Developmental Psychology
2013, Vol. 49, No. 3, 426–431


0012-1649/13/$12.00 DOI: 10.1037/a0029486

# "Shall We *Blick*?": Novel Words Highlight Actors' Underlying Intentions for 14-Month-Old Infants

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By 14 months, infants have become exquisite observers of others' behavior and successful word learners. But do they coordinate their early observational and language capacities to gain insight into the intentions of others? Building upon Gergely, Bekkering, and Király's (2002) classic head-touch phenomenon, we consider the contribution of language to 14-month-old infants' imitation of an unconventional behavior (turning on a light with one's forehead, rather than hand). Providing a novel word ("I'm going to *blick* the light!") prompted infants to imitate; simply drawing attention to the action ("Look at this!"; "Look at what I'm doing!") did not. Thus, by 14 months, infants gain insight into the intentions of others by considering not only what we do but also what we say.

*Keywords:* conventionality, imitation, intentionality, word-learning



Humans are quintessentially social: We stand out amongst other species for the intricacy of our language and the complexity of our social relations. Human social relations are often expressed in overt behaviors that vary across families and cultural communities. In some families, children and parents are expected to kiss upon reunions and failing to do so is considered a breach. In others, where kissing is not expected, failing to offer a kiss carries little signal value. Social conventions also extend beyond family life. In some communities, we bare our heads when entering a place of worship, in others we cover them.

How do infants learn these social conventions? Infants' observational faculties are central to human cultural transmission. Even in the first year of life, infants are exquisite observers of social interactions. Yet observation cannot, on its own, be sufficient for the acquisition of social conventions. After all, many of the behaviors that infants observe in others are "opaque": Considered on their own, they offer little (or no) insight into the goals, intentions, or motivations of others (Gergely & Csibra, 2006). Moreover, the behaviors that we perform are sometimes imperfect indices of our underlying intentions. For example, " . . . determining that a basketball player who misses a jump shot aimed to put a ball into the stands would be a gross miscalculation of the situation" (Hamlin, Hallinan, & Woodward, 2008). Instead, in order to learn the conventions of their communities and identify which behaviors to emulate and which to suppress, infants must take into account not only the overt behaviors they observe but also the intentions of those performing them.

Recent evidence reveals that young infants are well on their way to doing just that. They go beyond mere observation to make inferences about the underlying goals of others within the first year of life (Brandone & Wellman, 2009; Woodward, 1998, 1999). Infants as young as 14 months also selectively reenact behaviors that they interpret as intentional but not those they interpret as accidental (Bellagamba & Tomasello, 1999; Carpenter, Akhtar, & Tomasello, 1998; Meltzoff, 1988; Southgate, Chevalier, & Csibra, 2009). Among the most compelling demonstrations of infants' "intention-reading" is the seminal work by Gergely et al. (2002), based on Meltzoff's (1988) paradigm. Fourteen-month-olds observed an experimenter produce a novel, unconventional behavior—turning on a light by tapping it with her forehead, rather than her hand. Strikingly, infants "read through" the behavior to consider her intentions. If the experimenter's hands were *free* (resting on the table) when she tapped the light with her forehead, infants imitated her action exactly, tapping the light with their own heads. In contrast, if the experimenter's hands were *occupied* (grasping a blanket around her shoulders), infants used their hands (not their heads) to turn on the light. This difference between infants' performance in the *hands-free* and *hands-occupied* condition likely reflects their sensitivity to the goals and intentions of others. We know that infants attend carefully to an agent's means (or behaviors) to make inferences about that agent's goal (Verschoor & Biro, 2012). Notice that in the head-touch procedure, when the experimenter's hands were *occupied*, tapping the light with her head was the *only* available means for turning on the light. Thus, infants may have interpreted her head-touch as interesting but not as essential to accomplishing her goal. In contrast, when the experimenter's hands were *free,* and she *could* have used her hand to turn on the light, infants may have made the inference that that using her head was indeed essential to accomplishing her goal.

This article was published Online First July 23, 2012.

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This work was supported by National Institute of Child Health and Human Development Grant HD-30410 to Sandra R. Waxman and by support from the Jacobs Foundation for Marian L. Chen. We are grateful to the participants and to S. Arunachalam, K. Geraghty, G. Gergely, S. Hunnius, I. Király, and E. Leddon for discussion.

