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## Learning to talk in a gesture-rich world: Early communication in Italian vs. American children

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### Abstract

Italian children are immersed in a gesture-rich culture. Given the large gesture repertoire of Italian adults, young Italian children might be expected to develop a larger inventory of gestures than American children. If so, do these gestures impact the course of language learning? We examined gesture and speech production in Italian and US children between the onset of first words and the onset of two-word combinations. We found differences in the size of the gesture repertoires produced by the Italian vs. the American children, differences that were inversely related to the size of the children's spoken vocabularies. Despite these differences in gesture vocabulary, in both cultures we found that gesture + speech combinations reliably predicted the onset of two-word combinations, underscoring the robustness of gesture as a harbinger of linguistic development.

### Keywords

Early communication; gesture and culture; gesture in Italian; gesture-word combinations; two-word speech

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Italian culture is widely claimed to be gesture-rich (e.g., Kendon, 1995, 2004b). The gestures of Italian speakers are both frequent and elaborate – an observation that is apparent to even the most casual observer. Indeed, travelers to Italy can now choose from a wide array of 'gesture dictionaries' (e.g., Diadori, 1990; Munari, 1994) compiled for the non-specialist describing the many gestures that are commonly attributed to Italian speakers.

One of the first systematic studies of the gestures that Italian speakers produce was Efron's (1941). Efron studied Italian immigrants to the USA and discovered an extensive vocabulary of gestures whose meanings were widely shared and often used in place of speech. He also noted the consistent, conspicuous and elaborate nature of these gestures, echoing earlier authors (e.g., De Jorio, 1832 e.g., De Jorio, 2000) who observed that Italian speakers gesture extensively and use a large, common vocabulary of gestural forms (see also Kendon, 1995, 2004a).

More recently, two lines of work have evolved in an effort to explore further these cross-cultural differences in gesture. The first expands on Efron's (1941) foundational study and focuses on gestural forms that can readily be quoted or elicited – so-called 'emblems' (Ekman & Friesen, 1969) or 'quotable gestures' (Kendon, 1992) – and whose meanings can be interpreted even in the absence of speech. Studies in this tradition have reported wide cultural variation in the composition of gesture 'vocabularies' around the globe (e.g., Morris, Collett, Marsh & O'Shaughnessy, 1979; for a recent discussion, see Kendon, 2004b).

The second line of work asks whether there are cross-cultural differences in gesture that can be traced to structural differences in the languages they accompany. For example, a number of studies have explored the co-speech gestures produced by speakers of different languages to determine whether differences in linguistic structure (e.g., whether or not manner is encoded in the verb; where 'topic' is placed in the sentence) have consequences for how information is expressed in gesture (e.g., Kita & Özyürek, 2003; McNeill, 2000; McNeill & Duncan, 2000; Özyürek & Kita, 1999).

Despite the mounting empirical evidence for cultural differences in the gestures that adult speakers produce when they talk, we know relatively little about how children in different cultures use gesture during the earliest stages of language-learning. Numerous studies have described the role of gesture in the early communicative development of Italian children and, in separate studies, American children (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979).<sup>1</sup> Both Italian and American children communicate using gestures before they are able to speak (e.g., Bates et al., 1979; Iverson, Capirci & Caselli, 1994) and, after they begin to talk, children in both cultures continue to produce gestures in combination with words (e.g., Butcher & Goldin-Meadow, 2000; Capirci, Iverson, Pizzuto & Volterra, 1996; Goldin-Meadow & Morford, 1990). The general consensus is that the gestures children produce early in language development provide a means by which they can communicate information that they cannot yet express in speech (for recent reviews, see: Capone & McGregor, 2004; Goldin-Meadow, 2003; Volterra, Caselli, Capirci & Pizzuto, 2005).

Despite general parallels in the early developmental course of gesture, no studies to date have compared Italian and American children with regard to their gesture repertoires, the frequency with which gestures are used,<sup>2</sup> or the way in which gesture changes as children's language becomes more complex. Given the relatively large repertoire of gestures that adult Italian speakers display, it is quite possible that young Italian children will also develop a relatively large repertoire of gestures, larger than the repertoire developed by American children (for relevant examples, see Capirci, Contaldo, Caselli & Volterra, 2005; Caselli, 1990). If so, the question becomes: do these gestures have an impact on the course of language-learning in Italian vs. American children? For example, we know from previous work that children who are first to produce gesture + word combinations conveying two elements in a proposition (point at bird + 'nap') are also first to produce word + word combinations ('bird nap'; Goldin-Meadow & Butcher, 2003; Iverson & Goldin-Meadow, 2005; Pizzuto & Capobianco, 2005; see also Capirci et al., 1996). If Italian children do have a larger repertoire of gestures than American children, might they begin to produce gesture + word combinations and, in turn, two-word combinations earlier than American children?

In the present study, we examined gesture and speech production by very young Italian and American children during the window of time between the onset of first words and the onset

<sup>1</sup>Bates et al. (1979) collected data on both American and Italian children, but did not explicitly compare the groups.

