Children's gestures are meant to be seen*

Martha W. Alibali and Lisa S. Don
University of Wisconsin, Madison / Carnegie Mellon University

This study investigated whether children alter their gestures when their listeners cannot see those gestures. Sixteen kindergarten children viewed four short cartoon episodes. After each episode, the child retold the story to an adult listener. For two episodes, the child and listener sat face-to-face, and for the other two episodes, an opaque curtain was placed between them. Children gestured at a significantly higher rate when they could see their listeners than when they could not. However, the amount, fluency, and content of children's speech did not differ across conditions. Thus, kindergarten children alter their gestures to suit their listeners, and the observed changes in gesture do not appear to depend on changes in speech.

Keywords: gesture, children, communication, interaction

Do children modify their communicative behaviors based on the needs of their listeners? Many studies have shown that children as young as two years of age simplify their speech when speaking to younger children (Shatz & Gelman, 1973; Tomasello & Mannle, 1985) or to dolls (Sachs & Devin, 1976). Further, children as young as three use more verbally explicit speech when speaking to a blindfolded listener than when speaking to a listener who can see (Maratsos, 1973). Thus, there is clear evidence that young children can modify their *speech* to fit their listeners' needs.

In the present work, we examine whether young children modify another aspect of their communicative behavior — their spontaneous gestures. Specifically, we examine whether children alter their gesture production depending on whether their listeners can see those gestures. Several studies with adult participants have shown that speakers gesture less when their listeners are unable to see their gestures (e.g., Cohen & Harrison, 1973; Emmorey & Casey, 2001). However, to date, it is not clear whether this also holds for children.

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Two reports in the literature have addressed this issue, but the findings are not conclusive. First, Warren and Tate (1992) report two studies showing that young children (ranging from 24 to 75 months) gesture less on the telephone than when in face-to-face interactions with a listener. In one study, both younger children (M age=38.7 months) and older children (M age=66.7 months) gestured more often when face-to-face than when on the telephone, but older children showed the effect more strongly than younger children, as revealed by a significant interaction between age group and condition. In the other study, both younger children (M age=34.6 months) and older children (M age=61.1 months) showed the effect, and the interaction of age group and condition was not significant. However, as Warren and Tate acknowledge, "holding the [telephone] receiver restricts movement" (p.254), so these findings must be interpreted with caution. Second, Doherty-Sneddon and Kent (1996) compared effects of listener visibility on gesture production in 6- and 11-year-old participants. In this study, children described a route marked on a map to a partner who had the same map without the route marked on it, either face to face or with a screen between them. The 11-year-old children gestured less in the screen condition, but there were no reliable differences across conditions for the 6-year-old children. Thus, the evidence in the literature is both scant and mixed, with one mention of positive findings in children as young as 24 months, and one report of null findings in 6-year-olds. Given these conflicting results, it seems worthwhile to test the issue directly.

Research with adults has shown that the effects of listener visibility are not the same for all types of gestures. In a recent study, Alibali, Heath and Myers (2001) found that adults decreased their production of representational gestures, which depict aspects of the meaning of speech, when their listeners could not see those gestures. However, adults' production of beat gestures, which mark the rhythm of speech, was unaffected. Young children often produce representational gestures (McNeill, 1992), so it seems possible that children might also modify their use of such gestures depending on whether their listeners can see them.

In the present study, we compared children's gesture production when they spoke face-to-face with their listeners, and when visibility was blocked by a curtain. Because children are skilled at modifying their speech for the needs of the listener, we hypothesized that they would also modify their gesture production for the needs of the listener. Thus, we predicted that children would produce fewer representational gestures when their listeners were unable to see those gestures. This result would have potential significance for the debate about whether gestures serve a communicative function (e.g., Clark, 1996) or a speaker-internal function, such as facilitating lexical retrieval (e.g., Butterworth & Hadar, 1989; Krauss, 1998) or aiding conceptualization (e.g., Alibali, Kita, & Young, 2000; Kita, 2000). If young children use gestures differently when those gestures have the potential to communicate than when they do not, it would support the view that gestures are produced as part of speakers' communicative intention.

