I'll put my hand here like this!" and covered the salient features—the truck's headlights (or the house's windows/clock's hands)—with her fingers. She then posed the two questions: "Right now, can you see/look at the [common noun]?" in the exact same way as in the Agent condition. Again, questions were repeated verbatim if no response followed within 5 s. The procedure was repeated with the two remaining objects.

Scoring and reliability

The experimenter scored the responses during the session. If a child said "yes" or "mm-hm" (with rising intonation) or nodded, a positive response (1) was scored. If a child said "no" or "mm-mm" (with falling intonation) or shook her or his head, a negative response (0) was scored. Two children did not give clear responses on 2 trials each (1 "see" trial in total), so these trials were disregarded. To assess interrater reliability, an independent research assistant, who was unaware of what children were asked, coded a randomly selected sample of 4 (25%) of the children based on the audiovisual recordings. The rater agreed with the experimenter's judgment on all trials, thereby leading to a Cohen's kappa of 1.

Results

Preliminary analyses revealed no effects of trial ($p = .52$) or gender ($p = .54$). Whether agents were labeled with common nouns or proper names in the test question had no effect on children's responses ($p = .62$). These variables were disregarded in a final analysis of variance (ANOVA) with condition (Agent vs. Object) and question (look vs. see) as repeated measurement factors. Fig. 2 shows the

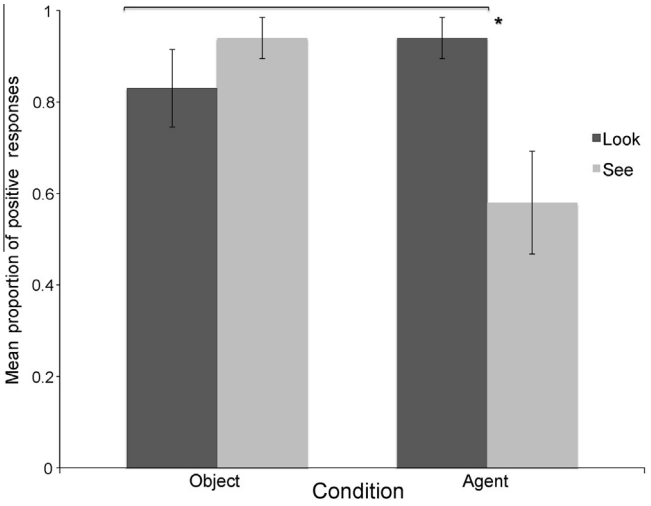

Fig. 2. Mean proportions of positive responses as a function of condition and question in Experiment 1. Error bars represent standard errors of the means. The asterisks represent statistical significance at a level of alpha = 5%.

mean proportions of children's positive responses as a function of these factors. In the Object condition, children affirmed the "look" question in .83 (*SE* = .08) of the cases and affirmed the "see" question in .94 (*SE* = .04) of the cases. In the Agent condition, they responded positively in .94 (*SE* = .04) of the cases when asked if they could look at the agent compared with .58 (*SE* = .11) of the cases when asked if they could see the agent.

There were significant effects of condition, $F(1, 15) = 7.92$, $p = .013$, $\eta_p^2 = .35$, and question, $F(1, 15) = 5.37$, $p = .035$, $\eta_p^2 = .26$. These effects are explained by their significant interaction, $F(1, 15) = 8.74$, $p = .01$, $\eta_p^2 = .37$. As predicted, children gave *less* affirmative responses when asked if they could see the agent compared with all other questions.

Even though the interaction effect was strong regardless of condition order, children were more likely to affirm that they could see the agents when they were presented with the objects first, as revealed by a three-way interaction among condition (agent vs. object), question (look vs. see), and order of conditions ($p < .001$). What this suggests is that answering the questions about objects first and affirming their visibility led children to objectify the agents and respond consistently with their previously given positive replies. This was confirmed by a paired-sample *t* test with just those children who received the agents before the objects. These children affirmed that they could look at the agents in .88 (*SE* = .09) of the cases compared with only .33 (*SE* = .14) when asked if they could see them—a difference that is highly significant, $t(7) = 3.52$, $p = .01$, Cohen's $d = 1.27$, despite the small sample size.