<sup>2</sup>Blake, Vitale, Osborne & Olshansky (2005) found no differences in gesture use across Canadian Italian learners, Canadian English learners, French learners and Japanese learners. However, Blake et al. excluded symbolic gestures (representational gestures in our terms) from their analyses, and representational gestures are precisely the gestures that were found to differ in Italian vs. English learners in our analyses.

of two-word combinations. The data were collected in comparable settings for the two groups of children, and we coded communicative behaviors using the same criteria. We asked whether Italian children develop larger gesture repertoires than American children and, if so, whether those larger repertoires have an impact on the size of the children's vocabularies and the onset of their two-word utterances.

## METHOD

### Participants

Six typically-developing children from middle- to upper-middle-class families participated in this research. The three Italian children (2 males, 1 female) were from monolingual Italian-speaking families living in the Rome area (for additional details, see Capirci et al., 2005). The three American children (2 males, 1 female) were from monolingual English-speaking households. The American children were selected from a larger sample of children who participated in a longitudinal study of communicative development (Iverson & Goldin-Meadow, 2005), and were individually matched to the Italian children on the basis of (a) gender; and (b) age of onset of single words and of two-word combinations.

All the children were followed longitudinally between the ages of 10 and 24 months. We focus here on sessions between the onset of single-word speech (range 10–12 months) and the emergence of two-word combinations (range 17–21 months). The average number of observation sessions collected for each child was 8.6 (range 6–12). The criterion for onset of one-word speech was production of at least two instances of the same sound pattern to refer to an object or event. Children were credited with producing two-word combinations when they produced at least two examples of productive two-word combinations (e.g., 'more juice', 'no bath'); frozen phrases such as 'all-gone' were not considered two-word utterances.

### Procedure

Children were videotaped monthly at home for approximately 30 minutes. The observations were divided into three 10-minute segments so that children were filmed in three different contexts: play with a standard set of toys provided by the experimenter; play with the child's own toys; and interaction during a meal or snacktime (e.g., Capirci et al., 1996; Iverson et al., 1994; Iverson & Goldin-Meadow, 2005). The standard toy set was identical for both Italian and American children and included a toy telephone, a plate, a cup, a toy glass, two animal picture books, a spoon, a teddy bear, two small cars, a ball and two combs. The experimenter did not structure any of the segments and, instead, encouraged care-givers (mothers in all cases) to engage their children in play and conversation as they normally would.

### Coding

We focused on gestures and speech used communicatively. The child had to make a clear effort to direct the listener's attention (e.g., through eye gaze, vocalization, postural shift) for a vocal or gestural signal to be considered communicative (Thal & Tobias, 1992). Communicative behaviors consisted of gesture alone, speech alone, or gesture and speech produced together.

**Coding gesture**—Two additional criteria were used to ensure that a gesture was functioning as a communicative symbol (see Butcher, Mylander & Goldin-Meadow, 1991; Goldin-Meadow & Mylander, 1984): (a) The gesture could not be a direct manipulation of a person or object (i.e., it had to be empty-handed; Petitto, 1988) or an adjustment of the body (e.g., changes of posture, folding the hands). All actions performed on objects were excluded, with the exception of instances in which a child held up an object to bring it to another's attention (i.e., *hold-up* or *show* gestures), an act that serves the same function as pointing, (b) The gesture

could not be produced as part of a ritual act (e.g., blowing a kiss to someone) or game (e.g., patty-cake).

Gestures were classified into one of two categories. *Deictic gestures* indicate referents in the immediate environment. Children produced three types of deictic gestures: (1) **SHOWING**,<sup>3</sup> or holding up an object in the listener's potential line of sight; (2) **POINTING**, or extensions of the index finger or a flat hand towards a referent; following Thai & Tobias (1992), instances of patting a location or object were also coded as pointing; and (3) **RITUALIZED REACHES**, or arm extensions toward an object, usually accompanied by repeated opening and closing of the palm. The referent of a deictic gesture was assumed to be the object indicated (or held up) by the hand.

**Representational gestures**—These gestures refer to an object, person, location or event through hand movement, body movement or facial expression. They differ from deictic gestures in that their forms vary with their meanings; as a result, they are less dependent on context for interpretation. The children used two types of representational gestures: (a) **Iconic gestures** have forms that are transparently related to their meanings, either action meanings (e.g., bringing empty hand to lips for **EAT**; moving the body rhythmically without music for **DANCING**), object meanings (e.g., holding empty fist to the ear for **TELEPHONE**), or attribute meanings (e.g., extending the arms for **BIG**; waving the hands for **HOT**), (b) **Conventional gestures** have forms that are arbitrarily related to their meanings (e.g., shaking the head **NO**; turning and raising the palms up for **ALL-GONE**; bringing the index finger to the cheek and rotating it for **GOOD**).