If changes in gesture are observed in the curtain condition, we must consider whether these changes *derive from* changes in speech. To foreshadow the results, we do observe changes in children's gestures, so we also investigate possible changes in speech. Children might alter the content of their speech in one of two ways when they cannot see their listeners. First, they might simply *avoid* content that is best conveyed with gesture. For example, they might avoid talking about spatial relationships, because such information is more readily conveyed in gesture. Such a shift might lead children to speak *less* in the curtain condition. Alternatively, children might *compensate* with speech when they cannot use gesture communicatively. For example, they might express spatial relationships in speech, rather than solely in gesture. Such a shift might lead children to speak *more* in the curtain condition. Further, if children do alter their speech content when they cannot see their listeners, then they may find it more effortful to formulate speech in the curtain condition than in the face-to-face condition. As a consequence, they may speak less fluently in the curtain condition. Based on these considerations, we also examined the effects of visibility on the amount, content, and fluency of children's speech.

Method

Participants

Sixteen kindergarten students (10 males, 6 females; mean age 5 years, 6.5 months) from a university laboratory school participated. Two participants had learned English as a second language.

Stimuli

The stimuli were four short episodes of an animated cartoon about a mouse and an elephant (the German cartoon *Die Sendung mit der Maus*) that included music but no words (see Appendix for episode descriptions). Eight of the participants viewed the episodes in one order, and the remaining eight viewed the episodes in the reverse order.

Procedure

Children were tested individually, and the session was videotaped with a hidden camera. At the outset of the session, the experimenter introduced her "friend", the confederate listener, to the child, and explained the experimental procedure. She showed the child the portable curtain that could be placed between the child and the listener (a mobile clothes rack with a curtain hung over the bar), and she demonstrated that even though the child could not see the listener, the listener could still hear the child.

Next, each child was asked to view a set of four short cartoon episodes, one at a time. For each episode, the listener waited outside the room while the child viewed the episode twice. The listener was then invited back into the room, and she asked the child to retell the cartoon story. After the child's narration, the listener prompted the child once, saying, "Did anything else happen?" The listener then left the room again, and the child watched the next episode. The session proceeded in this manner until the child had viewed and narrated all four episodes.

Eight children narrated the first two episodes face-to-face and the last two episodes with the curtain in place (the face-to-face first group). The remaining eight participants narrated the first two episodes with the curtain in place and the last two episodes face-to-face (the curtain first group).

Transcribing speech

Each narration was transcribed verbatim from the videotape. Filled pauses (e.g., "um"), word fragments, and repeated words were included in the transcripts.

Identifying and coding gestures

Each gesture was identified and coded as either a *representational* gesture or a *beat* gesture. *Representational* gestures (N=184, or 98% of the 187 gestures observed) were defined as gestures that depict semantic content via the shape, placement, or motion trajectory of the hands. Beat gestures (N=3, or fewer than 2% of the 187 gestures observed) were defined as motorically simple, rhythmic gestures that do not depict semantic content related to speech. The observed distribution of representational and beat gestures in these kindergarten children was not surprising given previous reports in the literature that beat gestures are not common until about age 11 (McNeill, 1992). Because so few beat gestures were observed, our analyses focus exclusively on representational gestures.

All data were initially coded by a single coder. To establish reliability, one episode was randomly selected from each child (25% of the data) and was recoded by a second coder. Agreement between coders was 89% for identifying representational gestures.

Coding speech

Amount of speech was measured in terms of total number of words, excluding filled pauses (e.g., "um" and "uh") and word fragments.

Fluency was assessed with two measures: (1) rate of filled pauses per 100 words, and (2) rate of speech errors per 100 words. Four types of speech errors were identified (see Levelt, 1983): (a) *repetitions*, in which the speaker repeats one or more words ("he jumped, he jumped up"), (b) *repairs*, in which the speaker alters one or more words within a syntactic frame ("and something, a ball, came down"), (c) *fresh starts*, in which the speaker shifts to a new syntactic frame ("and the mouse, this big prickly thing was coming down beside him"), and (d) *uncorrected syntactic errors*, in which the speaker produces a syntactic error, e.g., an agreement error, a past tense error, or a word deletion, but does not overtly repair the error ("he throwed it").

