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"Not See, Not Hear, Not Speak": Preschoolers Think They Cannot Perceive or Address Others Without Reciprocity

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A curious phenomenon in early social-cognitive development has been identified: Preschoolers deny that they can see others who cannot also see them (Russell, Gee, & Bullard, 2012). The exclusive focus on vision has suggested that this effect is limited to gaze, but children's negations might reflect a broader phenomenon that extends to vocal communication. In Experiment 1 ($N = 24$), 3- to 4-year-olds were asked if they could *see* an agent whose *eyes* were covered, *hear* an agent whose *ears* were covered, and *speak to* an agent whose *mouth* was covered. In all cases, negative responses were more frequent than in a control condition in which the facial area was unoccluded. Experiment 2 ($N = 24$) provided evidence that children's negations did not result from a misunderstanding of the questions. The findings suggest that young children apply a principle of reciprocal relatedness that is not limited to gaze.

A curious phenomenon has been detected in young children's judgments about their perception of others: The majority of them deny that they can see a person whose eyes are occluded (Flavell, Shipstead, & Croft, 1980; Moll, Arellano, Guzman, Cordova, & Madrigal, 2015; Russell, Gee, & Bullard, 2012) or who is looking away (McGuigan, 2009). Unless they make eye contact with someone, preschoolers consider themselves unable to see the person. These erroneous negations have been interpreted as resulting from children's inherent disposition for reciprocal engagement and mutual regard. That is, children's impression that they cannot see an agent who does not simultaneously see them is rooted in their preference for bidirectional social interaction. Around the age of 5 years, children abandon the demand of reciprocity and, like adults, acknowledge that others can be seen in the absence of eye contact (Flavell et al., 1980).

What is entirely unknown at this point is if young children's overly strict demand of reciprocal engagement is limited to gaze or if it reflects a broader phenomenon that spans across various domains. Children might assign visual perception a special status because it allows agents to recognize each other simultaneously and instantly. Thanks to a white sclera that is characteristic of humans compared with other primates (Kobayashi & Kohshima, 2001), human gaze is a highly potent social signal (Kleinke, 1986) that even young infants reciprocate (Batki, Baron-Cohen, Wheelwright, Connellan, & Ahluwalia, 2000; Farroni, Csibra, Simion, & Johnson, 2002). The eyes are special in that they unite the function of perception with that of expression (Gobel, Kim, & Richardson, 2015). Gaze can reveal someone's attentional focus, and

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if directed at a person, it can suffice to constitute a personal address. The social value of gaze is tragically revealed by the risk for congenitally blind children to develop "autistic-like" features (Brown, Hobson, Lee, & Stevenson, 1997; Hobson & Bishop, 2003; Hobson & Lee, 2010). Entering a shared social world is challenging in the absence of mutual regard and joint visual attention.

Another realm in which children may be biased toward reciprocity is verbal communication. Dialogue is a critical ingredient of face-to-face encounters that ties persons together in what Malinowski (1923) called "phatic communion." Vocal exchanges are inherently reciprocal because addressing someone implies an invitation to respond (orders and commands are exceptions in this regard). Mead (1934) stressed that the "vocal gesture" resonates as much in the speaker as in the addressee and that the speaker simultaneously adopts the role of the listener and shares his or her perspective. Yet, verbal transactions are marked by a *sequential* adoption of the speaker role and hence lack the simultaneity and synchrony that give eye contact its unique character of a "meeting of minds." It must be noted that by focusing on the context of conversation, some important differences and asymmetries between hearing and speaking are glossed over. It does not take speech for us to hear one another. For example, I might hear you when you sneeze or walk across the hallway. But our topic is children's sense of being able to relate to others in face-to-face encounters, and in this context, hearing and speech are closely coupled, with hearing being geared toward the other's vocalizations.

In light of these considerations, both opposing views are plausible: a) The first view is that preschoolers have a more general "bidirectional" notion of perception and addressability that becomes manifest in various modalities in which human intersubjectivity plays out, including those central to vocal communication. If so, children should deny being able to hear or speak to someone who cannot hear or speak to them. b) The second view is that preschoolers treat gaze as special because it holds a unique opportunity for simultaneous reciprocity and instant mutual recognition—with the effect that children only demand reciprocal relatedness for gaze.