Discussion

In line with previous findings (e.g., McGuigan & Doherty, 2006; Russell et al., 2012), the 36-month-olds in this experiment often denied that they could see an agent whose eyes were covered, adding to evidence that preschoolers make mutual gaze a condition for another's visibility—"I see you only if we see each other!"

Our findings expand the current knowledge of this phenomenon by demonstrating that children apply the mutuality condition when "see" is used but not when "look" is used. Thus, they understand the semantic differences between the verbs captured in Ryle's (1954/2002) characterization of "look" as an inspection verb and "see" as a detection verb. Looking is the activity by which one sets up the conditions for seeing, and this activity goes on regardless of the type of object or the state it is in. By visually attending to something or someone, one thereby looks at it or the person. Seeing, in contrast, implies a form of success or achievement (see Vendler, 1957) in which the looking behavior culminates. Children's differential responses show that they grasp this difference in meaning. The success they find missing in the case of seeing, but not of looking, is the simultaneous mutual recognition of two persons.

As mentioned, adults might play a significant role in the adoption of the mutuality demand by acting as if children were invisible during games of peekaboo. In addition, our word choices convey a semantic difference between "look" and "see" that can further illuminate why children demand mutuality when the latter verb is used. We metaphorically say that we went to see—not look at—a friend or a doctor. Such nonliteral uses of "see" imply a social encounter with mutual responsiveness and might contribute to children's tendency to negate the visibility of another person whose eyes are occluded. One caveat is that many languages do not allow for this figurative use of "see," but if they have verbs that are synonymous with "look" and "see," children should draw the same distinction as the English-speaking children. Future research needs to explore this issue.

Whether agents were labeled with a common nouns or proper names at test did not affect children's judgments. For example, classifying an agent as a monkey did not lead children to objectify it and treat it like a truck, and singling it out individually with a proper name did not increase children's willingness to personify it and deny its visibility.

Important questions remain unanswered, and two of these were addressed in the second experiment. The first is whether children's responses differ depending on if they face a doll or a human. Although dolls are sufficient in eliciting the mutuality demand, as this and other work (e.g., Flavell et al., 1980; McGuigan & Doherty, 2006) has demonstrated, genuine eye contact is possible only with another human, and so children might adhere more strongly to the mutuality constraint vis-à-vis

actual humans. But given children's proneness to anthropomorphize dolls, it might make no difference whether the agent is real or a cultural artifact made to be personified.

The second question concerns the relation between the mutuality constraint and children's mastery of the reciprocal pronoun "each other." Surprisingly, no studies have investigated when and how children acquire this pronoun (or "one another," although this term is uncommon in dialogue with children). Both positive and negative associations are conceivable. On the one hand, those who negate seeing someone who does not also see them might be especially sensitive to the presence of reciprocity—which could manifest itself in competent use of the reciprocal pronoun "each other."

But the opposite is plausible as well. Children who possess the verbal tool ("each other") that allows them to identify mutual gaze may acknowledge that one person can see another without one's gaze being reciprocated. Children may come to expand the scope of "see" to include instances of one agent seeing another "unidirectionally" by way of having acquired a device that lets them specifically pick out the felicitous bidirectional cases.

These two questions were addressed in the following experiment. Children half a year older were tested to avoid floor performance on a novel pronoun task that we administered.

Experiment 2

In this experiment, 3.5-year-olds were asked if they could "see" and "look at" a doll or human whose eyes were occluded (Perception Questions). The children also received a novel task testing their knowledge of the pronoun "each other" (Pronoun Task).

Method

Participants

Participants were 16 (8 female) 3.5-year-olds (M = 42.43 months, range = 40.20–45.13). They were recruited from the same database as those who participated in Experiment 1. The same inclusion criteria were applied. Of the 16 children, 11 were White, 1 was African American, and 4 were "other." As in Experiment 1, parental reports indicated that all children knew and used the terms "look" and "see." Parents filled out the short form of the MacArthur Communicative Development Inventory (CDI; see Fenson et al., 2000). Two additional children participated but were excluded from the analyses because they were unwilling to interact with the dolls and respond to questions. Children were tested individually in a testing room (430 × 430 cm or 465 × 340 cm) at the university's child research laboratory.