Content of speech was assessed with two measures: (1) use of verbs that convey manner, and (2) spatial content. To assess use of manner verbs, we identified eight motion events in the cartoon episodes (two from each episode) and examined whether children described the events using verbs that did or did not convey manner information (e.g., *went* vs. *twisted* around, see Talmy, 1985). To assess spatial content, we calculated the rate of spatial prepositions (e.g., up, across, over, etc., used either as verb particles or in prepositional phrases) per 100 words.

Results

Did gesture rate differ across conditions?

For each condition, we divided the total number of gestures by the total number of words and multiplied by 100 to yield the gesture rate per 100 words. As predicted, children gestured at a higher rate when they could see their listeners than when they could not, $F(1,14)=9.35$, $p<.01$ (excluding non-native speakers, $F(1,12)=6.38$, $p<.05$). However, unexpectedly, this effect depended on condition order, $F(1,14)=6.31$, $p<.05$, as shown in Figure 1 (excluding non-native speakers, $F(1,12)=4.15$, $p=.06$). Children in the face-to-face first group gestured at comparable rates in both conditions, but children in the curtain first group first gestured much less frequently in the curtain condition.

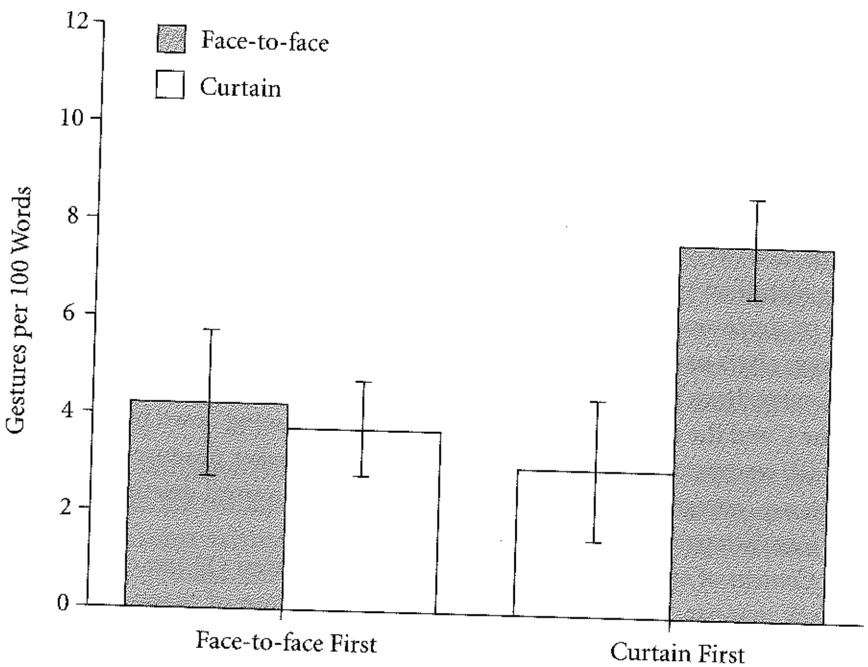

Figure 1. Mean rate of representational gestures per 100 words produced in each condition by children in each condition order group.

On an individual level, twelve participants gestured at a higher rate in the face-to-face condition, and four showed the reverse pattern ($p=.04$, binomial test). Three of the four who showed the reverse pattern narrated first in the face-to-face condition.

Taken together, these findings suggest that the interaction effect observed in Figure 1 may be due in part to children slowly "warming up" to the experimental situation. Children may have slowly become more comfortable as the experiment progressed, and their lack of ease at the outset of the session may have influenced their gesture rate. Indeed, participants gestured at a higher rate

in the second half of the experiment than in the first half, $F(1,14)=6.31$, $p<.05$. In addition to this warm-up effect, there was also an effect of experimental condition, in that participants gestured at a higher rate when they could see their listeners than when they could not. The warm-up effect (i.e., higher gesture rate in the second half of the experiment) and the condition effect (i.e., higher gesture rate in the face-to-face condition) are additive in the curtain-first group, leading to a dramatic difference in gesture rate across conditions, $F(1,7)=16.98$, $p<.005$. However, the warm-up effect and the condition effect cancel one another out in the face-to-face-first group, leading to similar gesture rates across conditions $F(1,7)<1$, ns.

Thus, on the whole, children produced more representational gestures when they could see their listeners than when they could not. Indeed, as seen in Figure 2, children gestured at a higher rate in the face-to-face condition for each of the four episodes, although the difference was very slight in the High Bar episode. The condition effect was reliable across episodes, $t(3)=2.55$, $p<.05$, one-tailed.