We tested these positions by asking children aged 3 and 4 years old if they can see (seeing task), hear (hearing task), or speak to (speaking task) an adult whose eyes, ears, or mouth were occluded (occlusion condition), respectively—as shown in Figure 1. Children's answers were compared to their answers in a control condition in which the facial area was not occluded (no-occlusion condition). In Experiment 2, we addressed two skeptical or reductive accounts of children's negations. Specifically, we asked if children's negations result from a misunderstanding or misinterpretation of the question (thinking that they are asked if the *other* can perceive/address *them*) and if children pay attention to the correspondence between the verb and the covered organ (e.g., see/eyes) or if they also

FIGURE 1 The adult in the seeing (left), hearing (center), and speaking (right) task.

negate the questions when a different, noncorresponding facial organ is occluded. We expected that children's negations cannot be explained by a misunderstanding of the question and that children take the correspondence between verb and occluded facial area into account.

EXPERIMENT 1

Methods

Participants

Twenty-four (12 female) children aged 3 to 4 years old (*M* = 3;9; range = 3;0–4;5) participated. They were tested individually at a children's museum (*n* = 21) or at the university's child laboratory (*n* = 3) in a large U.S. city. No child had any known disabilities. Fifteen participants were White, 6 were Hispanic, 2 were Multiracial, and 1 was Asian. Their socioeconomic background was mixed, with annual family incomes ranging from $20,000 to > $120,000. No children were excluded from the final sample.

Materials, Design, and Procedure

A within-subjects design was used. Two experimenters (E1 and E2) used their hands or an occluder as shown in Figure 2 to cover their facial areas: a black rectangular cover (7 cm × 23 cm) for the eyes and mouth and protective muffs (13 cm in diameter) for the ears. The order of tasks (seeing, hearing, speaking), condition (occlusion vs. no occlusion), and occlusion type (hand, device) were counterbalanced. For each task, there were 4 occlusion trials: 2 in which E1 covered the given facial area with her hands and the device and 2 in which E2 did the same. Each occlusion trial was directly followed or preceded by the corresponding trial in which the same experimenter did not occlude the facial area. Hence, there were 8 trials per task (4 occlusion, 4 no occlusion), or 24 trials altogether. E1 and E2 sat next to each other facing the child at a distance of 85 cm.

FIGURE 2 Devices used to occlude the eyes or mouth (left) and ears (right).

Demonstration Phase. Before the test phase of a given task, the child was shown the disabling effect of covering a given facial area. When E1's eyes were covered, E2 held up her fingers and asked E1 to "say how many fingers!" When E1's ears or mouth were covered, E2 asked E1 to "repeat after me!" and uttered a sentence. In each case, E1 proved unable to comply and said, "I don't know" (eyes), "Huh, what?" (ears), or mumbled unidentifiable sounds (mouth). E2 then turned to the child and stated, "She can't: Her eyes/ears/mouth are/is covered!" Note that the verbs "see," "hear," and "speak" were omitted during this demonstration to avoid biasing children's responses at test.

Test Phase. In the occlusion condition, E1 oriented to the child and then covered her eyes, ears, or mouth using her hands or the device, depending on the trial. In the seeing and speaking tasks, E1 looked straight at the child. To maximize similarity between tasks, E1 made a humming sound in the hearing task, so that she could actually be heard (just like she could be seen in the seeing task). E2 then asked the child, "[*Name of child*], can you see/hear/speak to [*name of E1*]?" The trial was immediately followed or preceded by the corresponding control trial, in which E2 posed the same question with the facial area unobstructed (no-occlusion condition). E1 and E2 then reversed roles, with E2 covering her eyes, ears, or mouth and E1 asking the questions.

Children's responses were scored as positive or negative. Positive responses (scored as "0") included "yes" and nodding; negative responses (scored as "1") included "no" and head shaking. The experimenters scored the data live, and an independent rater scored the recorded responses unaware of condition. The raters agreed on all trials except one, thus showing excellent reliability ($\kappa = .99$). Out of 576 trials, 6 could not be coded because a child responded by addressing the experimenter (calling her name or asking her questions; 3 trials), gave no discernable answer (1 trial), or gave no answer (2 trials). These trials were excluded. For every child, the sum of *negative* responses in a given combination of task and condition was calculated and divided by the number of valid trials (4, unless a trial was omitted), thus leading to proportional scores (e.g., if a child negated 3 out of 4 questions, her score was .75).