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The results thus far from imitation tasks serve as evidence that by 14 months, infants look beyond the "opaque" behaviors they observe to glean the underlying goals and intentions of others. This ability, coupled with infants' tendency to imitate those events that they interpret as intentional, provides an important entry point for acquiring the social conventions of a community.

Infants' observational acumen is impressive, but it is not their only route to reasoning about others' behavior. They can also glean considerable information from the linguistic contexts in which the activities that they observe are embedded. Human language is a conduit, par excellence, for conveying culturally shared information (Callanan, 2006; Harris & Koenig, 2006). Even as early as 6 months of age, naming a series of distinct objects or events highlights relations among them that would not have been detected from a surface inspection alone (Balaban & Waxman, 1997; Ferry, Hespos, & Waxman, 2010; Waxman & Markow, 1995). Infants also appreciate that the words we use are themselves social conventions; words have socially shared meaning (Akhtar & Tomasello, 2000; Diesendruck, 2005; Graham, Stock, & Henderson, 2006; Sabbagh & Henderson, 2007; Waxman & Gelman, 2009). Finally, infants appreciate that words can signal speakers' underlying goals or intentions (Buresh & Woodward, 2007; Graham, Stock, & Henderson, 2006; Martin, Vouloumanos & Onishi, 2012).

Taken together, then, by their first birthdays, infants have mastered two important routes to acquiring the social conventions of their respective communities. First, as they observe the human activities in which they are immersed, they consider the intentions of their pedagogical partners when choosing which actions they themselves should emulate (Gergely et al., 2002). Second, as they attend to the language within which the activities of human commerce are embedded, they appreciate that the words of their language are themselves social conventions that can communicate the intentions of others (Akhtar & Tomasello, 2000; Jaswal & Neely, 2006).

Our goal in the current experiments is to weave together these distinct sets of findings, asking whether 14-month-old infants coordinate their insights about human behavior and their intuitions about human language in the service of discovering which behaviors, observed in others, are ones to imitate. Using Gergely et al.'s (2002) head-touch paradigm as a starting point, we ask whether infants' interpretation of an adult's decidedly unconventional behavior is influenced by the linguistic context within which the behavior unfolds. If infants appreciate that words have shared meaning and can convey speakers' underlying intentions, then they should be more likely to interpret an experimenter's decidedly unconventional behavior as something that should be learned when the experimenter names the behavior than if it remains unnamed.

## Experiment 1: Replicating the Original Head-Touch Phenomenon

The goal was to replicate Gergely et al.'s (2002) head-touch study.

### Method

**Participants.** Forty-six healthy full-term infants from the greater Chicago, Illinois area participated ($M$ age = 14.2 months; range = 13.0–15.2 months). Infants were from primarily Caucasian middle- to upper-middle-class families recruited via mailings and were assigned randomly to either the *hands-free* condition ($n$ = 24, 12 boys) or the *hands-occupied* condition ($n$ = *22*, 11 boys; described below). An additional 11 infants were excluded because of restlessness (seven: four in the *hands-free* and three in the *hands-occupied* condition) or failure to touch the light during test (four: two in the *hands-free* and two in the *hands-occupied* condition). Infants in this latter category failed to contact the light in the first 3 min of the test phase.[1] The number of infants excluded did not vary as a function of either condition or gender.

**Materials.** Materials included a small white push-light (a light that turns on when the top is pressed) and a blanket. Parents completed the MCDI (Fenson et al., 1994).

**Procedure.** The procedure was modeled after Gergely et al. (2002). Infants were seated on the parent's lap at a small table. Parents were instructed not to interact with their infant or to otherwise influence the infant's behavior in any way. The push-light was placed out of the infant's reach. The entire session was videotaped for later coding.

***Familiarization phase.*** The experimenter, seated across from the infant, began by greeting the infant by name and establishing eye contact. She then drew attention to the push-light, saying, "See what I have here?" She then shivered and explained that she was cold and needed a blanket. She got up to retrieve a blanket, draped it over her shoulders and returned to her seat saying, "That's better. I'm warmer now." The blanket remained draped over her shoulders for the duration of the task.

At this point, infants were assigned randomly to either the *hands-free* or the *hands-occupied* condition. As in Gergely et al. (2002), these differed only in the placement of the experimenter's hands. In the *hands-free* condition, the experimenter placed her hands flat on the table on either side of the light. In the *hands-occupied* condition, she used her hands to hold the blanket around her shoulders. In both conditions, she then performed the same, novel behavior: She bent forward and pressed the light with her forehead to turn it on. After demonstrating this event three times, the experimenter, infant, and parent all returned to the waiting room to play for 5 min.