However, it is important to note that representational gestures did not disappear when the curtain was in place. Children produced an average of 3.39 ($SE=0.85$) representational gestures per 100 words in the curtain condition. Thus, even without reciprocal visibility, children continued to produce representational gestures.

Did children modify their speech across conditions?

We next consider whether the observed changes in children's gesture production were accompanied by changes in the amount, fluency, or content of their speech.

Amount of speech. If children compensate with speech in the curtain condition, they might produce more words. Alternatively, if they avoid content that is best expressed using gesture, they might produce fewer words. We found no significant difference in the number of words produced per episode across conditions (curtain $M=25.30$, $SE=6.32$, vs. face-to-face $M=27.69$, $SE=6.92$, words per episode), $F(1,14)<1$, ns (excluding non-native speakers, $F(1,12)=1.13$, ns). However, as seen in Figure 3, participants produced more words in the second half of the experiment than in the first half, regardless of condition order, yielding a significant interaction between condition and condition order, $F(1,14)=5.84$, $p<.05$ (excluding non-native speakers, $F(1,12)=4.31$, $p=.06$). Because participants saw the cartoon episodes in two different orders, this effect cannot be due to the later episodes being more complex and consequently requiring more words to explain. However, this effect is compatible with the "warm-up" interpretation described above.

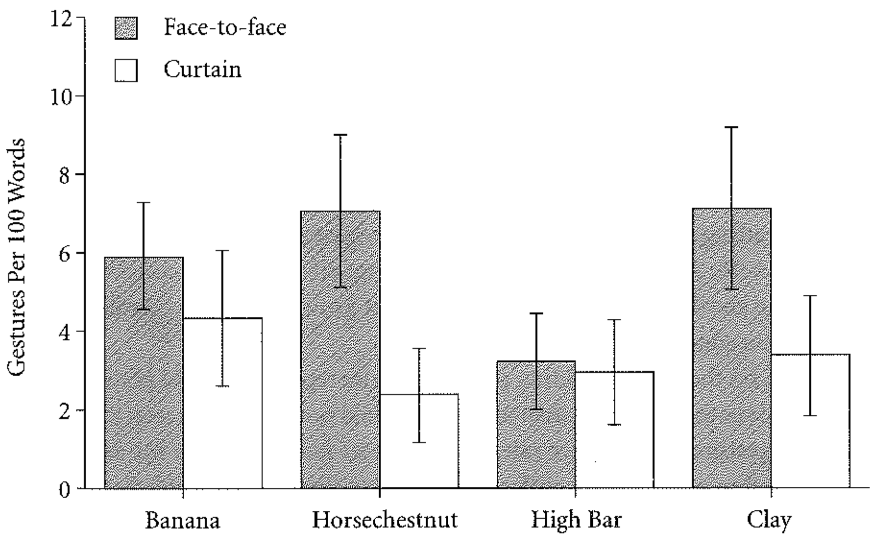

Figure 2. Mean rate of representational gestures per 100 words produced by children in each condition for each episode. Eight participants viewed the episodes in one order (banana, horsechestnut, high bar, clay) and the remaining eight participants viewed the episodes in the reverse order.

Fluency. If children alter their speech when they cannot see their listeners, then formulating speech may be more effortful in the curtain condition, and this additional effort might be manifested in less fluent speech. We assessed fluency using two dependent measures: (1) the rate of filled pauses, and (2) the rate of speech errors. We found no significant differences across conditions, either in filled pauses (curtain $M=1.79$, $SE=0.72$, vs. face-to-face $M=1.12$, $SE=0.44$, per 100 words), $F(1,14)=1.07$, ns (excluding non-native speakers, $F(1,12)<1$, ns) or in speech errors (curtain $M=6.11$, $SE=0.88$, vs. face-to-face $M=6.04$, $SE=0.76$, per 100 words), $F(1,14)<1$, ns (excluding non-native speakers, $F(1,12)<1$, ns). Further, the interaction between condition and condition order was non-significant for both measures.

Content. We assessed content using two dependent measures: (1) the types of verbs used to describe motion events and (2) the rate of spatial prepositions.