Results and Discussion

Analyses were run using a logistic regression model with Huber-White sandwich estimators of variance to account for repeated-measurement clustering within subjects. These analyses yielded no effects of occlusion type (hands vs. device), order of tasks, or condition (ps > .39). Average differences between the negative responses in the occlusion and no-occlusion conditions were computed for each task via marginal estimates from a Task × Condition interaction. Standard errors were computed using the delta method (Oehlert, 1992). These average differences were used to assess how the occlusion affected the children's sense of being able to perceive or address the other while removing the degree to which children have the same sense when there is no occlusion. Table 1 shows how many children received a given difference score, with the mean difference scores in the final column. These were .56 ($SE = .09$) for the seeing task, .34 ($SE = .08$) for the hearing task, and .22 ($SE = .08$) for the speaking task, respectively. We compared these mean difference scores to 0 using the marginal estimates from the logistic regression model. To counter alpha-inflation, p values were adjusted using the Holm-Bonferroni procedure (Holm, 1979). In the seeing task, children negated that they could see the adult significantly more often when the adult's eyes were occluded than when they were unoccluded, $p < .001$, $d = 1.27$. In the hearing task, the same children negated that they could hear

TABLE 1
Number of children who received a given difference score for the seeing, hearing, and speaking tasks

Proportional difference score									
	−.25	.00	.25	.33	.50	.75	1		
Task								*Total*	*Mean difference*
Seeing		8	—	—	4	2	10	24	.56 (SE = .09)
Hearing		13	1	—	2	4	4	24	.34 (SE = .08)
Speaking	1	13	3	1	1	3	2	24	.22 (SE = .08)

Note. Difference scores were derived from the marginal estimates from the Task × Condition interaction in a logistic regression model of the negative responses. The child with a score of .33 had three instead of four total valid trials.

the adult significantly more often when the adult's ears were occluded than when they were unoccluded, $p < .001$, $d = 0.83$. In the speaking task, they negated that they could address the other via speech significantly more often when the adult's mouth was covered than when it was not covered, $p < .01$, $d = 0.65$. As Table 1 shows, the differences in means reflect a shift to negative answers in occlusion trials compared with no-occlusion trials for many children, thus showing that the effect is not driven by just a few, perhaps confused, children.

To test if children discriminated to different degrees between occlusions and nonocclusions depending on the task, we compared the mean difference scores for the tasks to one another using the aforementioned logistic regression with a Task × Condition interaction. These results showed that children distinguished significantly more strongly between occlusion and nonocclusion of the eyes than of the ears, $p = .029$, $d = 0.78$, and the mouth, $p = .001$, $d = 0.89$. Children also showed significantly greater discrimination between occlusion and nonocclusion of the ears compared with the mouth, $p = .034$, $d = 0.37$. These findings suggest that children's subjective sense of being able to perceive or address another is most severely disrupted when the other's eyes are obstructed and, furthermore, that this disruption is stronger for the senses (seeing, hearing) than for speech production.

We also tested if the three tasks—despite the dissimilarities of seeing, hearing, and speaking—are united by a common thread that lets children answer consistently across modalities. To this end, we correlated children's difference scores between tasks. The results showed that children's responses correlated strongly throughout the tasks, with Spearman's $r = .82$ for seeing and hearing, $r = .60$ for seeing and speaking, and $r = .72$ for hearing and speaking (all *p*s < .001). These findings suggest that children's negations following the different occlusions share a common cause and in each case reflect their attitude toward the impeded reciprocity.

Finally, we tested if the younger (M = 3;4) and older (M = 4;2) half of the sample (median split at 3;8) differed in the degree to which they discriminated between occlusions and nonocclusions. We compared the two groups by examining the interaction terms of Age × Condition in logistic regression models for each of the three tasks. Unadjusted p values are presented. In none of the tasks did the 3- and 4-year-olds produce significantly different response patterns ($p = .09$, $d = 0.03$ for the seeing task, $p = .35$, $d = 0.56$ for the hearing task, and $p = .57$, $d = 0.33$ for the speaking task). Descriptively, the 4-year-olds' difference scores were higher for all tasks, which shows that children at this age do not yet relax their requirement of reciprocal engagement.