Materials

Perception questions. The same three dolls (baby, monkey, and fox) and corresponding props (plastic bottle, comb, and bowl) as in Experiment 1 were used. Two occluding devices with which the experimenter covered her eyes were used. These were a black beanie (25 cm high, 20 cm wide, and 14 cm in diameter) and a black plastic bucket (25 cm high, 24 cm wide, and 29 cm in diameter), the front of which revealed the lower part of the face, including the mouth. In another trial, the experimenter used both hands to cover her eyes. These three ways in which the experimenter's eyes were occluded are illustrated in Fig. 3.

Pronoun task. A picture book consisting of nine laminated colored pages (each 29 cm high × 23 cm wide) collated with binder rings was used. A red cover page showed a single picture (13 cm high × 10.5 cm wide) of two bears hugging each other. The other eight pages (four green ones for the *comprehension subtask* and four blue ones for the *production subtask*) each included three vertically arranged drawings (8 cm high × 12 cm wide). All drawings on a given page depicted two agents (humans, animals, or schematic characters) performing the same action. The actions were pointing, washing, kicking, and drawing for the comprehension subtask, and poking, smiling, touching, and waving for the production subtask.

Fig. 3. The three ways in which the experimenter covered her eyes during the Perception Questions in Experiment 2.

For the comprehension subtask, one image per page depicted one agent performing the action to the other (e.g., A points at B; see top left of Fig. 4), another image depicted both agents performing the action but not to each other (e.g., A and B point somewhere; see bottom left of Fig. 4), and the third image showed the agents performing the action to each other (e.g., A and B point at each other; see center left of Fig. 4). The spatial positions of the pictures varied, with the target picture (showing a case of "each other") twice in the center and once in the bottom or top position.

For the production subtask, the top picture always showed how one agent performed the action to the other (e.g., A pokes B), the middle picture showed the two agents in reversed roles (e.g., B pokes A), and the bottom picture showed the two agents performing the action to each other (e.g., A and B poke each other).

Fig. 4 depicts one page from each subtask.

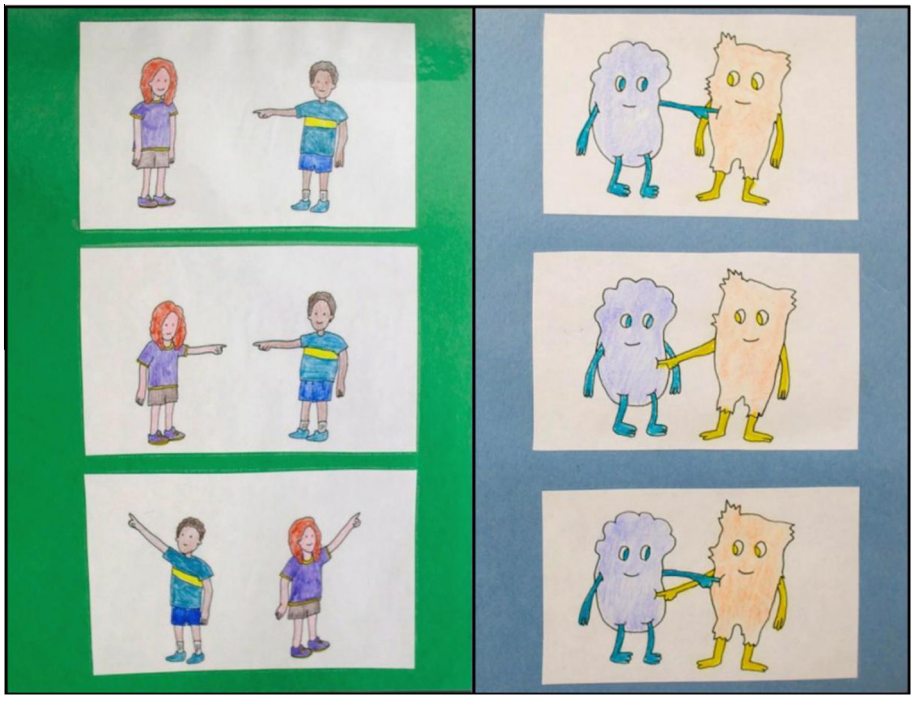

Fig. 4. One of the pages used for the comprehension subtask (left) and production subtask (right) of the Pronoun Task from Experiment 2.

