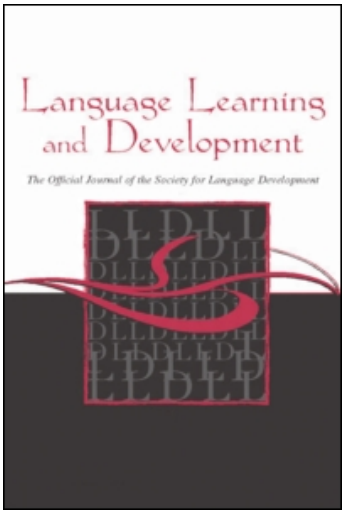

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Social Experience, Social Attention and Word Learning in an Overhearing Paradigm

Laura A. Shneidman[a]; Jennifer Sootsman Buresh[a]; Priya M. Shimpi[a]; Jennifer Knight-Schwarz[a]; Amanda L. Woodward[a]
[a] Department of Psychology, University of Chicago,

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Social Experience, Social Attention and Word Learning in an Overhearing Paradigm

Laura A. Shneidman, Jennifer Sootsman Buresh, Priya M. Shimpi, Jennifer Knight-Schwarz, and Amanda L. Woodward

University of Chicago, Department of Psychology

This study explored the relation between children's daily experiences, their attentional behaviors, and their ability to learn words from directed and overheard speech at 20 months of age. Novel objects were presented and labeled in one of two conditions: (a) a Direct condition in which an experimenter addressed the child or (b) an Overhearing condition in which an experimenter addressed a confederate. Children's attentional behaviors during training were coded and parents were asked to describe their children's social experiences outside of the laboratory. In the Direct condition there was no reliable pattern of correlations between experience, attention, and word learning. In the Overhearing condition, word learning positively related to both the amount of time children spent with multiple adults and to the duration of children's attention to the experimenters during training. Furthermore, children's experience around multiple adults positively related to their attention to the experimenters. These findings suggest the possibility that children who have more experience with multiple adults develop attention strategies that enable them to learn words in an overhearing situation.

Joint attention, the mutual focus between conversational partners on an object or activity, has been heavily stressed in theories of early language development (e.g., Baldwin, 1991; Bruner, 1995; Carpenter, Nagell, & Tomasello, 1998; Harris, Jones, Brookes, & Grant, 1986; Tomasello & Farrar, 1986). There is much evidence supporting joint attention's facilitative effects. Several naturalistic studies showed that children who participate in more episodes of joint attention with their caregivers have larger vocabularies than children who experience less joint attention (Carpenter et al., 1998; Tomasello & Farrar, 1986; Tomasello & Todd, 1983). Experimental studies have further demonstrated that joint attention aids children's word learning in laboratory tasks (e.g., Baldwin, 1991; Dunham, Dunham, & Curwin, 1993; Tomasello & Farrar, 1986).

As it has been traditionally defined, joint attention has stressed mutual engagement between a child and an adult conversational partner. Researchers have looked for evidence that an adult and a child are actively attending to each other while they share focus on an object or activity. This type of engagement may provide several benefits. First, since mutual engagement serves to

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Priya M. Shimpi's affiliation has changed. She is now at Mills College; Jennifer Knight-Schwarz is now at Emory University; Amanda L. Woodward is now at the University of Maryland.

Correspondence should be addressed to Laura A. Shneidman, Department of Psychology, University of Chicago, 5848 S. University Ave, Chicago, IL 60637. E-mail: lauras@uchicago.edu

increase children's focus on labeled referents (Baldwin & Markman, 1989), it may facilitate the forming of an association between a word and its referent. Second, mutual engagement may enhance children's attention to communicative cues such as eye gaze and/or gesture and thus render the labeler's referential intent easier to discern (e.g., Tomasello, 1995).

Recently, Akhtar and Gernsbacher (2007) have questioned whether mutual engagement is necessary for early word learning. These authors contrast *joint attention*, which emphasizes mutual engagement, and *joint focus*, to describe cases in which a child focuses on what a speaker attends to without the mutual engagement with the speaker. They suggest that joint focus without mutual engagement may be sufficient for early word learning when children are able to independently attend to and understand the communicative cues of a speaker.