In sum, the data suggest that young children operate with a principle of reciprocal relatedness, especially, but not only, when it comes to gaze. They not only sense that they cannot see another whose eyes are covered, but they also sense that they cannot hear or verbally address another whose ears or mouth are covered, respectively. Their insistence on reciprocity is thus not confined to seeing but spans across different modes of personal engagement.

However, alternative interpretations might be considered. First, one might wonder if the children thought they were being asked if the *adult* could perceive or speak to *them*. After all, the adult’s perception/speech was saliently impaired, so it might seem pragmatically odd to children that they were asked about their own (normal) instead of the adult’s (exceptional) circumstances. We do not consider this interpretation plausible because prior research has shown that children vary their answer depending on the verb deployed in the question: They deny that they can see but affirm that they can look at another whose eyes are occluded (Moll et al., 2015). These adjustments are inconsistent with the view that children negate the questions because they confuse the subject and object of perception.

Another question concerns modal correspondence. Maybe children respond negatively whenever *any* facial area is occluded—whether it is the modality designated by the verb (see/eyes) or not. Some intermodal “spillover” is consistent with the reciprocal engagement hypothesis. For example, children might assert that they cannot speak to someone with covered eyes or ears because their personal address does not “go through” or is even refused. But children should not completely ignore modal mapping, and prior work has shown that they do not. For example, children assert that they can see an agent whose mouth is covered (McGuigan & Doherty, 2006).

To provide further evidence against these alternative interpretations, we addressed these issues in another experiment with two control conditions, each of which was compared to the occlusion condition of Experiment 1. In the *subject reversal condition*, we asked children if the adult could see/hear/speak to them. The rationale was that if children in Experiment 1 believed they were asked about the other’s ability to perceive or speak, their answers would closely resemble those when *actually* asked about the other in Experiment 2. In the *modality mismatch condition*, we asked children if they could see/hear/speak to an adult whose ears/eyes/nose were covered or shut, respectively. We predicted that children would produce more negations in the subject reversal condition than in the occlusion condition but fewer negations in the modality mismatch condition than in the occlusion condition.

EXPERIMENT 2

Method

Participants

Twenty-four (12 female) preschoolers (M = 3;10; range = 2;2–4;7), none of whom took part in Experiment 1, participated. Ten were tested at the museum and 14 at the university. Thirteen were Multiracial, 2 were Hispanic, 7 were White, 1 was Asian, and 1 was African American. No child had any known disabilities. Their socioeconomic backgrounds varied greatly, with annual incomes ranging from < \$20,000 to > \$120,000. Three other children were tested but excluded because they were unresponsive (1) or inattentive (2).

Materials, Design, and Procedure

In addition to the materials used in Experiment 1, a long black hairclip (9 cm × 1 cm × 1 cm) was used by E1 to pinch her nose shut in the modality mismatch condition of the speaking task. The subject reversal condition always preceded the modality mismatch condition to avoid starting with strange (mismatch) questions, which might make children question the seriousness or reliability of the adult. Both conditions were composed of 12 trials, 4 for each task: 2 in which the organ was covered by hand and 2 in which it was covered by the device. As in Experiment 1, there was thus a total of 24 trials.

Subject Reversal Condition. After the same brief demonstration phase, E1 covered her eyes in the seeing task, her ears in the hearing task, and her mouth in the speaking task—as in Experiment 1. E2, who sat opposite from E1 and next to the child, asked the child, "Can [*name of E1*] see/hear/speak to you?" followed by, "Can [*name of E1*] see/hear/speak to me?" (The perceiver was thus always E1, with E2 and the child as objects of perception.) E1 then used the alternative means (e.g., her hands) to cover the same facial area, and E2 repeated the same questions.

Modality Mismatch Condition. Consistent with the other tasks, it was briefly demonstrated to the child that E1 could not smell (a fragrance) while wearing the nose clip. E1 covered her *ears* in the seeing task, covered her *eyes* in the hearing task, and pinched her *nose* in the speaking task. E2, who sat next to E1, then asked, "Can you see/hear/speak to [*name of E1*]?" E2 then covered her own facial area in the same way, and E1 asked the child the same questions about E2.