**Coding speech**—We coded all communicative, meaningful vocalizations. These consisted of either adult English or Italian word forms (e.g., ‘dog/cane’, ‘hot/caldo’, ‘walking/camminare’) or patterns of speech sounds used to refer consistently to a specific object or event (e.g., ‘ba’ for ‘bottle’; ‘ncuma’ for ‘ancora’).

**Coding the relationship between gesture and speech**—All instances in which a gesture was produced co-temporally with speech were classified as gesture-word combinations and categorized on the basis of the relation between the information conveyed in the two modalities: (a) gesture *complemented* speech by singling out the referent indicated by the accompanying word (e.g., pointing to flowers while saying ‘flowers’ to indicate flowers on the table); and (b) gesture *supplemented* speech by providing a different but related piece of information about the referent (e.g., pointing to a picture of a bird while saying ‘nap’ to indicate that birds can take naps).

**Reliability**—For the American children, reliability between two independent coders was assessed on 10% of the 80 sessions available for the complete sample of 10 children (Iverson & Goldin-Meadow, 2005). Agreement between coders was 93% ( $N = 639$ ) for isolating gestures and 100% ( $N = 52$ ) for classifying gesture-word combinations as *complementary* or *supplementary*. Cohen's kappa statistics for these coding decisions were 0.92 and 1.00 respectively. Agreement was 100% ( $N = 242$ ) for assigning meaning to gestures. For the Italian children, reliability between two independent coders was assessed on a subset of the videotaped sessions and ranged between 91% and 100% agreement between the two coders depending upon the coding category.

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<sup>3</sup>Throughout the text, gesture glosses are indicated in SMALL CAPITALS.

## RESULTS

### Communicative repertoire

**Gesture**—Do American and Italian children use gesture differently? We conducted two analyses to address this question. For the first analysis, we examined each of the children's gestures and determined its referent. Because we were interested in examining potential group differences in the range of referents conveyed in deictic vs. representational gestures, this analysis was based on the number of different referents expressed within a session. For example, if a child pointed at a ball during a session, *ball* was counted as a deictic gesture referent regardless of whether it was produced once or on multiple occasions. Similarly, if a child shook her head NO during a session (one or more times), no was included as a single representational gesture referent.

Across sessions, the number of different referents conveyed in gesture did not differ across the two groups of children ( $M_{IT} = 19.22$ ,  $SD = 6.22$ ;  $M_{AM} = 16.27$ ,  $SD = 12.37$ ; Mann-Whitney  $U = 3$ ,  $ns$ ). The children in both groups varied in terms of the age at which they produced their first two-word combination. In order to compare gesture production in children at comparable language levels, we selected the 5-month period prior to the acquisition of two-word utterances for each child, and calculated the number of deictic and representational gestures produced by the child during each of the months of that period. Figure 1 presents the mean number of gestures of each type produced by the Italian children (Fig. 1a) and the American children (Fig. 1b) in a total of six sessions: sessions 1, 2, 3, 4 and 5 months prior to the onset of two-word combinations, respectively, and at the two-word onset session.

As is evident in the figure, the American children produced primarily deictic gestures and relatively few representational gestures. In contrast, the Italian children produced a larger repertoire of representational gestures, at times producing as many representational as deictic gestures. Indeed, an examination of the repertoires of individual children indicated that the three Italian children all had larger representational gesture repertoires than the three American children (averaging across sessions,  $M_{IT} = 8.11$ ,  $SD = 3.27$ ;  $M_{AM} = 2.05$ ,  $SD = 1.43$ ; Mann-Whitney  $U = 0$ ,  $p = 0.05$ ). In addition, almost all the American children's few representational gestures were conventional gestures (e.g., HI, headshake NO, head nod YES, ALL-GONE). In contrast, a substantial portion of the representational gestures in the Italian children's repertoires were iconic, and referred to objects (e.g., wiggling the nose for RABBIT; flapping the arms for BIRD), actions (e.g., bringing an empty hand to the mouth for EAT, leaning the head to the side and resting the cheek on the palm for SLEEP; moving the hands over the face for WASH), or characteristics of an object or situation (e.g., extending the arms for BIG; waving the hands for HOT). Iconic gestures of this sort were almost never found in the American children's representational repertoire.

We next asked whether there were differences in the extent to which the children made communicative use of gestures. For this analysis, we counted the total number of deictic and representational gestures (i.e., tokens) produced by each child at each session (including repetitions). Figure 2 presents the data. At all sessions, deictic gestures were much more frequent than representational gestures for the American children (Fig. 2b). Indeed, the vast majority of gestures produced by American children across sessions were deictic ( $M_{AM} = 0.83$ ,  $SD = 0.12$ ) rather than representational ( $M_{AM} = 0.17$ ,  $SD = 0.12$ ) and, again, very few of the American children's representational gestures were iconic. In contrast, both deictic ( $M_{IT} = 0.57$ ,  $SD = 0.09$ ) and representational gestures ( $M_{IT} = 0.43$ ,  $SD = 0.09$ ), both iconic and conventional, were found in considerable numbers in the Italian children's productions (Fig. 2a).