Design

Half of the children received the Perception Questions first, and the other half received the Pronoun Task first. There were 12 trials for the Perception Questions: 6 trials in which dolls were used and 6 trials in which the experimenter covered her eyes with her hands, the beanie, or the bucket. The order of questions (look vs. see) and agent type (doll vs. human) were counterbalanced, such that of those 8 children who received the dolls first, half received the "look" question before the "see" question and vice versa for the other half. The order of questions was reversed after the first 6 trials. The orders of the dolls (Max, Lisa, and George) and occluding devices (hands, beanie, and bucket) were quasi-randomized. For the Pronoun Task, the order of subtasks (comprehension vs. production) was counterbalanced and the order of pages (actions) within the subtasks was quasi-randomized.

Procedure

Perception questions. For the trials involving dolls, the procedure was exactly the same as in Experiment 1, with the only modification that the experimenter always referred to the dolls by their proper names at test. Thus, after the experimenter occluded the doll's eyes with her hand, she asked, "Right now, can you see/look at [proper name of doll, e.g., 'George']?" For the trials in which the experimenter occluded her eyes, the experimenter removed the table and positioned her chair so that she faced the child at a distance of 60 cm (the same distance as that between the child and the dolls). The experimenter then either said "I'll put my hands here like this!" and covered her eyes with both hands or said "I'll put this here like this!" and placed one of the occluding devices (beanie or bucket) over her eyes. Fig. 3 illustrates her appearance in the three cases. The experimenter then posed the test questions: "Right now, can you see/look at me?" As in Experiment 1, test questions were repeated up to two times if no response followed within 5 s.

Pronoun task. The experimenter brought out the picture book and placed it on the table in front of the child. The experimenter pointed at the cover page and said, "They are hugging each other!" She then turned to the first page of the comprehension or production subtask.

In the comprehension subtask, the experimenter briefly glanced at the page. The experimenter then looked at the child and asked, "Can you show me where they [verb, e.g., 'point at'] each other?" After the child responded by pointing, the experimenter turned the page. She repeated the procedure for the remaining three pages.

In the production subtask, the experimenter pointed to the top picture and said "Here, she/he [verb, e.g., 'pokes'] him/her!" As the experimenter uttered the pronouns "she/he" and "him/her," she pointed to the agent and patient, respectively. The experimenter then repeated this procedure with the picture in the middle, where the agent and patient roles were reversed. Finally, the experimenter pointed at the bottom picture and asked, "Now, what are they doing in this picture?" After the child responded, the experimenter turned the page and repeated the procedure with the remaining three pages.

In both subtasks, the experimenter prompted an answer up to two times if a child did not respond within 7 s. The latency was slightly longer than that for the Perception Questions to grant enough time to examine the pictures.

Coding and reliability

Perception questions. The same coding scheme as in Experiment 1 was applied, and responses were coded during the session. If no vocal response was given in a trial in which the experimenter had her eyes covered, she checked the video-recordings for gestural responses (nodding or head shaking) posttest. To assess interobserver reliability, an independent observer, who was unaware of the content of the question, coded the responses of a randomly selected sample of 25% (4) of the children and judged whether they gave positive or negative responses. The two raters disagreed on 1 trial (a "look" question), leading to a Cohen's kappa of .96. A total of 6 trials (1 involving a "see" question) were discarded due to the lack of a clear response, which is why mean proportions of positive responses instead of mean sum scores are reported below.

Pronoun task. The experimenter coded the answers live during the session. For the comprehension subtask, a correct response (1) was coded if a child pointed at the picture showing the reciprocal action, that is, the two agents [verb-ing, e.g., 'pointing at'] each other. A response was coded as incorrect (0) if a child pointed at a different picture. For the production subtask, a response was scored as correct (1) if a child responded with "each other" or "one another." Other responses, including those containing "both" or "together," were coded as incorrect (0). To assess interrater reliability, an independent research assistant (the same one mentioned in the previous paragraph), who was ignorant of what children were asked, coded the responses of 25% of the children. She judged which of the images (top, middle, or bottom) the child pointed to (comprehension subtask) or whether the child's utterance contained "each other" or "one another" (production subtask). There was no disagreement between the two raters, thereby leading to a Cohen's kappa of 1.