The scoring and reliability procedures were the same as before. A total of 9 out of 576 trials could not be coded because the child said, "I don't know" (4), gave no answer (4), or said "Huh?" (1). Proportional scores were thus calculated in the same manner as in Experiment 1. Interrater reliability was perfect ($\kappa = 1$).

Results and Discussion

Analyses were conducted using logistic regression models with Huber-White sandwich estimators of variance to account for repeated-measurement clustering within subjects. There were no effects of occlusion type or task order (ps > .14). Figure 3 shows the mean proportions of children's negative responses as a function of task and condition. Comparisons of the subject reversal condition with the occlusion condition and of the modality mismatch condition with the occlusion condition for each task were conducted in the logistic regression model via a Condition × Task interaction. The marginal estimate for the average difference between conditions was computed for each task. The Holm-Bonferroni procedure for alpha adjustment was used for comparisons between tasks within each hypothesis.

Seeing Task

As predicted, children produced more negations in the subject reversal condition than in the occlusion condition of Experiment 1 (marginal significance, $p = .053$, $d = 0.55$). Also in line with our prediction, they produced fewer negations in the modality mismatch condition than in the occlusion condition, $p = .003$, $d = 0.92$.

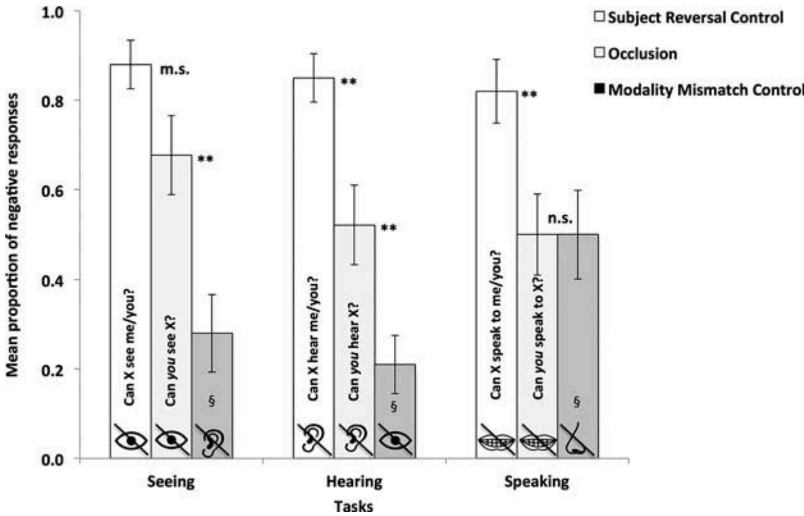

FIGURE 3 Mean proportions of children's negative responses in Experiment 2 (with standard errors of the mean as error bars) broken down by task and condition.
Note. The occlusion condition stems from Experiment 1.
§The question was the same as in the occlusion condition.
**Significance at $p < .01$.
m.s. = marginal significance ($p = .053$).

Hearing Task

As predicted, children produced more negations in the subject reversal condition than in the occlusion condition, $p = .004$, $d = 0.93$, and fewer negations in the modality mismatch condition than in the occlusion condition, $p = .009$, $d = 0.82$.

Speaking Task

As predicted, children gave more negative answers in the subject reversal condition than in the occlusion condition, $p = .009$, $d = 0.80$. Counter to our prediction, they negated the questions equally in the modality mismatch condition and the occlusion condition, $p = .90$, $d = 0.01$.