Indeed, in many non-Western cultures much of young children's social learning occurs without mutual engagement. While Western caregivers typically monitor children's attentional focus and tailor interactions to meet the needs of their children, this style of teaching is far from universal (Rogoff, Mistry, Goncü, & Mosier, 1993). For example, in a Guatemalan Mayan village, direct interactions between children and adults are rare. In this community the responsibility of learning is placed on children; children independently attend to and learn from observations of adult activities and interactions (Rogoff et al., 1993). Observations of communities where learning from observation is stressed show that children competently learn language despite being rarely directly addressed by others (see Akhtar, 2005a; Akhtar & Gernsbacher, 2007; Lieven, 1994). For example, Ochs and Schieffelin (1984) observed that infants in the Kaluli tribe of Papua New Guinea were proficient word learners despite the fact that they were seldom the conversational addressees. Others have made similar observations about Mayan children (Rogoff, et al., 1993; see also Rogoff, 2003). Recent experimental work shows that even children growing up in Western cultures readily learn new words outside episodes of mutual engagement (Akhtar, 2005b; Akhtar, Jipson, & Callanan, 2001; Floor & Akhtar, 2006). In a series of studies Akhtar and colleagues tested children's ability to learn words from overheard speech. Children either heard a novel label for an object while they were directly addressed by an experimenter or they watched while the experimenter labeled the object for a second experimenter. Children as young as 18 months were able to learn words in both conditions (Floor & Akhtar, 2006). Akhtar (2005b) demonstrated the robustness of this ability, showing that 2-year-olds could learn novel words in overhearing situations while playing with a distracter toy, or when hearing the novel word embedded in a directive rather than in a labeling utterance.

Learning from overhearing requires that children enter into a state of joint focus with the speaker without the support of the speaker's active engagement. The child needs to have the motivation and ability to attend to and make sense of others' conversations. To do so requires the ability to deploy attention effectively, disengaging from one's own focus of attention, and, in some cases, alternating attention among several events simultaneously. It has been hypothesized that joint engagement facilitates learning because such engagement constrains a child's focus on a speaker, an object or activity, and the behavioral links between the speaker and object/activity (Tomasello, 1995). In an overhearing situation, a child needs to monitor these elements independently. For instance, in a situation in which a speaker is talking about some object to an addressee, the child needs to monitor the speaker and the addressee's faces, follow their eye gaze to the object, and infer that the speakers' words are relevant to that object.

Children living in cultures in which they are rarely directly engaged by caregivers develop attention behaviors that are characterized by such active attention to other people. For example,

Gaskins (1999) found that children under 2 years of age in a Yucatec Mayan community spend most of their day observing others, rather than working or playing. Furthermore, these children develop specific attentional strategies that could facilitate learning from others' interactions. Chavajay and Rogoff (1999) found that 14- to 20-month-old Guatemalan Mayan children can simultaneously attend to multiple events, an ability that would help children monitor multiparty interactions. This behavior has not been found to the same effect in cultures whose children spend less time observing others. For example, same-age peers in middle-class North American families tend to alternate their attention between co-occurring events, rather than simultaneously attend to them (Chavajay & Rogoff, 1999).

These findings suggest that social experiences shape the way children attend to and learn from others. However, as yet there have been no direct investigations of how differences in social experience might relate to social learning. The goal of the current study was to investigate this issue. We reasoned that Western children may, in fact, represent significant variation in the extent to which they have opportunities to observe adult conversations. Some children spend most time at home with a single caregiver, whereas others are surrounded by multiple speakers a significant proportion of the time. Children who have extensive experience around multiple others could, like Mayan children, develop attentional behaviors that are characterized by active monitoring of others' interactions. These children might therefore be more equipped than children without this experience to learn words in the absence of mutual focus. Observational experiences have been hypothesized to aid children's language development (Begnino, Clark, & Farrar, 2007; Blum-Kulka & Snow, 2002). For example, children who observe multiparty interactions follow and comprehend talk not directed toward them (Barton & Strosberg, 1997; Barton & Tomasello, 1991; Dunn & Shatz, 1989). Furthermore, young children's experiences in mother–child–sibling conversations have been found to positively relate to children's vocabulary, thus indicating benefits of learning in multiparty situations (Begnino et al., 2007). In the current study we assessed whether individual variations in social environment related to children's social attention and downstream social learning. If experience shapes learning in this context, then we might expect that variation in social experience will lead to differences in social attention, which in turn should affect learning outcomes.

Using an experimental paradigm based on that of Akhtar et al. (2001), we compared 20-month-old children's word learning in an overhearing situation to a situation in which children were directly addressed. We then examined children's attentional behavior in these situations. In the first analysis we asked whether children attended to the object while it was labeled. In the second analysis we examined the extent to which children monitored referential cues by measuring the length of time children attended to the experimenters. Prior research indicates that children do not blindly make associative pairings between an object they are attending to and a spoken label. Instead, they infer reference based on the behavioral cues of the labeler (e.g., Akhtar & Tomasello, 1996; Baldwin, 1993; Baldwin et al., 1996; Moore, Angelopoulos, & Bennett, 1999; Tomasello & Barton, 1994). Based on this research, we reasoned that attention to the experimenters could be particularly important for learning in an Overhearing situation. In this situation, children's attentional focus is not automatically aligned with the labeler's, and children may therefore be required to search for behavioral cues indicating reference. In our Overhearing condition, both the speaker and the addressee provided useful behavioral cues for matching a label to a referent. For example, the speaker was connected to the referent through gaze or touch, and the addressee also gave behavioral cues such as gaze or nodding that signified understanding the speaker's words as meaningful to the referent. If attention to the communicative

interaction provides important information for children, then attention to the two adults will predict learning in the Overhearing condition.