**Words**—Are the observed differences in gesture referents and gesture production accompanied by differences in the size of the children’s spoken word vocabularies? To address this question, we counted the total number of different spoken words (types, as opposed to tokens) produced by each child during each session of the 5-month period prior to the onset of two-word speech, and averaged the totals across children in each group per session. The data are presented in Fig. 3. As expected, vocabulary size increased sharply just prior to the onset of two-word speech in both groups. Interestingly, at all 6 sessions the Italian children produced fewer different spoken words than the American children. These findings are consistent with previous work showing that Italian children’s spoken vocabularies tend to be smaller than American children’s when assessed using parental report inventories (Caselli et al., 1994; Caselli, Casadio & Bates, 1999).

Although speculative, our findings raise the intriguing possibility that the Italian children’s spoken vocabularies are smaller than the American children’s *because* they use more representational gestures. Two pieces of information support this hypothesis. First, the representational gestures that the Italian children produced were in complementary distribution with their spoken vocabularies; in other words, the children used gestures for referents for which they did not have words. Across sessions, the mean proportion of representational gestures that were *not* redundant with words in the children’s vocabularies was more than twice as high for the Italian children ( $M_{IT} = 0.75$ ,  $SD = 0.15$ ) than for the American children ( $M_{AM} = 0.31$ ,  $SD = 0.39$ ;  $U=0$ ,  $p = 0.05$ ). Second, if we calculate the number of ‘words’ in the children’s vocabularies including not only spoken words but also non-redundant representational gestures, we find that the Italian children no longer have smaller vocabularies than the American children. Thus, when only spoken words are considered, the Italian children tended to produce fewer different words (averaged over the 6 sessions,  $M_{IT} = 22.24$ ,  $SD = 17.94$ ) than the American children ( $M_{AM} = 34.05$ ,  $SD = 20.80$ ;  $U = 0$ ,  $p = 0.05$ ). However, when non-redundant representational gestures are added to the mix, the difference disappears ( $M_{IT} = 28.85$ ,  $SD = 17.70$ ;  $M_{AM} = 34.61$ ,  $SD = 20.59$ ;  $U = 2$ ,  $ns$ ).

### Gesture-word combinations

All the children combined single gestures with single words, and they began to do so several months before they produced their first two-word combinations. In addition, all the children produced supplementary (e.g., pointing at cup while saying ‘mama’) and complementary (e.g., pointing at cup while saying ‘cup’) gesture-word combinations prior to combining two words (e.g., ‘mama cup’). On average, children began to produce supplementary gesture-word combinations 2.55 months ( $SD = 1.05$ ) before the onset of two-word speech. The corresponding interval between the appearance of complementary combinations and the transition to two-word speech was 6.33 months ( $SD = 3.27$ ).

Does the fact that the Italian children have more representational gestures in their repertoires affect the timing of their gesture-word and two-word combinations? Because representational gestures function more like words than do deictic gestures, the Italian children could have an advantage over the American children in producing supplementary gesture-word combinations (in which word and gesture combine to create a sentence-like meaning) and might produce these combinations earlier than American children. If so, they might also produce two-word combinations earlier than the American children.

To address this possibility, we first examined the age at which children in the two groups first began producing supplementary gesture-word combinations. We found no differences between the groups. On average, the Italian children first produced supplementary gesture-word combinations at age 16.67 months, approximately 2.67 months ( $SD = 1.15$ ) before the onset of two-word speech. Similarly, the American children first produced supplementary gesture-word



combinations at age 16.33 months, 2.33 months ( $SD = 1.15$ ) before the onset of two-word speech.

We then examined the relationship between the onset of supplementary gesture-word combinations and the onset of two-word speech in the two groups of children. A scatter plot displaying these data is presented in Fig. 4a. We see a strong positive relation between age of onset of supplementary gesture-word combinations and age of onset of two-word combinations (Kendall tau = 0.894,  $p = 0.017$ ). Interestingly, the timing of these two milestones was comparable for Italian and American children. This result may not be surprising given that, for both Italian and American children, the majority of supplementary combinations involved deictic gestures ( $M_{IT} = 3.19$ ,  $SD = 3.94$ , and  $M_{AM} = 3.87$ ,  $SD = 3.59$ , respectively, across sessions) rather than representational gestures ( $M_{IT} = 0.63$ ,  $SD = 0.96$ ;  $M_{AM} = 0.73$ ,  $SD = 0.70$  across sessions).

We conducted a similar analysis looking at the age of onset of *complementary* gesture-word combinations and two-word speech (Fig. 4b). Importantly, and different from supplementary gesture-speech combinations, there was *no* systematic relationship between the onset of complementary gesture-speech combinations and the onset of two-word combinations for either group of children (Kendall tau =  $-0.32$ , *ns*). Thus, consistent with previous findings (Capirci et al., 1996; Goldin-Meadow & Butcher, 2003; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005; Pizzuto & Capobianco, 2005), it is the ability to combine two different semantic elements within a single communicative act – as exemplified in the production of supplementary gesture-word combinations – that specifically predicts the onset of two-word speech.