Results

Perception questions

Preliminary analyses showed no effects of trial ($p = .23$), object (different dolls/occluding devices) ($p = .95$), or gender ($p = .16$). Receiving the Pronoun Task before the Perception Questions did not affect children's answers ($p = .90$). These factors were removed from a subsequent ANOVA with agent type (doll vs. human) and question (look at vs. see) as repeated measurement factors. Fig. 5 shows the mean proportions of positive responses broken down by these factors. On average, children affirmed the "look" question in .60 ($SE = .12$) of the cases when the agent was a doll and in .62 ($SE = .11$) of the cases when the agent was a human. When children were asked if they could see the doll and human, the mean proportions were .40 ($SE = .11$) and .33 ($SE = .12$), respectively. There was no effect of agent type, $F(1, 15) = 0.10$, $p = .76$, $\eta_p^2 = .007$, and no interaction, $F(1, 15) = 0.46$, $p = .51$, $\eta_p^2 = .03$. There was a significant question effect, $F(1, 15) = 9.84$, $p < .01$, $\eta_p^2 = .41$, showing that the 3.5-year-olds were more likely to affirm that they could look at the agent than they could see the agent.

Pronoun task and its association with the perception questions

No effects of gender ($p = .46$) or task order (Perception Questions first vs. Pronoun Task first) ($p = .32$) were obtained. Overall, the 3.5-year-olds' mean proportion of correct responses on the

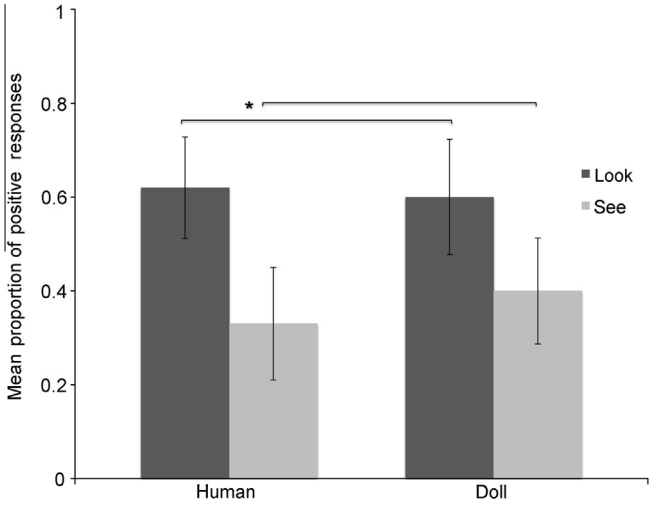

Fig. 5. Mean proportions of positive responses as a function of agent type and question in Experiment 2. Error bars represent standard errors of the means. The asterisks represent statistical significance at a level of alpha = 5%.

Table 1
Number of children who received a given combination of proportional scores in the subtasks of the Pronoun Task in Experiment 2.

Comprehension	Production				
	0	.50	.75	1	Total
.25	–	1	–	–	1
.50	2	–	1	2	5
.75	1	1	1	1	4
1	2	–	3	1	6
Total	5	2	5	4	16

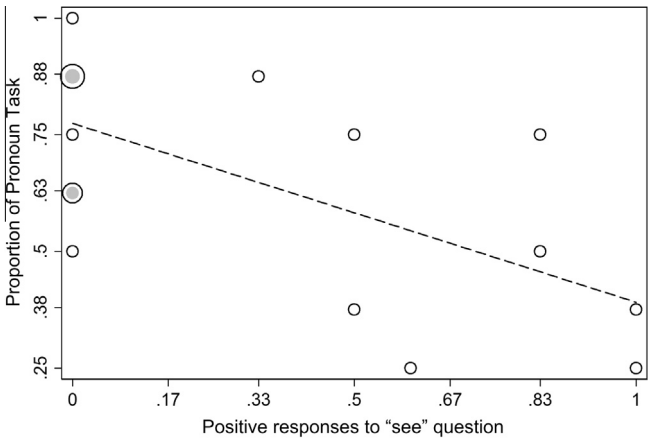

Fig. 6. The relation between children's positive responses to the "see" question and their overall performance on the Pronoun Task (proportional scores) in Experiment 2. The larger gray dots represent 2 or 3 children.