These results rule out that children in the occlusion condition assumed they were asked about the adult's ability to perceive or speak to them. When the children were *actually* asked about the adult's ability to perceive or address them, their negations approached ceiling—thus demonstrating that children had robust knowledge of the adult's impaired condition. While the negations in the occlusion condition presuppose this knowledge, they furthermore reflect an insistence on reciprocal relatedness, which is not (fully) endorsed by all children. The different levels of negation (with only marginal significance for the seeing task, which may be attributed to low power due to the high scores in the occlusion condition) demonstrate that the children discriminated between questions about their own perception/speech and that of the other. The results also rule out that children indiscriminately give negative answers whenever the other's face is partially occluded. The children judged that they could see the other when her ears were covered and hear her when her eyes were covered, thus evidencing that modal correspondence mattered to them. Yet, they equally denied being able to speak to the adult when her mouth was covered and her nose was pinched. We can only speculate about the cause of this null result, but it is possible that structural asymmetries between speech and the senses can explain it. Vocal production is neither entirely disabled when the mouth is covered (E1 made sounds in the demonstration phase) nor is it entirely intact when the nose is pinched (E1 spoke with a nasal voice in the demonstration phase), thus blurring the contrast that is much starker for vision and hearing, neither of which are compromised when the other is blocked. Some of the negations might also result from children having misunderstood the question of whether they can speak to the adult as a request to talk to her (which one child in fact did in two omitted trials in Experiment 1). By saying "no," children might express that they do not desire to speak to or do not know what to say to the adult.

GENERAL DISCUSSION

The present findings suggest that the opposing positions outlined in the Introduction need to be reconciled. Children do *not* limit their demand of reciprocity to gaze alone—which was suggested by the exclusive focus on vision in earlier work. Instead, children also deny being able to hear or speak to someone whose ears or mouth are covered, respectively. They respond consistently across these modalities, as the correlations between their answers in Experiment 1 have shown. Therefore, children's negation of another's visibility reflects a more general principle of reciprocal relatedness—a principle that they also apply to vocal communication: "I cannot hear you unless you can hear me" and "I cannot speak to you unless you can speak to me." Young children thus do not view communication as one individual unidirectionally imparting information to another. Instead, their notion of communication is bidirectional. The other's ability to take up and respond to one's expressions is a condition of success for their addressability.

At the same time, gaze is the primary domain in which children insist on reciprocity. Experiment 1 showed that gaze is where children apply the principle of reciprocal engagement with particular vigor. This finding underscores that gaze has an unparalleled social potency and plays a crucial role in establishing intersubjectivity (Hobson & Bishop, 2003; Hobson & Lee, 2010). As Rousseau (1762/1978) noted, humans live in the eyes of others, of which even young children seem to be aware. What distinguishes two people *sharing* a smile from two people smiling at the same time is that their eyes meet as they are smiling. Reciprocated gaze, in other words, allows for a "meeting of minds" and constitutes shared experience in a way that has no equivalent in other modalities.

Overall, the data indicate that reciprocal engagement is essential for children's sense of being able to perceive or relate to others. For them, relating to others implies that the perception or communication "flows" both ways. Children's negations observed in our study are evidence of this reciprocal disposition: They often judge it impossible to relate to someone who cannot simultaneously relate to them, with the effect that they underextend the verbs see, hear, and speak—when used with reference to an agent—to those felicitous cases in which the other can reciprocate the act. Note that children, even though their hiding behavior in games of hide-and-seek may suggest otherwise, do not consider the other's *body* as having disappeared (Russell et al., 2012). If asked where a person with occluded eyes is located, they would probably point toward her. Children's false judgments are thus only brought to light in certain interactions (hide-and-seek) and discourse about person perception.

An interesting speculation concerns atypical development. Though children's negations are erroneous from the standpoint of cognitive maturity, the "overdemand" of reciprocity seems to be part and parcel of normal social-cognitive development. Its absence might indicate an autistic trajectory. Persons on the autism spectrum are impaired in their ability to reciprocally engage with others (Hobson, 2002). They are atypically aroused by direct gaze (Kaartinen et al., 2012), and infants later diagnosed with autism show a decline in eye contact after the first months (Jones & Klin, 2013). A drive toward reciprocity is also missing in these children's gestures and speech, which are often deployed instrumentally, not for the sake of sharing experiences (Camaioni, Perucchini, Muratoni, Parrini, & Cesari, 2003; Mundy, Sigman, Ungerer, & Sherman, 1986). It is therefore conceivable that autistic children "skip" this phase of making reciprocity a condition for the successful perception and addressability of persons—a phase that might be crucial for healthy social-cognitive development. What also remains to be investigated is how typically developing children come to abandon their insistence on reciprocal relatedness before school age and accept that persons can be unidirectionally perceived or addressed.

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