We next explored how social experience may contribute to children's attention and word learning in the laboratory. Based on studies of word learning in the communities where there is little use of joint engagement, we know that exposure to overheard speech is common in the experience of these young children. Based on Chavajay and Rogoff (1999), we also know that children's attention patterns can reflect variations in their social experience. In the current study, we were interested in whether children who had extensive opportunities to monitor third-party conversations in their daily lives were more likely to learn in the Overheard condition. We were also interested in whether these children would be better able to monitor cues to the adults' attentional focus in the Overhearing condition than children without this experience. To obtain information about these opportunities, we interviewed parents about their children's daily social experiences with other adults and children. We then examined whether children's daily experiences related directly to their ability to learn from overheard speech.

To summarize, we asked four questions in the current study. First, we asked whether 20-month-old children learn words for novel objects in an overhearing situation, as compared to a situation in which they are directly addressed. Second, we asked whether children's attention during training predicts their word learning in both situations. Third, we asked whether children's daily experiences outside of the laboratory predict word learning. Finally, we asked whether these daily social experiences relate to attention behaviors.

METHOD

Participants

Fifty-two monolingual, English-speaking children from the greater Chicago area participated in this study. Children were randomly assigned to either a Direct or Overhearing condition. Twenty-five children (12 males, 13 females) participated in the Direct condition (Mean age: 20 months, 5 days; Range: 18 months, 19 days, to 21 months, 3 days), and 27 children (13 males, 14 females) participated in the Overhearing condition (Mean age: 19 months, 26 days; Range: 18 months, 4 days, to 21 months, 5 days). Twelve additional children participated in the experimental procedure but were excluded from the final sample due to parental interference (7), fussiness (2), videotapes could not be coded (2), and experimenter error (1). Three parents did not complete the interview due to experimenter error.

Procedure

Setup. The parent and child sat next to each other at a table. A metallic chute sat between two chairs on the other side of the table. The procedure consisted of a warm-up phase, training phase, and test phase.

Warm-up phase. First, an experimenter (E1) gave the child the two unfamiliar objects to be used in the experiment, a pink bicycle handle and a purple coaster. After the child played with the objects for a few minutes, E1 took them away from the child and left the room.

Training phase. Two new experimenters (E2 and E3), with no previous interaction with the child, entered the room to conduct the training trials. E2 and E3 sat at a table, next to each other and 1 meter across the table from the infant. For both conditions which object was the target was counterbalanced. The order of presentation (i.e., target or foil) was also counterbalanced.

In the Direct condition, E2 engaged with the child during the training phase. E2 would wait until the child was visually attending. She would then hold the target object toward the child while labeling it three times (e.g., "Look at the blicket!") and looking back and forth between the child and the object. Then E2 gave the object to E3, who put it down the metallic chute. Then E2 held the other object toward the child and glanced back and forth to it while producing positive sentences, but without labeling (e.g., "Wow! Look at this one!").

In the Overhearing condition, E2 and E3 neither engaged with nor made eye contact with the child at any point during the procedure. For each trial, E2 held an object toward E3 while glancing back and forth between her and the object. E2 labeled the target object using infant-directed speech three times (e.g., "Look at the blicket!") and then handed the object to E3, who put it down the chute. This was repeated with the other object without naming it (e.g., "Wow! Look at this one!").

In both conditions, three sets of training trials were performed, for a total of nine utterances (e.g., "Look at the blicket!" or "Look at that one!") per object. After the trials were complete, E2 and E3 left the room, and the first experimenter (E1) came back in the room to conduct the comprehension and preference test phase.

Comprehension and preference test phase. Children in both conditions received identical comprehension and preference trials. These trials were administered by E1, who returned to the testing room following the training phase. E1 was unaware of the experimental condition (Direct or Overhearing) and was also unaware of the target object (pink handle or purple coaster). First E1 allowed the child to play with the two objects from the training trials for 30 seconds. E1 then moved the chute next to the child and explained that they were going to play a game in which objects would be put down the chute. E1 first gave three warm-up trials with familiar toys (e.g., a plastic bear, dog, or car), so that children became familiar with putting objects down the chute.

Next, E1 gave 2 test trial blocks consisting of 4 preference trials and 4 comprehension trials. Trials were counterbalanced for order (preference or test trial first) and side of target object (right or left). E1 held one toy out in each hand while looking directly at the child. In the preference trials, children were asked to choose one object (e.g., "Get one you like"). In the comprehension trials, the child was asked to choose the target object (e.g., "Get the blicket"). The child's choice of object was scored from videotape by a coder unaware of the condition or target object.