Pronoun Task was .64 (*SE* = .06). On average, they correctly identified reciprocal actions by pointing in .73 (*SE* = .06) of the cases (comprehension subtask) and correctly labeled reciprocal action with "each other" in .55 (*SE* = .10) of the cases (production subtask). No child used the term "one another." An ANOVA with repeated measures revealed that the performance difference between subtasks was not significant ($p = .14$). Table 1 shows how many children received a given combination of proportional scores on the two subtasks.

To test whether children's mastery of "each other" is related to the mutuality constraint in person perception, we correlated their overall performance on the Pronoun Task with their responses to the "see" question (collapsed across agent types). As shown in Fig. 6, there was a strong *negative* relation between children affirming that they could see the other and their knowledge of the pronoun (Pearson's $r = -.64$, $p < .01$, two-tailed). This relationship remained substantial when controlling for age ($r = -.65$, $p < .01$) and vocabulary size ($r = -.60$, $p = .02$) (all *p*s two-tailed). Thus, children who denied that they could see the agent had superior knowledge of "each other" compared with those who said they could see the agent. No correlation was observed between children's answers to the "look" question and their knowledge of "each other" ($r = -.41$, $p = .12$).

Discussion

Overall, the rate of positive responses was lower than that of the 3-year-olds in Experiment 1. A reason for the greater number of negative responses across conditions could be that children found the questions to be trivial and reasoned that the experimenter meant to ask if the *other* could see

or look at *them* or if they could see or look at the other's *eyes* specifically. This could reflect a pragmatic misunderstanding, with children thinking that questions are more likely about non-obvious matters than about obvious ones. But this is speculative, and what is critical is the difference children drew between the verbs. They again denied the questions significantly more often when asked if they could see the other.

Whether a doll or human functioned as agent had no impact on children's responses. This supports the long-standing practice of using dolls, puppets, and avatars as representations of humans or human-like agents in studies on social–cognitive development and verifies that young children personify or anthropomorphize non-biological entities with faces (Jipson & Gelman, 2007).

A strong association between the mutuality constraint and mastery of the reciprocal pronoun "each other" was detected. Children who negated the other's visibility knew the pronoun better than those who acknowledged seeing the other. In other words, those who skillfully distinguished reciprocal action from individual or parallel action were also more likely to demand mutual gaze. This suggests that some children are particularly sensitive to the presence or absence of reciprocal acts, which manifests itself both in their knowledge of the pertinent vocabulary and in normative expectations of reciprocity. Future studies should explore whether this sensitivity to reciprocity translates into or is independent from moral sensitivity and empathic concern.

General discussion

In two experiments, young children were often willing to deny that they could perceive an agent (doll or human) whose eyes were covered. This provides strong evidence against the ostrich fallacy account that interprets children's ineffective hiding strategies (by covering their eyes) as a projection of their own visual limitations—"If I cannot see, others cannot see either." Perspective taking was not required in either experiment, and yet children factored in the other's point of view when denying her visibility.

This study is the first to show that children's negations are not indiscriminate but occur specifically when the mental term "see" is used. They were much more likely to affirm that they could "look at" an agent with covered eyes than they could "see" her. Thus, at the tender age of 3 years, children already understand that "look" and "see" have different meanings, with only the latter implying successful visual perception (Ryle, 1954/2002; Van Voorst, 1992; Vendler, 1957). Like adults, they are aware that looking does not necessarily imply seeing. One might look out the window but fail to see what is there because it is dark outside, or one might look at someone from afar without seeing the person because one's vision is poor or distorted. But unlike adults, these children require something extra when the perception is of a person, not an object. The remaining fundamental questions concern what precisely this "extra" entails and why children apply such overly conservative criteria.

One might think that what children find missing is the other's actualization of her or his powers as a sentient being. They might consider the other invisible whenever her or his perceptual capacities are interrupted. But children also negate seeing another who has her or his eyes open but is looking past them (Russell et al., 2012). Thus, they do not deny the other's visibility on the grounds that her or his visual perception is impaired. Furthermore, when another looks straight at them but is wearing opaque or reflective glasses, children still negate seeing the other even when they know that the glasses allow the wearer to see (Flavell et al., 1980; Russell et al., 2012). This shows that they are not satisfied with seeing and being seen at the same time. Two parallel acts of one agent seeing the other is not enough; what these children demand is the *joint* perception of mutual regard (i.e., the eyes making contact), which unifies the individuals in one act of mutual recognition.