***Test phase.*** The experimenter, infant, and parent returned to the testing room. The push-light was placed easily within the infant's reach; the infant was encouraged to play with it for 2 min.

**Coding and preliminary analysis.** Two independent observers, blind to condition, coded the videotaped sessions to identify whether infants attempted to turn on the light with their hands or their heads. Following Meltzoff (1988), infants who either contacted the light with their head or brought their head within 10 cm of the light received a score of 1; those who contacted the light

[1] If infants did not initiate contact with the light within 2 min from the onset of the test phase, the experimenter left the room for a period of 1 min, encouraging the infant to play with the light in her absence. If infants failed to initiate contact with the light throughout this 3-min period, they were omitted from analysis.

only with their hands received a score of 0.[2] Agreement between the coders was excellent (95% agreement) and did not vary by condition. To resolve the rare disagreements, a third coder served as a "tiebreaker."

Preliminary analyses revealed no difference between the conditions in infants' vocabulary (as measured by the MCDI) and no correlation between vocabulary and performance at test.

## Results

In the *hands-free* condition, 17 out of 24 infants (71%) turned on the light with their heads (see Figure 1). Imitation of this novel action was significantly more frequent in the *hands-free* than the *hands-occupied* condition (five out of 22; 23%), $\chi^2(1, N = 46) = 10.645$, $p = .001$. This outcome mirrors that reported by Gergely et al. (2002). In fact, performance in the current experiment was indistinguishable from performance in Gergely et al.'s comparable conditions: for the *hands-free* comparison, Yates $\chi^2(1, N = 37) = 0.076$, *ns*; for the *hands-occupied* comparison, $\chi^2(1, N = 36) = 0.719$, *ns*.

A careful review of the infants' behavior revealed an intriguing trend. Although the effect of condition was reliable for both male and female infants, we noticed that the tendency to use their heads to turn on the light appeared to be more pronounced in female infants in both conditions—*hands-free*, 10/12 (or 83%); *hands-occupied*, 4/11 (or 37%); Yates' $\chi^2(1, N = 23) = 3.53$, $p = .06$—than in their male counterparts—*hands-free*, 7/12 (or 58%); *hands-occupied*, 1/11 (or 9%); Yates' $\chi^2(1, N = 23) = 4.156$, $p = .04$. (Male and female infants did not differ in either their mean age or MCDI score.) This trend is sufficiently intriguing to warrant attention in the next experiment.

In sum, the significant main effect of condition in Experiment 1 replicates prior work using this paradigm (Gergely et al., 2002; Paulus, Hunnius, Vissers, & Bekkering, 2011) and sets the stage for considering the contribution of naming to infants' imitation of unconventional behavior.

## Experiment 2: Identifying the Contribution of Naming

In Experiment 2, our goal was to discover whether language—and novel words in particular—promotes infants' tendency to reenact the experimenter's opaque behavior. We reasoned as follows: If infants appreciate that words have socially shared meanings (Buresh & Woodward, 2007; Diesendruck, Carmel, & Markson, 2010; Jaswal & Neely, 2006; Sabbagh & Henderson, 2007) and that actions that have been named are good candidates for generalization, then they should be more likely to imitate an unconventional behavior if that behavior is named than if it remains unnamed. In order to test this idea, the experimenter labeled the upcoming action before demonstrating a *hands-occupied* head-touch. Recall that in Experiment 1, only 23% of the infants touched their own heads to the light in the *hands-occupied* condition. If infants interpret naming an unusual action as a sign that it is intentional, then labeling should increase their rate of head-touching, even when the situational constraints would not otherwise support imitation (e.g., in the *hands-occupied* condition).

## Method

**Participants.** Forty-eight healthy full-term infants from greater Chicago, Illinois area ($M$ age = 14.2 months, range = 13.6–15.0 months) were recruited as in Experiment 1. All infants viewed a *hands-occupied* demonstration; infants were assigned randomly to either the *novel word* ($n = 24$, 12 boys) or *neutral language (control*; $n = 24$, 14 boys) condition (described below). There were no differences between the genders in either age of vocabulary scores (MCDI). An additional 15 infants were excluded due to restlessness (seven: five in the *novel word* condition, two in the *neutral language* condition), equipment malfunction (two), or failure to touch the light during test (six: four in the *novel word* condition, two in the *neutral language* condition). The number of infants excluded did not vary as a function of either condition or gender.