Measures

Attention patterns. Videotapes of the Direct and Overhearing word training interactions were coded using a digital video coding program (Aronson, 1999; Hellwig, 2007) for the location and duration of children's visual attention and contiguity of their attention to the toy while its label was given. Visual attention was classified as directed toward (a) the experimenter who labeled the object (E2), (b) the addressee (E3), (c) the toy, or (d) any other location. The child's duration of attention to each of these foci during the training was calculated. In addition

to overall attention, we assessed the extent to which children experienced contiguity between hearing the word and viewing the object by counting the number of times (of a possible 9) that the child was looking at the target object when the label was uttered.

To assess reliability, a second, independent coder re-coded 10 of the tapes (4 from the Direct condition and 6 from the Overhearing condition). There was strong agreement between the two coders' assessments of the duration children attended to the target object (α = .97) and the social partners (α = .97), and the proportion of time children attended to the target object while the target word was being uttered (α = .95).

Parental report. Vocabulary Report: Before arriving at the session, parents were asked to complete the MacArthur Communicative Development Inventory long form (Fenson et al., 1994).

Daily Activity Interview: After testing, parents were interviewed about the child's daily activities. In the interview, an experimenter asked the parent to describe each day in a typical week, hour by hour. Based on these interviews, children's weekly waking hours were divided into three mutually exclusive categories. These were (a) the number of hours the child spent alone with only one adult, (b) the number of hours the child spent with multiple adults and no other children (here adults were defined as speakers over 9 years), and (c) all other waking hours. The first category, the number of waking hours the child spent alone with one adult per week, was used as a proxy measure for the amount of time children were likely to be only directly addressed in their everyday lives. The second category was used as a proxy measure of how often children were likely to overhear others speaking to each other. We chose this as our measure of experience overhearing for two reasons. First, this measure was most like our experimental condition, children in our study looked on while two adults had a conversation. Second, we considered this to be the most conservative measure of time children were likely to overhear speech in their everyday lives. With two or more adults present, and no other children, we considered it very likely that the adults would be talking to each other in view of the children. In other cases, where many children were present, we were unsure whether overheard conversations or other activities might be taking place.

RESULTS AND DISCUSSION

Did Children in the Two Conditions Learn the Name for the Object?

We first assessed whether children in the two conditions learned the word for the named object. We assessed learning in two separate analyses. First, we asked whether children chose the named object more often in the comprehension trials (when the experimenter asked the child for the target object) than in the preference trials (when the experimenter asked the child to get one he or she liked). Second, we asked whether children chose the named object more often than would be predicted by chance.

Table 1 summarizes children's responses during the comprehension test. Preliminary analyses revealed no effects of sex, vocabulary, age, or test trial order (preference versus test first) on target selection, so subsequent analyses collapsed across these measures. We found a marginal main effect of target object, $F(1,50) = 4.03$, $p = .05$. This indicates that regardless of trial type,

TABLE 1
Proportion Target Object Selection on Preference and Comprehension Trials

Trial Type	*Direct Condition (n = 25)* *M (SD)*	*Overhearing Condition (n = 27)* *M (SD)*
Preference	.50 (.29)	.58 (.31)
Comprehension	.63 (.35)*	.65 (.30)*

Note. * indicates significant difference from chance at $p < .05$, one tailed.

children chose the pink handle more often than the purple coaster, but children in the two groups did not differ on this measure, $F(1,48) = .48$, *ns*. To assess whether children chose the named object more often in the comprehension trials than in the preference trials, we conducted an analysis of variance (ANOVA) on the proportion of time children selected the target object with condition (Direct or Overhearing) and target object (pink handle versus purple coaster) as the between-subjects variables and trial (comprehension and preference) as the within-subjects variable. There was a main effect of test trial, $F(1,50) = 4.84$, $p = .03$, $\eta_p^2 = .09$, indicating that children selected the target object more on comprehension trials than on preference trials. There were no other main effects or interactions. Notably, there was no main effect of condition, $F(1,50) = .46$, $p = .50$, $\eta_p^2 = .01$, and no Condition X Test Trial interaction, $F(1,50) = .54$, $p = .47$, $\eta_p^2 = .01$, indicating no difference in the extent to which the two groups chose the target object more in the comprehension trials than in the preference trials.

A second measure of learning is whether children selected the named object when asked, "Where's the blicket?" at rates greater than chance (50%). To address this question, we conducted planned contrasts comparing test choices to chance in each condition. One-tailed *t* test showed that children in both of the conditions chose the target object on the comprehension trials more often than expected by chance, Direct: $t(24) = 1.83$, $p < .05$; Overhearing: $t(24) = 2.12$, $p < .05$. Of note, children did not select the target object more often than expected by chance when asked for their preference, Direct: $t(24) = .00$, *ns*; Overhearing: $t(24) = 1.39$, *ns*.