English speakers, both adults and children, often convey the manner associated with a given motion both in words (such as *swing* or *crawl*, Talmy, 1985), and in gestures (McNeill, 2002). Speakers sometimes express manner of motion in both speech and gesture (e.g., "he walked away" with a gesture that depicts *walking*). At other times, speakers express manner information only in

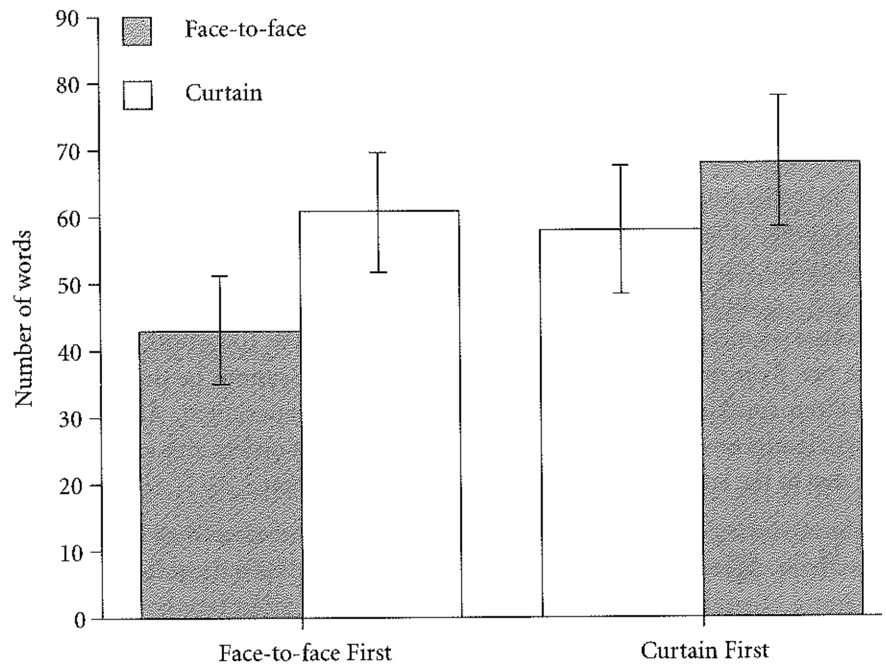

Figure 3. Mean number of words produced in each condition by children in each condition order group.

speech (e.g., "he walked away" with a gesture that indicates *direction*), only in gesture (e.g., "he went away" with a gesture that depicts *walking*), or in neither speech nor gesture (e.g., "he went away" with a gesture that indicates *direction*).

If children compensate with speech in the curtain condition, they might express manner in speech rather than gesture, so they might use more manner verbs. Alternatively, if they avoid manner information altogether, they might use fewer manner verbs. To test these possibilities, we identified eight motion events in the cartoon episodes, and examined whether children described the events using verbs that conveyed manner or verbs that did not (e.g., *walked* vs. *went* away). We found no significant difference across conditions (curtain $M=68\%$, $SE=9\%$, vs. face-to-face $M=65\%$, $SE=10\%$ of instances), $F(1,6)<1$, ns (excluding non-native speakers, $F(1,6)<1$, ns).[1] The interaction between condition and condition order was also non-significant.

Finally, we examined whether listener visibility influenced children's expression of spatial content. If children compensate with speech in the curtain condition, they might use more spatial words. Alternatively, if they choose to avoid spatial content altogether, they might use fewer spatial words. To test these possibilities, we assessed the rate of spatial prepositions (e.g., up, across, over, etc., used either as verb particles or in prepositional phrases) per 100 words in each condition. We found no significant difference across conditions (curtain M = 9.36, SE = 0.66, vs. face-to-face M = 9.87, SE = 0.56), $F(1,14) < 1$, ns (excluding non-native speakers, $F(1,12) < 1$, ns). However, as seen in Figure 4, participants produced spatial words at a higher rate in the second half of the experiment than in the first half, regardless of condition order, yielding a significant interaction between condition and condition order, $F(1,14) = 5.00$, $p < .05$ (excluding non-native speakers, $F(1,12) = 2.91$, $p = .11$). Note that, because we measured the *rate* of spatial prepositions per 100 words, rather than the raw *frequency* of spatial prepositions, this effect cannot be due simply to children speaking more in the second half of the experiment. Also, because participants saw the cartoon episodes in two different orders, this effect cannot be due to the later episodes having more spatial content.