**Materials and procedure.** The materials and procedure used were identical to the *hands-occupied* condition of Experiment 1, with one crucial difference: Before tapping the light with her head, the experimenter commented on her upcoming action. In the *novel word* condition, she announced, "Look, I'm going to *blick* the light! Watch me *blick* the light." In the *neutral language (control*) condition, she commented on her upcoming action but offered no novel word, announcing instead, "Look at this! Watch this!" At test, she asked infants in both conditions, "Can you do it too?"

**Coding and preliminary analysis.** Coding was identical to Experiment 1. Agreement between the coders was high (98% agreement) and did not vary by condition. To resolve the rare disagreements, a third coder served as a "tiebreaker." As in Experiment 1, there was no difference between the conditions in infants' vocabulary and no correlation between MCDI scores and performance at test.

## Results and Discussion

Introducing a novel word for the impending novel event had a powerful effect on 14-month-olds' tendency to imitate the unconventional behavior (see Figure 2). In the *novel word* condition, 14 out of 24 infants in (58%) tapped the light with their heads; this exceeded the rate observed in the *neutral language* condition, four out of 24 (17%), $\chi^2(1, N = 48) = 8.889$, $p = .002$. Clearly, then, simply alerting infants to an upcoming novel event (e.g., "Look at this! Watch this!") was insufficient to prompt them to imitate the experimenter's unconventional behavior. Performance in the *neutral language* condition was comparable to that in the *hands-occupied* condition of Experiment 1 (five out of 22, or 23%) in which the experimenter said nothing at all to herald her upcoming action. However, in Experiment 2, when the experimenter used a novel word (e.g., "I'm going to *blick* the light"), infants imitated her otherwise opaque behavior and did so at a rate (58%) that was comparable to that in the *hands-free* condition of Experiment 1 (71%), $\chi^2(1, N = 48) = 0.82$, ns.

Interestingly, echoing the trend that we observed in Experiment 1, the tendency to use their heads to turn on the light was more pronounced in female infants (*novel word*, 10/12, or 83%; *neutral language*, 2/10, or 20%) than in their male counterparts (*novel word*, 4/12, or 33%; *neutral language*, 2/14, or 14%). Moreover, in

[2] In both Experiments 1 and 2, all infants who contacted the light with their heads also contacted it with their hands at some point during the response period. This is consistent with multiple implementations of Gergely et al.'s (2002) original design (Király, Egyed & Gergely, 2012; Paulus et al., 2011; Zmyj, Daum, & Aschersleben, 2009).

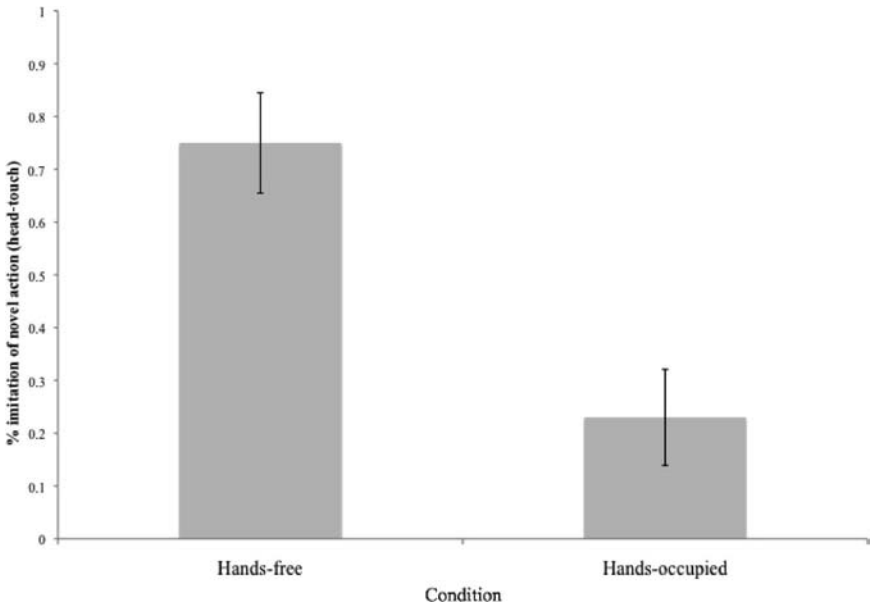


*Figure 1.* Experiment 1. Percentage of infants in each condition (and *SE*) who imitated the experimenter's novel (head-touch) behavior.



the current experiment, the main effect for condition holds up for girls, Yates' $\chi^2(1, N = 22) = 6.455$, $p = .01$, but not for boys, Yates' $\chi^2(1, N = 26) = .466$, *ns*.