To summarize by two assessments, children in each condition showed evidence of learning the label for the named object. Specifically, children chose the target object in the comprehension trials more often than in the preference trials, and they chose the target object in the comprehension trials, but not in preference trials, more often than would be expected by chance.

Did Children in the Two Groups Differ in Their Attention During the Training Phase?

Before examining the relations between learning and patterns of attention during training, we examined whether children in the two groups differed in their attentional behavior during training. Table 2 summarizes these results. First, we assessed whether children in the two groups differed in the total amount of time they watched the training phase of the experiment. We ran an independent samples *t* test to assess whether children in the two groups differed in the proportion of time they looked at the combined relevant elements of the training (the target object, the experimenter who labeled the object, and the confederate) relative to the total amount of time the target object was in view. Despite the differences in training, the two groups did not differ in the proportion of time they looked at these elements of the event, Direct: *M* (*SD*) = .91 (.09);

TABLE 2
Children's Visual Attention During Training

	Proportion of Time in Training Spent Attending to Location			
Condition	*Target Object M (SD)*	*Experimenters M (SD)*	*All Relevant Locations M (SD)*	*Target Contiguity M (SD)*
Direct (n = 25)	.68 (.16)	.23 (.12)	.91 (.09)	6.76 (1.8)
Overhearing (n = 27)	.60 (.11)*	.33 (.12)*	.93 (.08)	5.29 (1.8)*

Note. Target contiguity score represents the number of times the child looked at the target object out of the nine times that object was labeled. * indicates Overhearing condition differed from Direct condition at $p < .05$.

Overhearing: M (SD) = .93 (.08), $t(50) = .61$, $p = .54$. Thus, children in the two conditions were equally attentive to the events.

We next asked whether the two groups differed in how they allocated attention to the different aspects of the event. Table 2 summarizes these findings. We found that children in the Direct condition attended more to the target object during training relative to the amount of time it was in view than did children in the Overhearing condition, $t(50) = 2.11$, $p < .05$. Children in the Overhearing condition attended to the people in the interaction (the experimenter and the confederate) for a greater proportion of time than did children in the Direct condition, $t(50) = 3.20$, $p < .01$.

Finally, we examined whether there were differences between the two groups in our measure of contiguity, the number of times the children looked at the target object while hearing the label. Recall that the target object was labeled nine times during training. Children in the Direct condition looked significantly more times at the target object while it was being labeled than did children in the Overhearing condition, $t(50) = 2.91$, $p < .01$; see Table 2.

To summarize, children in each condition attended equally to the combined set of relevant items in the interaction. But children in the two conditions differed in the amount they attended to individual elements. Compared to children in the Overhearing condition, children in the Direct condition looked longer at the target object and less at the people in the interaction. Children in the Direct condition were more likely than children in the Overhearing condition to look at the object at the same time the label was given.

Did Children's Attention During Training Predict Whether They Learned the Word?

Findings on the relationship between attention behaviors during training and word learning are summarized in Table 3. If word learning is mainly driven by contiguity, then attention to the object should predict learning in both conditions. However, if attention to the communicative interaction provides important information for children when overhearing, then attention to the experimenters will predict learning in the Overhearing condition. For all correlations between learning and attention behaviors we controlled for children's vocabulary (CDI score).

In the Direct condition there were no significant correlations between children's attention to the target object or the experimenters and word learning when controlling for vocabulary. In the Overhearing condition there was a positive correlation between the amount of time children watched the experimenters and word learning ($r = .51$, $p < .05$), and there was also a negative

TABLE 3
Correlations Between Attention Measures and Comprehension Scores Controlling for Vocabulary (CDI)

Comprehension Score	*Duration of Attention to Experimenters*	*Duration of Attention to Target Object*	*Target Contiguity*
Direct condition (n = 25)	+.28	−.22	−.13
Overhearing condition (n = 27)	+.51*	−.55**	−.50*

Note. * = $p < .05$; ** = $p < .01$.

correlation between the amount of time children watched the target object and word learning ($r = -.55$, $p < .01$).

Next we assessed whether contiguity (i.e., hearing the label while looking at the object) predicted whether children learned the word for the trained object. In the Direct condition there was no reliable correlation between these measures. In the Overhearing condition there was a negative correlation between attention to the target object during labeling and word learning ($r = -.50$, $p < .05$).

To summarize, the specific patterns of attention we coded did not predict word learning in the Direct condition. In contrast, in the Overhearing condition attention behaviors were related to word learning. Children who learned the word in the Overhearing condition attended more to the experimenters during training and attended less to the target object during training and during labeling. It is important to note that children who learned were not failing to attend to the target object during training; every child who participated in this study attended longer to the target object than to the people during training. Children who learned in the Overhearing condition were simply allocating a greater proportion of their looking time to the experimenter (E2) and the confederate (E3).