## DISCUSSION

### Cultural differences in the gestures of very young children

Our findings suggest that there is cultural variation in the gesture repertoires found in even the youngest speakers. The Italian children in our sample conveyed a broad range of meanings via representational gestures, and they produced representational gestures more frequently than did the American children. The American children, in contrast, relied primarily on deictic gestures, which were also found in the Italian children's gesture repertoires.

It is likely that these findings reflect differences in the nature of the gesture models to which the children are exposed. Young Italian children are immersed in a gesture-rich culture (Kendon, 1995, 2004b): gestures not only occur frequently in communication, but there is also a large repertoire of culturally-defined representational gestures to which even very young children are exposed. Exposure to a rich gestural model may attune Italian children to the ways in which representational information can be captured by the manual modality; and Italian caregivers may readily identify an action produced by the child as a representational gesture, incorporating it into the gesture repertoires they use with the child. Support for this notion comes not only from the fact that Italian children produced more representational gestures than American children, but also from the fact that the representational gestures produced by Italian children included numerous object/action (e.g., EAT, TELEPHONE) and attribute (e.g., BIG, HOT) gestures. When representational gestures were produced by American children, they were almost exclusively conventional gestures (e.g., HI, YES, ALL-GONE).

Although our results must clearly be interpreted with caution because of the small sample size, the findings do hint at a possible explanation for the previous finding that Italian children tend to have smaller spoken vocabularies than American children (Caselli et al., 1994; Caselli et al., 1999): Italian children may find a way to refer to objects, actions and attributes using the many gestural forms they see in their worlds. Not only did Italian children produce more

different representational gestures than American children, but their gestures were also much more likely to express meanings that did not overlap with the words in their spoken vocabularies (and vice versa). In fact, when we added non-redundant representational gestures to the Italian children's spoken vocabularies, we found that their lexical repertoires (words plus non-redundant representational gestures) were now the same size as the American children's spoken vocabularies. Thus, representational gestures make a substantial contribution to Italian children's communicative potential, providing a way for them to express meanings that they do not yet convey in words (Capirci et al., 2005; Caselli, 1990; Iverson et al., 1994; Volterra, Bates, Benigni, Bretherton & Camaioni, 1979).

One important question for future research is how representational gestures of this sort enter the repertoires of Italian children. There are at least two possibilities that merit further investigation (see also Capirci et al., 2005). One is that Italian caregivers may be more likely to embed specific actions and/or gestures in the play and book-reading routines in which they engage with their children. Werner & Kaplan (1963) have argued that actions and gestures produced in the context of such routines become gradually decontextualized and used by children for communicative purposes; greater frequency of occurrence of actions/gestures in routines (or more frequent occurrence of routines overall) could lead to a larger repertoire of representational gestures. Alternatively, children may create representational gestures spontaneously as they perform actions on objects in the context of social interaction; if children are made sensitive to the representational potential of the manual modality by the frequent use of gesture in their environments, they may more readily extract gesture forms from their own actions. This possibility is supported by the observation by Capirci et al. (2005) that many of the early object-related actions produced by young Italian children during social interaction (e.g., bringing a telephone to the ear) carried meanings similar to those expressed in later-emerging representational gestures (e.g., bringing an empty hand to the ear for TELEPHONE).

The American children in our sample produced very few representational gestures. However, the literature suggests that American children can readily acquire representational gestures of the sort that the Italian children produced if they are exposed to enriched gestural input. For example, Goodwyn & Acredolo (1993) and Goodwyn, Acredolo & Brown (2000) showed that young American children whose parents were asked to gesture to them as they produced a set of words acquired a repertoire of approximately 20 representational gestures, a much larger repertoire than found in any of the American children in our study (for additional discussion, see Volterra, Iverson & Castrataro, 2005). For American children growing up in a cultural environment that is not particularly rich in representational gestures, amassing a set of representational gestures may require explicit training.

### **Gesture and the transition to two-word speech**

We replicated our previous finding that the onset of supplementary gesture-word combinations is related to, and predictive of, the onset of two-word utterances (Capirci et al., 1996; Goldin-Meadow & Butcher, 2003; Iverson & Goldin-Meadow, 2005; see also Pizzuto & Capobianco, 2005) in a direct comparison of Italian and American children. These findings are consistent with the hypothesis that gesture plays a facilitating role in early language development.

How might gesture facilitate language learning? Supplementary gesture-word combinations could play a role in the young child's developing language systems in at least two ways (Goldin-Meadow & Wagner, 2005). First, producing supplementary gesture-word combinations could induce changes in the input children receive. Consider, for example, a child who points at his or her mother's coffee cup while saying 'mama'. The child's caregiver might respond by saying, 'Yes, that's mama's cup', in effect 'translating' the child's gesture-plus-word combination into a multiword utterance and providing the child with timely verbal input. In recent work (Goldin-Meadow, Goodrich, Sauer & Iverson, 2007), we found that maternal



utterances produced in response to children's supplementary combinations had significantly longer MLUs than those produced in response to reinforcing (or, in our terms, complementary) combinations. The longer MLUs were not simply a function of an overall increase in maternal MLU; rather, mothers increased the length of their sentences selectively in response to particular gesture-word combinations that their children produced. In addition, maternal 'translation' of children's gestures into words (as in the above example) was positively related to the onset of two-word speech. Thus, supplementary gesture-word combinations may elicit just the right input to help children take the next step in learning two-word utterances.