These results are consistent with the proposal that by 14 months, infants (and perhaps especially girls) appreciate the status of words as social conventions (Diesendruck et al., 2010; Jaswal & Neely, 2006; Sabbagh & Henderson, 2007) and understand that words convey speakers' underlying intentions (Buresh & Woodward, 2007; Martin et al., 2012). As a result, infants are more likely to imitate a novel behavior, however unconventional, if it has been named than if it remains unnamed. There is, however, an alternative interpretation. Notice that the *novel word* condition contained two sources of information that were absent in the *neutral language* condition: The *novel word* condition not only contained a novel word but also embedded this word within a sentence that focused directly on the upcoming action ("I'm going to *blick* the light"). In contrast, the *neutral language c*ondition contained no novel word, and focused more diffusely on the upcoming scene ("Watch this!").

To tease apart these factors, we designed an additional control condition, featuring an orienting sentence that directed attention more specifically toward the upcoming action (as in the *novel word* condition) but contained no novel word ("Look at what I'm doing! Watch what I'm doing!").[3] We reasoned as follows: If the novel word was instrumental to infants' tendency in the *novel word* condition to imitate an otherwise opaque unconventional behavior, then infants in this additional *orienting (control*) condition should not imitate. To put this hypothesis to a strong test, we focused our attention on female infants ($n = 11$) for this control condition. At issue was whether female infants, who showed a pronounced tendency in *novel word* condition to use their heads, would continue to do so in the *orienting* condition. The results were straightforward: In the *orienting* condition, infants rarely turned the light on with their heads; only two out of 11 did so (18%). This mirrors the performance of their female counterparts in the *neutral language* condition (2/10, 14%), and falls significantly below that of the females in the *novel word* condition, $\chi^2(1, N = 23) = 9.763$, $p = .002$. In sum, even female infants, who showed a pronounced tendency to use their heads in the *novel word* condition showed no such tendency in the *orienting* condition. That is, simply alerting them to an upcoming novel event (e.g., "Look at this!") was insufficient to prompt them to imitate the experimenter's unconventional behavior.

## General Discussion

The results of the two experiments reported here reveal that 14-month-old infants weave together information from the events they witness and the language that describes them to decide which aspects of their social environment should be learned. When the situational constraints (e.g., in the *hands-occupied* condition) would not otherwise lead them to imitate, infants tended to imitate an unconventional behavior only when the experimenter used a novel word to herald her upcoming action ("I'm going to *blick* the light"). Providing a novel word for an unusual action seemed to clarify that the novel behavior was relevant to be learned and generalized. This tendency to reproduce the experimenter's unusual behavior when it is labeled suggests that female infants not only understand the conventional nature of words but also exploit this information when deciphering the intentions of others.

The current results open several new avenues for future research. For example, it will be important to identify why the tendency to use their heads was more pronounced in female infants than in their male counterparts. As we have noted, although the

[3] This condition was run concurrently with other conditions of Experiment 2.