Did Children's Daily Experiences Predict Word Learning?

We asked whether daily experience related to children's ability to learn from overheard conversations by examining the relationship between learning and the three measures of children's weekly waking time extracted from the interview (see Table 4).

In the Direct condition, we did not find any relationship between children's daily experiences and word learning. In the Overhearing condition, we found that time spent alone with multiple adults was positively related to learning, when controlling for children's vocabulary ($r = .45$, $p < .05$). This result provides evidence that variation in children's social experiences is related to children's ability to learn from overheard speech. Children who spend a great deal of time alone with multiple adults presumably have many opportunities to overhear conversations. This kind of experience may facilitate learning from overheard speech.

Our measure of "other waking hours" included time that children spent with one or more adults and other children or infants. As such, it is perhaps surprising that this measure failed to correlate with learning in the Overhearing condition, given that this measure likely included time children spent overhearing speech. We believe that there are at least two possibilities for this nonfinding. First, since the overheard interaction in our study was an interaction between two adults, it seems that the most relevant experience children could have is time spent around

TABLE 4
Correlations Between Social Experience Measures and Attention During Training

Social Experience	*Duration of Attention to Experimenters*	*Duration of Attention to Target Object*	*Target Contiguity*
Direct Condition (n = 23)			
Hours per week with one adult	+.01	–.07	–.04
Hours per week with multiple adults	+.38	–.38	–.48*
Other time	–.09	.07	.09
Overhearing Condition (n = 26)			
Hours per week with one adult	+.08	–.01	–.32
Hours per week with multiple adults	+.47*	–.12	–.57**
Other time	–.37	+.11	+.53**

Note. * = $p < .05$; ** = $p < .01$.

multiple adults and perhaps not time spent around multiple children. Second, it may be the case that the measure "other waking hours" was simply too broad to capture time children may have spent overhearing conversations. Future research should use a more exact measure of children's experiences overhearing speech in order to examine more precisely which types of social experience might relate to children's ability to learn from overheard speech.

Did Children's Daily Experiences Predict Their Attention During the Training Phase of the Experiment?

Based on the literature demonstrating that cultural environment has a profound effect on children's attentional styles, we next explored whether a similar relationship held for children's immediate social environment. Results are summarized in Table 5. Here we examined the relation between children's daily experiences outside of the laboratory and their attention during the training portion of the experiment. We explored whether measures of children's daily experiences were related to their propensity to monitor the target object and the experimenters during training. Recall that our previous analyses showed that attention to the experimenters, and not to the target object, positively related to learning. Weekly time children spent with one adult was unrelated to children's attention in the word-learning task in either the Direct or Overhearing condition. Time spent with multiple adults was significantly and positively related to attention to the experimenters in the Overhearing condition (r = .47, $p < .05$). In addition, in both conditions the

TABLE 5
Correlations Between Children's Daily Experiences and Learning Controlling for Vocabulary (CDI)

Comprehension Score	*Hours per Week Alone with Multiple Adults*	*Hours per Week Alone with one Adult*	*Other Time*
Direct condition (n = 25)	–.06	+.20	–.13
Overhearing condition (n = 27)	+.45*	+.21	–.36

Note. * = $p < .05$.

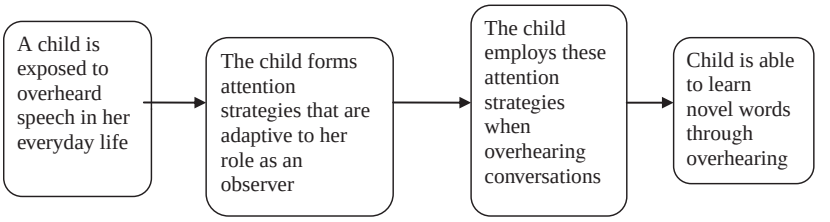

FIGURE 1 Attention as a mediator between social experience and learning.

weekly time children spent with multiple adults was negatively related to contiguity of attention to the target object during labeling (Direct: $r = -.48$, $p < .05$; Overhearing: $r = -.57$, $p < .05$). These results indicate that variation in social environment within a culture does relate to how children allocate their attentional focus. Children who spend ample time with multiple adults are likely to attend more to the people and less to an object when overhearing speech.

Environment, Attention, and Learning From Overheard Speech

We found that children who spent more time with two or more adults paid more attention to the two adults in the Overhearing condition; similarly, the amount of attention paid to the two adults in the Overhearing condition positively related to children's word learning. These results raise the possibility that children's attention behaviors mediate, in part, the relationship between social experiences and word learning from overhearing. This hypothesis is consistent with our data. When controlling for attention to the experimenters, the positive relationship between time spent with multiple adults and word learning reduces in magnitude and loses statistical significance ($r = .31$, *ns*), suggesting the possibility that attention behaviors mediate this relationship.