Second, the act of producing supplementary combinations could facilitate cognitive changes in the children themselves. For example, Özçalışkan & Goldin-Meadow (2005) have recently shown that children reliably produce specific semantic constructions (e.g., predicate + argument) in supplementary gesture-speech combinations (e.g., point at baby doll while saying 'sleeping') several months before the construction appears entirely in speech (e.g., 'baby sleeping'). Supplementary gesture-speech combinations could provide children with opportunities to 'practice' integrating multiple pieces of information in a communicative message and to work out problems inherent in conveying a semantic relation within a single utterance (see also Capirci et al., 1996; Pizzuto & Capobianco, 2005). Indeed, in recent studies of older children learning how to solve maths problems (Broaders, Cook, Mitchell & Goldin-Meadow, 2007; Cook, Mitchell & Goldin-Meadow, 2008), we have found that the act of gesturing can itself play a causal role in learning.

### Representational gestures and the transition to two-word speech

The findings reported here suggest that it is deictic rather than representational gestures that are essential to supplementary gesture-word combinations, even for children whose gesture repertoires contain a significant number of representational gestures. In principle, a large repertoire of representational gestures could have provided Italian children with an additional way to communicate two different, but related pieces of information. But it did not. Italian children, like American children, used deictic gestures almost exclusively in their supplementary gesture-word combinations (for similar findings with other groups of Italian children, see Capirci et al., 1996; Pizzuto & Capobianco, 2005). Moreover, Italian children began to produce supplementary gesture-speech combinations at the same time as American children, which, in turn, predicted the onset of two-word utterances in both groups.

This finding is reminiscent of data from longitudinal observations of a hearing Italian child of deaf parents who was exposed to sign and speech from birth (Capirci, Iverson, Montanari & Volterra, 2002). At 16 and 20 months, the child's production of representational gestures (in terms of repertoire size and tokens) was more than two standard deviations above the mean for a comparison group of Italian children exposed only to speech. But this substantial representational gesture repertoire did not give the child an advantage with respect to the onset of supplementary combinations or the onset of two-word utterances, relative to his monolingual peers.

Why might children – even children with many representational gestures – rely so heavily on deictic gestures when producing supplementary gesture-word combinations? One possibility is that pointing places fewer cognitive demands on the child. Producing a supplementary *representational* gesture-word combination requires the child to retrieve two symbols (each conveying a different piece of semantic content), hold the symbols in mind simultaneously, and coordinate vocal with motor activity (i.e., articulate the word while producing the gesture; for further discussion, see: Iverson & Fagan, 2004; Iverson & Thelen, 1999). The demands made by combining a representational gesture with a word on retrieval and memory may simply be too great for very young children. In contrast, producing a supplementary *deictic* gesture-word combination draws on three relatively well-established skills: retrieving a single word,

identifying the referent of the deictic gesture, and coordinating the co-production of the word and gesture. Incorporating a deictic pointing gesture into a supplementary combination may thus reduce the demands on young children's limited cognitive resources, thereby enabling them to produce combinations with more sophisticated and complex informational content (for a similar argument, see Özçalışkan & Goldin-Meadow, 2005).