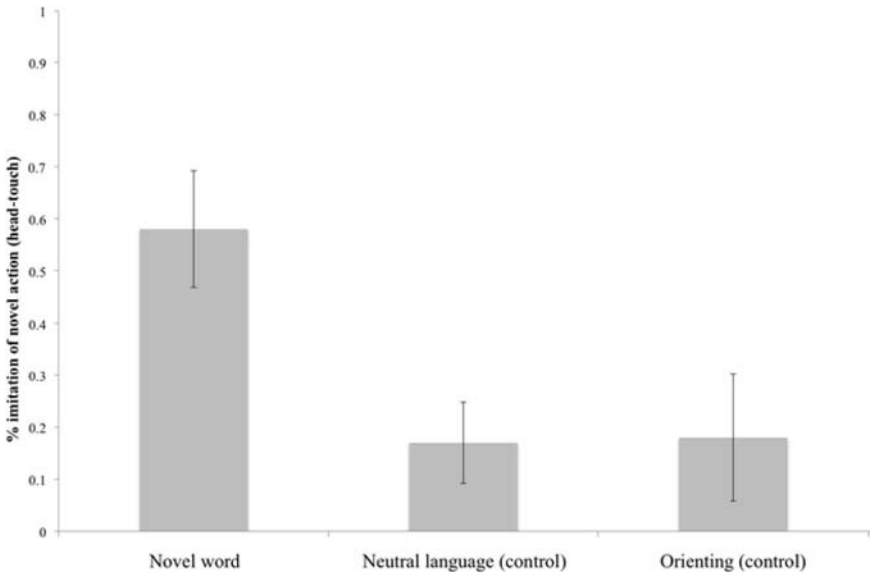


*Figure 2.* Experiment 2. Percentage of infants in each condition (and *SE*) who imitated the experimenter's novel (head-touch) behavior.



difference between genders was not statistically significant (except in the *novel word* condition), the trend is intriguing. No other head-touch studies report a gender difference in imitation, and scant evidence exists to indicate gender differences in imitation. A review of the literature found one study in which male infants were better at imitating a male experimenter's propulsive movements at 6–9 months (Benenson, Tennyson, & Wrangham, 2011) and another in which 14-month-old female infants were more likely than males to imitate their mothers (Forman & Kochanska, 2001). What remains to be seen is whether the trend that we have reported here reflects the fact that our experimenter was female: Infants may be more attuned to imitating experimenters of the same gender. Another key question is whether this trend is limited to imitations of the head-touch or whether it is evident in infants' tendency to imitate other unusual behaviors as well. To address this issue, additional research is warranted.

In future work, it will also be important to identify more precisely why novel words prompted infants to imitate the experimenter's head-touch. Was this naming effect tied specifically to introducing a novel word for this action ("I'm going to *blick* the light")? Alternatively, perhaps introducing any novel word in the utterance would suffice (e.g., "Look at the *blick*!" or simply, "*Blick*!")? This question is related to issues of referential clarity (Fennell & Waxman, 2010; Martin et al., 2012) and to infants' ability to distinguish among different kinds of words (e.g., nouns, verbs) and their links to meaning (see Christophe, Millotte, Bernal, & Lidz, 2008; Höhle, Weissenborn, Kiefer, Schulz, & Schmitz, 2004; and Waxman, 1999).

The current results provide some insight into recent formulations of Gergely and Csibra's natural pedagogy theory. In particular, the findings reported here provide evidence for the *genericity bias* (Csibra & Gergely, 2009; Futó, Teglas, Csibra, & Gergely, 2010; Yoon, Johnson, & Csibra, 2008). The claim is that when they find themselves in situations in which they can learn from an adult, infants are biased to learn information that is *novel*, *relevant* and *generalizable* and that this *genericity bias* supports infants' ability to generalize the information beyond the particular instance that they observe. We suggest that naming the novel action (Experiment 2) may have highlighted not only the intentionality but also the generalizability of the novel action.

Additionally, our results provide some insight into a recent debate over infants' motivations for imitation. Recently, Paulus et al. (2011) proposed an alternative explanation for the Gergely et al. (2002) results. Instead of evaluating a situation for the experimenter's underlying motivation, infants may map the experimenter's observed actions onto their own existing motor repertoire. This motor matching theory, called *motor resonance*, offers an alternative explanation for why infants perform the head-touch when the experimenter's hands are free (infants can support themselves on their hands while doing the head-touch) but not in the *hands-occupied* condition (without the support of their hands infants are unable to perform the head-touch). However, matching to an experimenter's motor program cannot explain why infants' tendency to head-touch increases in our *novel word* condition, when the experimenter's hands are occupied. The motor resonance theory cannot accommodate such top-down situational constraints.

Human language is the conduit par excellence for conveying our own intentions and those of others. It permits us to go beyond what meets the eye, to clarify the motivation behind otherwise "opaque" behaviors (e.g., bowing our heads in a place of worship). By 14 months, infants consider not only what others do but also what they say, to assess the goals and intentions underlying overt behaviors and to make principled decisions about which behaviors to imitate.

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Received June 1, 2011
Revision received March 1, 2012
Accepted June 21, 2012 ■