We introduce a model explaining a possible pathway for these relations (see Figure 1). Children who have experience overhearing two or more linguistically competent speakers may be more likely to develop attention strategies that, in turn, help them succeed at word learning when they are not directly addressed. Under this model, exposure to overheard speech makes it more likely that children will independently monitor social cues relating to adults' referential intent. Children who are able to do this are more likely to learn words in overhearing situations.

GENERAL DISCUSSION

In the current study we replicated findings demonstrating that children can learn words for objects without the support of joint engagement with the speaker. We then went on to explore how variation in social environment and children's social attention may contribute to this ability. First, we explored children's attentional behaviors during training, asking how such behaviors related to word learning. We then examined the relationship between children's daily experiences and word learning. Finally, we investigated the relationship between children's daily social experiences and attentional behaviors. The results of this study add to the current literature by suggesting that varied patterns of social attention relate to subsequent word learning

from overheard speech and by showing that social attention and social learning relate to children's everyday experiences.

Our results indicate that when overhearing children focus more on the people in an interaction and less on a target object compared to when they are directly addressed. These findings are the first demonstration that children allocate attention in different ways when experiencing overheard compared to directed speech; however, they parallel results from recent studies exploring other kinds of observational learning. In a series of studies Moll and colleagues investigated infants' ability to keep track of what other people had experienced in episodes that either involved or did not involve mutual focus between an adult and a child (Moll, Carpenter, & Tomasello, 2007; Moll & Tomasello, 2007). In each of these studies, in conditions of joint engagement with an experimenter and an object, children looked mostly to the object with only brief looks to the experimenter. In contrast, during conditions where children looked on while two experimenters shared focus on an object, children allocated more visual attention to one of the experimenters (duration of looks to the other experimenter was not reported). Together with the current study, these findings indicate that when looking on, children tend to allocate more attention to the people in an interaction than they do when they are directly engaged.

We believe that children may be allocating ample attention to people in an overhearing interaction because they are searching for behavioral cues indicating others' attentional focus. Previous research has shown that children are likely to look to an adult's face when she performs an ambiguous but not an unambiguous action, indicating that they are searching for cues to intentionality (Phillips, Baron-Cohen, & Rutter, 1992). An overheard interaction is an ambiguous situation in that a child's focus of attention is not automatically constrained on what the speaker is looking at. While in a direct labeling interaction children can attend to a target object with relative certainty that the speaker's words are relevant to that object, when overhearing this is not the case. In this situation children must independently monitor the relevant parts of others' actions and interactions in order to make sense of their behavior.

Critically, our results indicate that such monitoring abilities are related to children's ability to learn from overheard speech. Within the Overhearing condition, attention to the interlocutors was positively related to children's ability to learn the novel word, while attention to the target object was negatively related to learning. In an overhearing situation, an adult's focus of attention is ambiguous and children may be required to independently search adults' faces for cues to intentionality. Failure to attend to these cues may result in difficulty learning words from overhearing. In contrast, during an episode of mutual interaction, an adult's focus of attention is automatically aligned with the child's. In this situation children may not be required to so actively attend to adult's behavioral cues in order to learn from their speech.

Further, the current findings revealed that social experience relates to children's attention and learning in an overheard context. Specifically, the amount of time children spent with multiple adults positively related to learning from overheard speech and to attention to the interlocutors during training. Based on the patterns of correlations we observed, we hypothesize that attention behaviors may mediate the relationship between children's experience with multiple adults and their ability to learn from overheard speech. The positive relationship between environmental experience and learning reduced in magnitude and lost statistical significance when controlling for children's attention behaviors. We believe that this provides preliminary evidence for a mediation model whereby children who have experience with multiple others are likely to allocate attention in a manner that facilitates learning from overheard speech (see Figure 1).

It is reasonable to hypothesize that our findings reflect the effects of environment on children's social attention and subsequent learning rather than other directions of causation. For one, it is not possible that performance in our study could have retroactively changed children's social environments or prior social attention. Further, although a person's social proclivities can lead him or her to select particular social contexts, it seems unlikely that this kind of self-selection played a strong role in the current study. Recall that our measure of social environments was relatively global. We asked who was in the presence of the infant during each waking hour, but we were not able to assess the extent to which infants attended to those people. While infants can control whom they attend to, the number of adults present in the context is typically outside their control and is determined instead by factors such as family structure and parental choices concerning childcare arrangements. Thus, it seems unlikely that the correlations we observed were due to infants' social attentiveness affecting changes in their social environments.