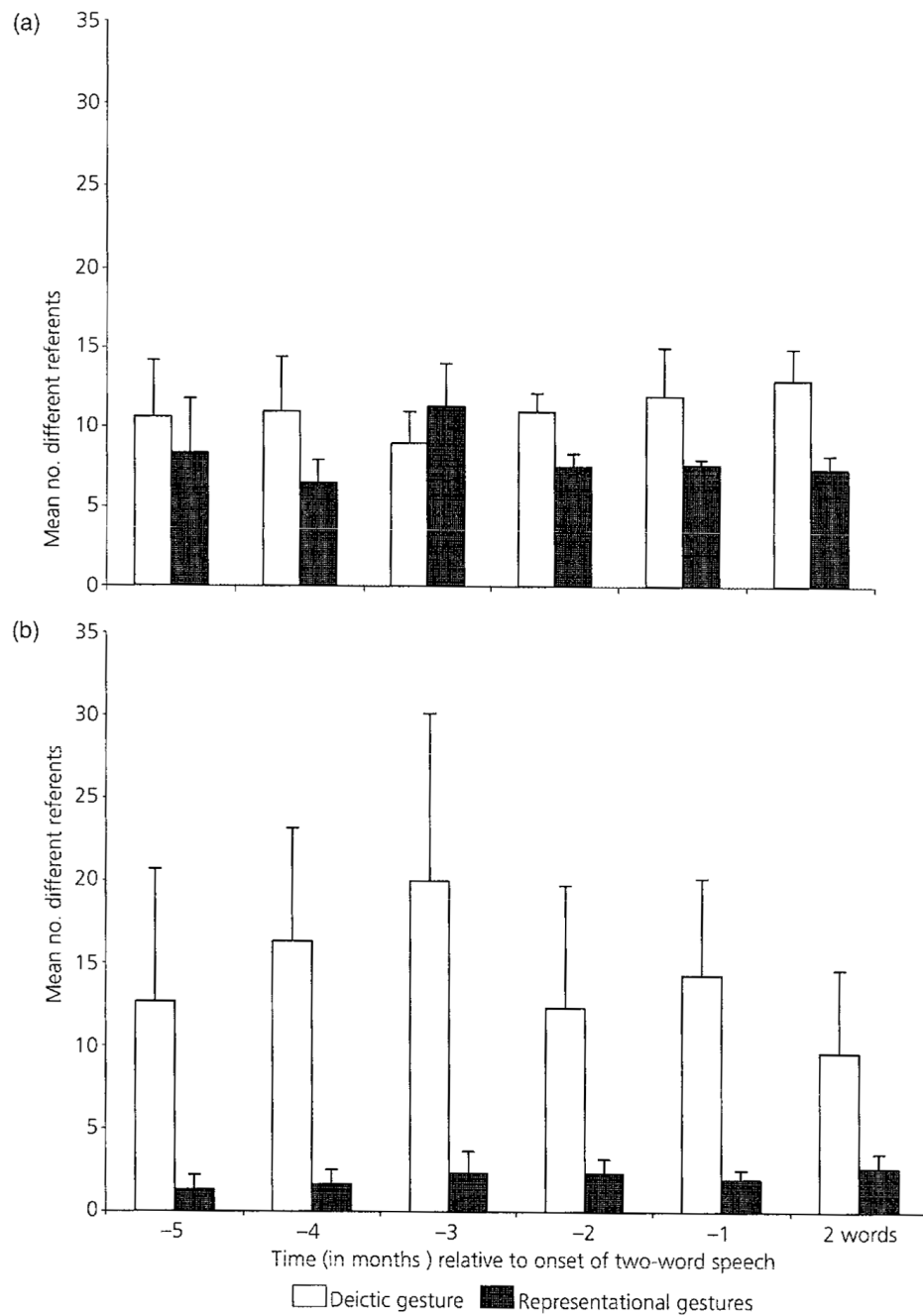
In sum, although further comparative studies with larger samples are clearly needed to substantiate our results, we have found that Italian and American children do differ in the composition of their early gesture repertoires. This difference may be responsible for the early differences in the size of Italian and American children's spoken vocabularies – Italian children's vocabularies are equal to American children's only when both spoken words and representational gestures are included in the count. However, the difference in the composition of their gesture repertoires does *not* influence when Italian and American children first use gesture along with speech to convey multiple pieces of information, that is, to produce gesture-word sentences and, eventually, word-word sentences. Exploring how children use gesture and learn language in cultures rich in gestural resources can thus provide us with a way to discover when gesture does, and does not, play a role in language learning.