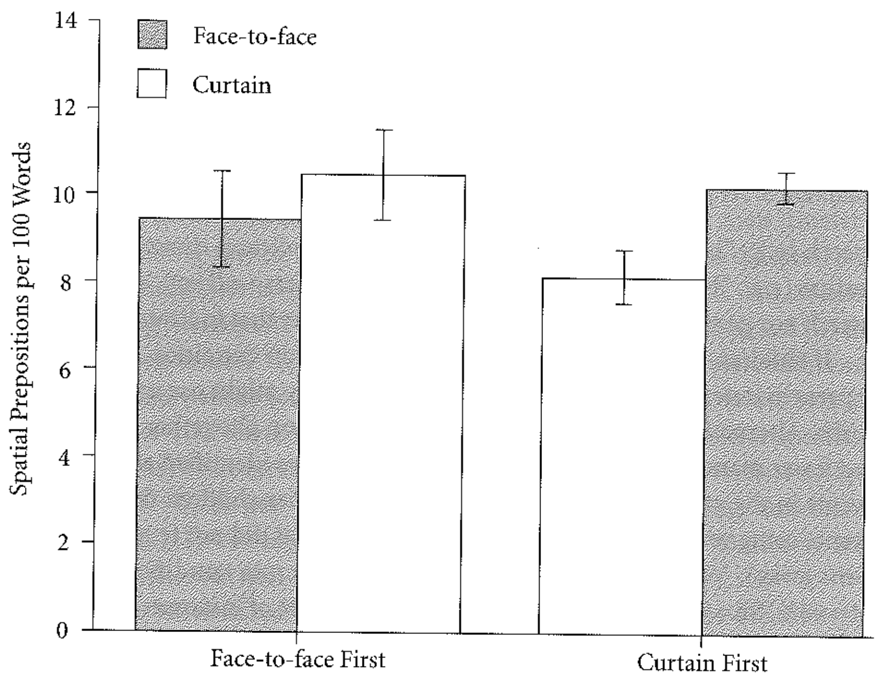

Figure 4. Mean rate of spatial terms per 100 words produced in each condition by children in each condition order group.

Despite the non-significant main effect of condition on rate of spatial prepositions, the general patterns observed for gesture rate and rate of spatial

prepositions are largely similar (i.e., more dramatic differences in the curtain-first group than in the face-to-face first group; compare Figure 1 and Figure 4). Therefore, based on these data, it seems prudent not to exclude the possibility that variations across conditions in spatial language may be causally related to variations across conditions in gesture rate. In this regard, it is worth noting that the correlation between rate of gestures and the rate of spatial prepositions was higher in the face-to-face condition ($r = .58$) than it was in the curtain condition ($r = .31$). Thus, the link between spatial language and gesture production (Rauscher, Krauss & Chen, 1996) may depend on whether gestures are used communicatively.

Discussion

This study examined whether kindergarten children alter their gesture production depending on whether their listeners can see those gestures. As predicted, children produced more representational gestures when speaking face-to-face with their listeners than when visibility was blocked with a curtain. This pattern is comparable to that found among adults (Alibali et al., 2001). Thus, by five years of age, children show a mature ability to alter their gesture production to suit the needs of their listeners.

Further, children appeared to alter their gestures without substantially altering their speech. We found no significant differences across conditions in number of words, rate of filled pauses, rate of speech errors, use of manner verbs, and rate of spatial prepositions. However, the general pattern observed for rate of spatial prepositions was largely similar to that observed for gesture rate (i.e., greater differences in the curtain-first group than in the face-to-face first group), suggesting that this measure may be worthy of further investigation in future studies. Of course, there are also many other aspects of children's speech that we did not examine, so it would be inappropriate to conclude that their speech did not change at all.

Unexpectedly, we found that children's behavior differed in several ways in the second half of the experiment as compared to the first half. In the second half of the experiment, children produced more words overall, they gestured at a higher rate per 100 words, and they expressed more spatial prepositions per 100 words. We suggest that these findings may be due to children's needing some time to "warm up" in the experimental situation. Children may have been somewhat nervous or uncomfortable at the outset of the experiment for several reasons.