We theorize that the demand for eye contact is a "growth error" resulting from children's grasp of how persons "function" in contrast to objects. Their responses are an overapplication of their understanding of persons as communicative and interrelated agents. They demand that a person be communicatively connected with those who address him or her because this is what distinguishes a person from an object. That children stick to this notion is not surprising in light of their biological predisposition to being addressed via eye contact and other ostensive communicative signals (Csibra & Gergely, 2009). Their first engagement with the world is social and reciprocal, as is shown by their early

participation in "primary intersubjectivity" (Trevarthen, 1979). Their bias toward reciprocal exchanges lets them overextend this principle to seeing, which they treat as a "bipolar act" much like giving or telling someone something—"I can only tell you something if you listen and hear what I have to say" or, likewise, "I can look at you, but it remains a mere attempt at seeing you until you 'take up' and reciprocate my gaze." That this in fact reflects a growth error (i.e., the overapplication of something that was recently learned) was confirmed in Experiment 2, which showed that making the error is positively related to mastering the pronoun "each other."

We interpret children's judgments as foreshadowing philosophers' insights into the role of mutual recognition in human sociality. Macmurray (1961) showed that any person is necessarily in relation to another and that an "I" exists solely as one element in the "I–You" complex. Darwall (2007) stated, "When I see another as a 'you', I see her as having the same relation reciprocally towards me" (p. 43). Finally, Buber (1937) claimed that the "I–Thou" relation is necessarily reciprocal and ontogenetically precedes the objectifying "I–It" mode in which humans mostly engage with objects. Children's negation of others' visibility unless there is eye contact proves that they have an intuitive grasp of these philosophical insights into the primacy of the second personal mode of interacting.

A theoretical alternative might be that children just need to perceive the other interact and make eye contact with anyone. In this scenario, the other actualizes her or his relational qualities as a person by interacting with a person, but the child is just a bystander. We believe that children would still deny being able to see the other in this case because they demand that the other's eyes interlock with their own. This prediction is based on evidence that children conceive of seeing as "being engaged" or "involved with" (McGuigan & Doherty, 2002; Moll, Carpenter, & Tomasello, 2011; O'Neill, 1996). They distinguish more broadly "being engaged with" versus "disengaged from" an object or situation but have yet to learn which specific necessary (e.g., unoccluded line of sight) and sufficient (visual input with no further involvement) conditions define seeing in contrast to other forms of involvement. Thus, we believe that the conditions they stipulate depend on the object and the situation. When facing agents or animated objects with eyes, children strive for mutual awareness and recognition—which typically involve eye contact (see Kleinke, 1986; Senju & Johnson, 2009). When the other looks away or shuts her or his eyes, the other is not ready (whether voluntarily so or not) for a personal address, and so the felicity conditions for a proper (i.e., second personal) engagement are defeated. When facing inanimate objects, the criteria for engagement that children bring to bear vastly overlap with adults' criteria for "seeing"; partial occlusion does not compromise their engagement with it even if the part is crucial for the object's functioning (a clock's hands; see our Experiment 1) or is characteristic of it (e.g., a tower's distinct top; see McGuigan & Doherty, 2006). But children might have other overly strict criteria for engagement with objects that have not yet been detected. Ways to test this involve an object's partial occlusion that prevents the recognition of its *kind* (e.g., covering a spoon's bowl area, making it indistinguishable from a fork) or precludes physical contact with something that is designed for manual purposes and that the child used just moments ago (e.g., placing scissors behind glass).

Russell and colleagues (2012) also interpreted children's denials as a growth error that has its roots in their immersion in intersubjectivity. But their view differs from ours in the following way: They believe that young children generally seek intersubjective validation of an individual's perceptual experience. Take the following thought experiment and prediction that they provide. Suppose that a young child and an adult both look at an object, with only the child being able to see the adult but not vice versa (a one-way mirror separates them, with the reflective side facing the adult). The object is positioned in their shared visual field, so it is visible to both. According to the authors' radical position, the child will deny that the adult can see the object because no eye contact has been made. In contrast, we predict that the child acknowledges the adult's individual perception of the object. The reason is that the demand for shared gaze comes into play only for dyadic encounters between persons. It will not be invoked when the question is simply if an individual (self or other) can see an object; no intersubjective validation of individual acts of perception are necessary.