It is possible that a third factor could be driving the relationships we found, but it is not obvious what this factor might be. We believe that the fact that we found relationships between experience with multiple adults, attention, and word learning in the Overhearing but not in the Direct condition limits the range of third factors that could be at work. For example, one might expect factors such as economic status or IQ to affect both kinds of word learning. Even so, further research is necessary to elucidate the causal relations at play. Future studies might directly manipulate children's experiences with multiple individuals or longitudinally follow children with particular types of experience in order to explore further the relationships between social experience, social attention, and learning.

Studies in non-Western communities have demonstrated that experiences influence the ways in which children attend to their environments across cultures. The authors of these studies (e.g., Chavajay & Rogoff, 1999) have argued that differences in attention style may emerge because of differences in cultural beliefs and expectations about how children learn. In middle-class communities in the United States, the responsibility of learning is placed on the caregiver; caregivers reflect this by actively monitoring children's attentional focus and tailoring interactions to meet the needs of their children (Rogoff et al., 1993). In contrast, in the Mayan community children are expected to independently attend to and learn from other people's interactions (Rogoff et al., 1993). Children living in cultures in which they are expected to be active observers develop attention strategies that are characterized by actively attending to other people (Chavajay & Rogoff, 1999; Gaskins 1999). The findings from our study extend this idea by demonstrating that individual variation in daily experience even within a larger cultural context may relate to the way in which children allocate attention. Children who have ample opportunities to observe multiple adults during their everyday lives are likely to monitor adults in a novel setting. Further, this study provides the first evidence that environmental experience relates not only to how children attend to their environment but also to their ability to learn from it. Children who have experience observing others are more likely to learn novel words from observation than are children who lack this experience.

The current findings open a number of critical issues for further study. Our results provide the first evidence that environmental experience and attention relate to social learning. However, little is known about the validity of the measures we used to index these phenomena. Future research should explore how best to assess individual differences in children's social experiences and attention behaviors. In addition, future research might address what kinds of environmental experiences relate to the ability to independently monitor cues to adult focus and learn from

overhearing. In this study we used a measure of the child's weekly time with multiple adult speakers as a proxy measure for opportunities to overhear conversations. We believed that this measure was the most conservative estimate of opportunities children had to overhear speech. However, our current measure of experience does not account for the possible contribution of experience overhearing adult-to-child speech or child-to-child speech.

Our measure of "other waking hours" presumably included these experiences, but because it was such a gross measure (it included all time children spent in the company of any other children) it perhaps failed to capture accurately the amount of time children heard these types of overheard speech. Another possibility is that experience overhearing relates to attention and learning in a specific way. In the current study, children overheard an interaction between two adults. As such, experience around multiple adults, and not around multiple children, may have been most relevant to learning. Future research might explore the role that specific types of environmental experiences have on specific learning situations.

Also, our measure of experience does not distinguish between overhearing conversations between adults per se and general experience around adults. Naturalistic information about the quantity and type of speech children typically overhear may help address whether such experience with adults gives children adequate experience overhearing meaningful speech (e.g., object labels) or whether time spent with multiple adults leads children to simply preferentially attend to adults, regardless of their speech. A more precise measure of environmental experience might also clarify what types of overhearing experience relate to the attention patterns we observed. Some types of overheard speech (e.g., speech about the here and now) may be more relevant than speech about absent objects or concepts.

Previous research indicates that episodes of joint engagement may be most important for learning early in the second year of life. Across multiple studies the positive correlations between the amount of joint engagement children experience and children's later vocabulary development are strongest at 14 months and then decrease in strength or disappear during the second year (see Akhtar & Gernsbacher, 2007). Moll and colleagues argue that joint engagement is, in fact, a necessary condition for some kinds of early social learning (e.g., Moll et al., 2007). These researchers investigated infants' ability to keep track of what other people had experienced in episodes that either involved or did not involve mutual focus between an adult and a child (Moll et al., 2007; Moll & Tomasello, 2007). Their results indicated a developmental difference in children's ability to succeed at these tasks in the absence of mutual focus. At 14 months children kept track of what an adult had experienced only when they were directly involved in a typical joint attention interaction (Moll et al., 2007; Moll & Tomasello, 2007). By 18 months children were able to learn from interactions that did not involve mutual focus between the adult and the child (Moll & Tomasello, 2007). Based on these findings, these researchers argue that joint engagement is a necessary condition for this type of early social learning. The results from the current study suggest that environmental experience could foster the ability to learn from overhearing. As such it opens the possibility that mutual engagement is not necessary for all children at the earliest points in development. Perhaps very young children with ample experience around multiple others would succeed at tasks like those presented in Moll and Tomasello. Future research should examine this possibility.

In summary, the results from this study replicate findings demonstrating that children can learn words via overhearing in the absence of mutual engagement with the teacher. Further, our results open the possibility that beyond broader cultural expectations a child's immediate social

environment relates to how he or she attends to and learns from others. Future research should directly investigate relationships between children's social experiences, their attention behaviors, and their ability to learn new words.

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