First, the experimenter and the adult listener were relatively unfamiliar to the children, even though each had spent some time in the children's classroom prior to the experiment proper. Second, the experiment took place in a room that was also unfamiliar to the children (i.e., a room at the school that was rarely used by the children). Because of these factors, children may have been less comfortable and consequently less animated in the first half of the experiment. As the experiment progressed, children may have relaxed a bit as they realized that the experimenter and listener were friendly, and that the experiment itself was fun. Thus, children's behavior in the first half of the experiment may reflect their lack of ease in the experimental situation. This may have caused them to speak less and gesture at a lower rate in the first half of the experiment, and the reduction in gesture rate may have evoked a corresponding reduction in the rate of spatial prepositions.

Such warm-up effects have not been reported in the adult literature, perhaps because most studies of listener visibility and gesture production in adults have used between-subject designs, which do not allow order effects to be identified. In the one published study that used a within-subject design with adults (Alibali et al., 2001), no order effect was observed. It seems possible that, because children have had less experience than adults with unfamiliar people and unfamiliar settings, children may be more susceptible to warm-up effects than adults. Indeed, we might have avoided the warm-up effect in the present study if we had used a peer or a family member as the listener, instead of an unfamiliar adult. More generally, the present findings highlight the need for additional research on how factors such as comfort level and emotional state influence gesture production.

The present findings also have implications for theories about why speakers produce gestures. Specifically, the findings suggest that young children use representational gestures *in order to* communicate. At first glance, this interpretation seems to contradict claims that speakers produce gestures in order to facilitate lexical access (Butterworth & Hadar, 1989; Krauss, 1998) or to aid conceptualization (Alibali et al., 2000; Kita, 2000). However, upon closer consideration, it is possible to reconcile these two points of view. In the present study, although children produced fewer representational gestures in the curtain condition, representational gestures did not completely disappear. It may be that some gestures are produced primarily for communicative reasons, whereas others are produced primarily for speaker-internal reasons. The findings of this experiment are compatible with the idea that representational gestures are multi-functional.

If representational gestures serve multiple functions, it seems possible that gestures that serve different functions may also differ in their size, placement, form, or timing. Gestures that are produced for communicative reasons may tend to be large, and they may typically be produced in the center of gesture space. Such gestures are also likely to be carefully articulated and carefully timed with respect to the co-expressive speech. In contrast, gestures that are produced for speaker-internal reasons may tend to be smaller, and they may typically be produced in the periphery of gesture space. Such gestures may also be less carefully articulated and less carefully timed with respect to the co-expressive speech. Future studies are needed to examine how these aspects of speakers' gestures vary as a function of visibility between speaker and listener.

In sum, the present findings provide clear evidence that young children modify their gestural behaviors to suit their listeners. Further, the findings indicate that children use gestures for communicative purposes. However, gestures did not disappear altogether when they could not be communicative. We suggest that gestures serve both communicative and speaker-internal functions, and that both of these functions are in place by the age of five years.

Notes

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1. This analysis was carried out using the motion event as the unit of analysis. One of the target events was not described in the face-to-face condition by any of the participants in the face-to-face first group. This event was therefore excluded from the analysis, and the denominator degrees of freedom were consequently reduced to 6.

References

Alibali, Martha W., Dana C. Heath & Heather J. Myers (2001). Effects of visibility between speaker and listener on gesture production: Some gestures are meant to be seen. *Journal of Memory and Language*, 44, 169–188.

Alibali, Martha W., Sotaro Kita & Amanda Young (2000). Gesture and the process of speech production: We think, therefore we gesture. *Language and Cognitive Processes*, 15, 593–613.

Butterworth, Brian & Uri Hadar (1989). Gesture, speech, and computational stages: A reply to McNeill. *Psychological Review*, 96, 168–174.