Another theoretical position for which we do not see support is that children are dualists who conceive of the human mind as independent from the body (Bloom, 2004). The fact that they report seeing the other's *body,* but not *her* or *him* (use of personal pronoun or proper name), has been interpreted as evidence for such a dualist position (Russell et al., 2012). We believe that this is false and that in fact

children's responses give direct evidence against it. The reason is that for a dualist, superficial changes to the body (the spatially extended substance), including the masking of one of its parts, should leave the independently conceived mind (the immaterial substance) and its accessibility unaffected. If children's negations speak at all to the question of how they conceive of the mind/body relation or identity—which is questionable—then the data suggest a monistic account.

Although reciprocity remains critical beyond early childhood, children drop the mutuality constraint (Flavell et al., 1980) and learn to hide successfully (Hughes & Donaldson, 1979) sometime between 4 and 5 years of age. We hypothesize that children's abandonment of the mutuality constraint is linked to their developing knowledge of perspectives. Thus, perspectives play an explanatory role after all, but not in the way envisaged by the ostrich fallacy account. Rather than egocentrically projecting their view onto others, preschoolers fixate on the most adequate perspective in a given situation (Moll & Meltzoff, 2011). In standard false belief tests, they state where one *should* look for the transferred object (Perner & Roessler, 2012). In appearance–reality tasks, they say what an object *should* look like given its identity and function (e.g., a sponge; see Flavell, 1986). And when asked to choose a photo that depicts their own visual perspective of an array, children select whichever image offers the most information even when it is not their own (Liben & Belknap, 1981; Light & Nix, 1983).

What 3-year-olds' negations in our study and their incorrect answers in theory of mind tasks have in common is the lacking acceptance of defective or inadequate perspectives. An epistemic perspective or an object's appearance is inadequate when it misrepresents reality, a visual perspective is inadequate when it fails to provide a good overview, and a look at a person is defective unless it is taken up and ignites a second personal encounter. Between 4 and 5 years of age, children come to accept these derivative perspectives, including a disengaged third personal perspective on persons. Thus, we interpret children's denials against the broader background of their theory of mind development and urge that this connection be empirically explored with correlational studies.

Specific predictions about disorders of social functioning follow from our interpretation of typical children's perceptual judgments. It is well established that children with autism spectrum disorder (ASD) cannot relate to others second personally in the way normal children do. They avoid mutual regard (Landa, Holman, & Garrett-Meyer, 2007), focus less on the eye area when observing social scenes (Riby & Hancock, 2008), and are limited in their ability to identify with others (Hobson, 2004; Hobson, Harris, García-Pérez, & Hobson, 2009). We predict that their impaired interpersonal connectedness lets them skip the "growth error" and give adult-like positive answers in the developmental window where neurotypicals produce their negative answers. Autistic children should adopt a more "sober" third personal stance when age-matched controls expect reciprocity and second personal engagement. The opposite is expected for children with Williams syndrome—a disorder of hypersociability that makes individuals more attuned to dyadic interactions than typical (Doyle, Bellugi, Korenberg, & Graham, 2004; Jones et al., 2000). In contrast to autistic children, these children should fail to outgrow the error across development because their known bias toward face-to-face encounters and dyadic communication keeps them from accepting a more disengaged third personal stance.

Finally, what needs to be further examined is the prominent role that vision plays for mutual recognition and interpersonal connectedness. It is a unique quality of gaze that it allows two individuals to recognize each other instantly (which touch might as well) while also making this two-sided recognition mutually transparent. This helps to explain why congenitally blind children are at risk for developing autistic features (Hobson & Bishop, 2003) because it is primarily through vision that children enter a shared world with others.

These results would confirm that, even though they might strike mature thinkers as bizarre, children's negations of another's visibility in the absence of eye contact express an astonishing awareness of the reciprocal nature of humans. It might be a marker for a critical and healthy way of relating to others as persons, not objects.

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