Clark, Herbert H. (1996). *Using language.* Cambridge, UK: Cambridge University Press.
Cohen, A. & R.P. Harrison (1973). Intentionality in the use of hand illustrators in face-to-face communication situations. *Journal of Personality and Social Psychology*, 6, 341–349.
Doherty-Sneddon, Gwyneth & G. Kent (1996). Visual signals and the communication abilities of children. *Journal of Child Psychology and Psychiatry*, 37, 949–959.
Emmorey, Karen & Shannon Casey (2001). Gesture, thought, and spatial language. *Gesture*, 1, 1, 35–50.
Kita, Sotaro (2000). How representational gestures help speaking. In David McNeill (Ed.), *Language and gesture: Window into thought and action* (pp.162–185). Cambridge, UK: Cambridge University Press.
Krauss, Robert M. (1998). Why do we gesture when we speak? *Current Directions in Psychological Science*, 7, 54–60.
Levelt, Willem J.M. (1983). Monitoring and self-repair in speech. *Cognition*, 14, 41–104.
Maratsos, Michael P. (1973). Nonegocentric communication abilities in preschool children. *Child Development*, 44, 697–799.
McNeill, David (1992). *Hand and mind: What gestures reveal about thought.* Chicago: University of Chicago Press.
McNeill, David (2002). An ontogenetic universal and how to explain it. In Cornelia Müller & Roland Posner (Eds.), *The semantics and pragmatics of everyday gestures.* Berlin: Weidler.
Rauscher, Frances H., Robert M. Krauss & Yihsiu Chen (1996). Gesture, speech, and lexical access: The role of lexical movements in speech production. *Psychological Science*, 7, 226–231.
Sachs, Jacqueline & Judith Devin (1976). Young children's use of age-appropriate speech styles in social interaction and role playing. *Journal of Child Language*, 3, 81–98.
Shatz, Marilyn & Rochel Gelman (1973). The development of communication skills: Modifications in the speech of young children as a function of listener. *Monographs of the Society for Research in Child Development*, 38 (5, Serial No. 152).
Talmy, Leonard (1985). Lexicalization patterns: Semantic structure in lexical forms. In Timothy Shopen (Ed.), *Language typology and syntactic description III: Grammatical categories and the lexicon* (pp.57–149). Cambridge: Cambridge University Press.
Tomasello, Michael & Sara Mannle (1985). Pragmatics of sibling speech to one-year-olds. *Child Development*, 56, 911–917.
Warren, Amye R. & Carol S. Tate (1992). Egocentrism in children's telephone conversations. In R.M. Diaz & L.E. Berk (Eds.), *Private speech: From social interaction to self-regulation* (pp.245–264). Hillsdale, NJ: Lawrence Erlbaum Associates.

Appendix

Episode Descriptions

Banana
Mouse takes a banana from his back pocket, throws it into the air, and catches it. He peels the banana and takes a bite. He walks toward a wastebasket and throws the peel into the basket.

The peel flies out of the basket and lands on Mouse's face. He throws the peel into the basket again, and the peel flies out of the basket and lands on his face again. He throws the peel into the basket again, turns the basket over, and walks away. The basket follows Mouse, with the elephant's feet showing at the bottom.

High Bar
Mouse jumps onto a high bar, swings, flips around, and lands on the ground. The elephant tries to jump onto the bar and in doing so bends the bar. Mouse tries to fix the bar but cannot. Then a leprechaun with a tall hat enters and walks under the bar. As his hat passes under the bar, it pushes up on the bar and fixes it. The elephant laughs.

Pottery
Mouse is seated on a bench at a potter's wheel. He takes a piece of clay from a bucket that is next to him on the bench, and places the clay on the wheel. He spins the wheel and the clay flies off the wheel and onto the wall. He takes another piece of clay, spins it on the wheel, and it flies onto the opposite wall. Mouse then climbs onto the wheel, spins himself, and flies off the wheel, out of view.

Horsechestnut
Mouse is sleeping under a tree and is awakened when a horsechestnut falls from the tree. He touches the prickly nutshell and hurts his finger. He then leaves and returns with a board and a rock. He places the board on the rock and the nut on one end of the board. He jumps on the board, causing the nut to fly into the air. The nutshell breaks open when it hits the ground. Mouse eats the nut.

Authors' addresses

Martha W. Alibali
Department of Psychology
University of Wisconsin, Madison
1202 W. Johnson St.
Madison, WI 53706
USA
E-mail: mwalibali@facstaff.wisc.edu

About the authors

Martha W. Alibali is Associate Professor of Psychology and Educational Psychology at the University of Wisconsin, Madison. Her research investigates children's cognitive development and communication.

Lisa S. Don carried out this work as part of her Senior Honors Thesis in the Department of Psychology at Carnegie Mellon University, Pittsburgh, Pennsylvania.