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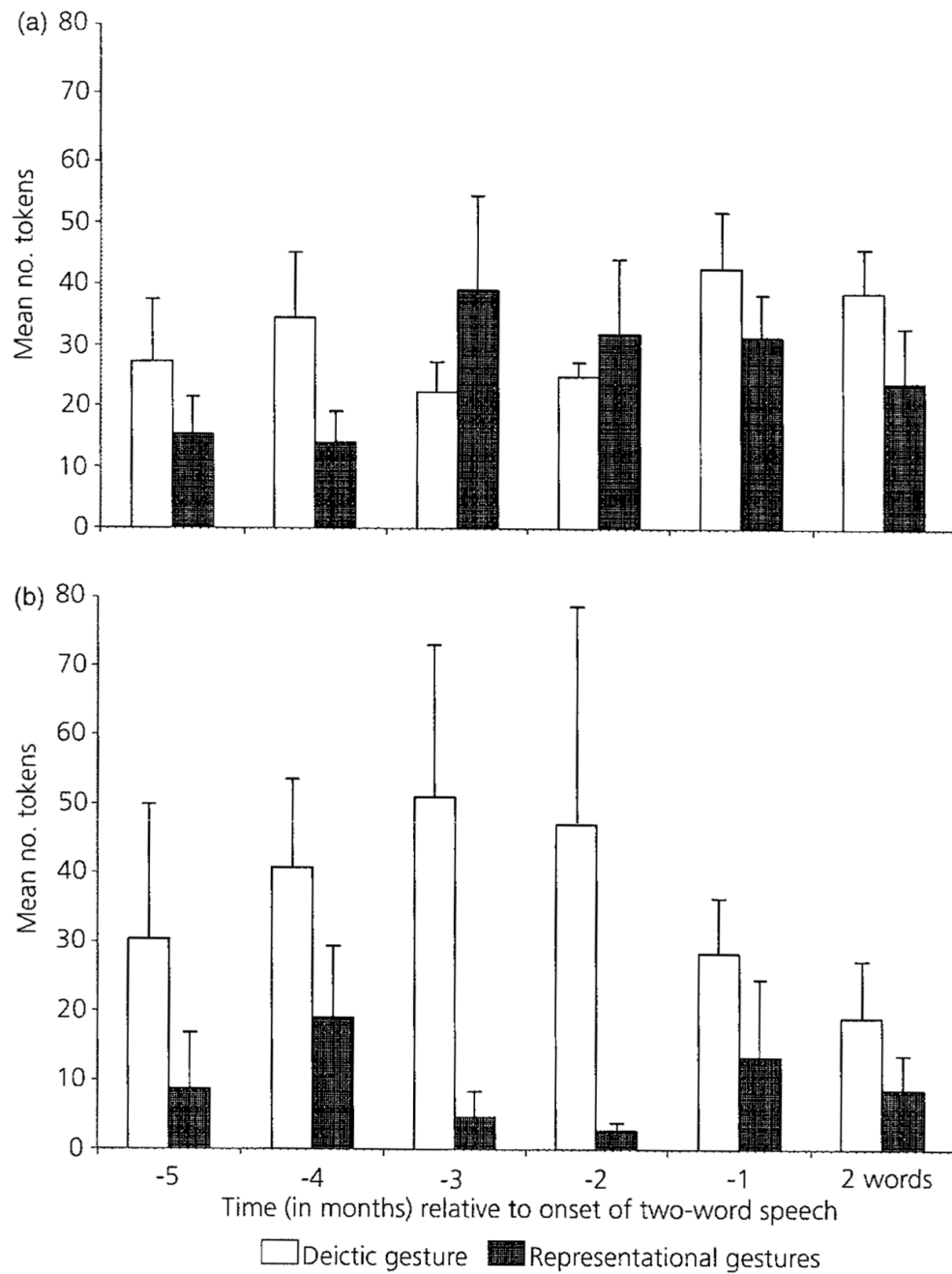
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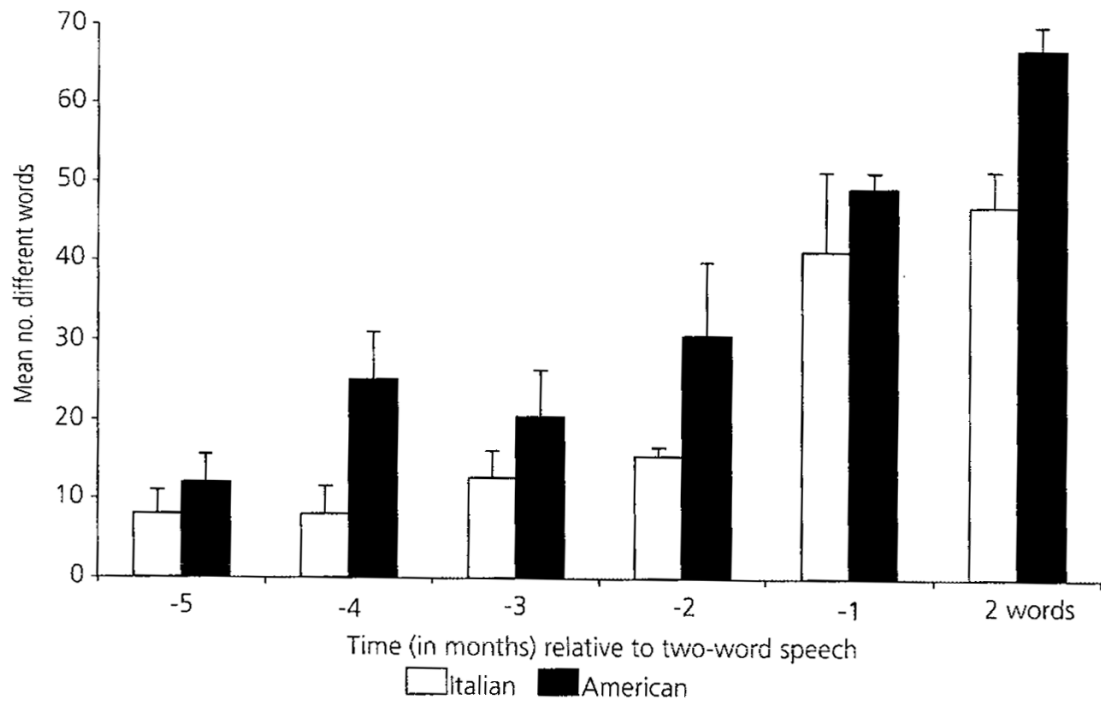


**Figure 1.** Mean number of different referents conveyed in deictic and representational gestures by (a) Italian and (b) American children in the five sessions preceding, and the session coinciding with, the onset of two-word combinations; bars represent standard errors

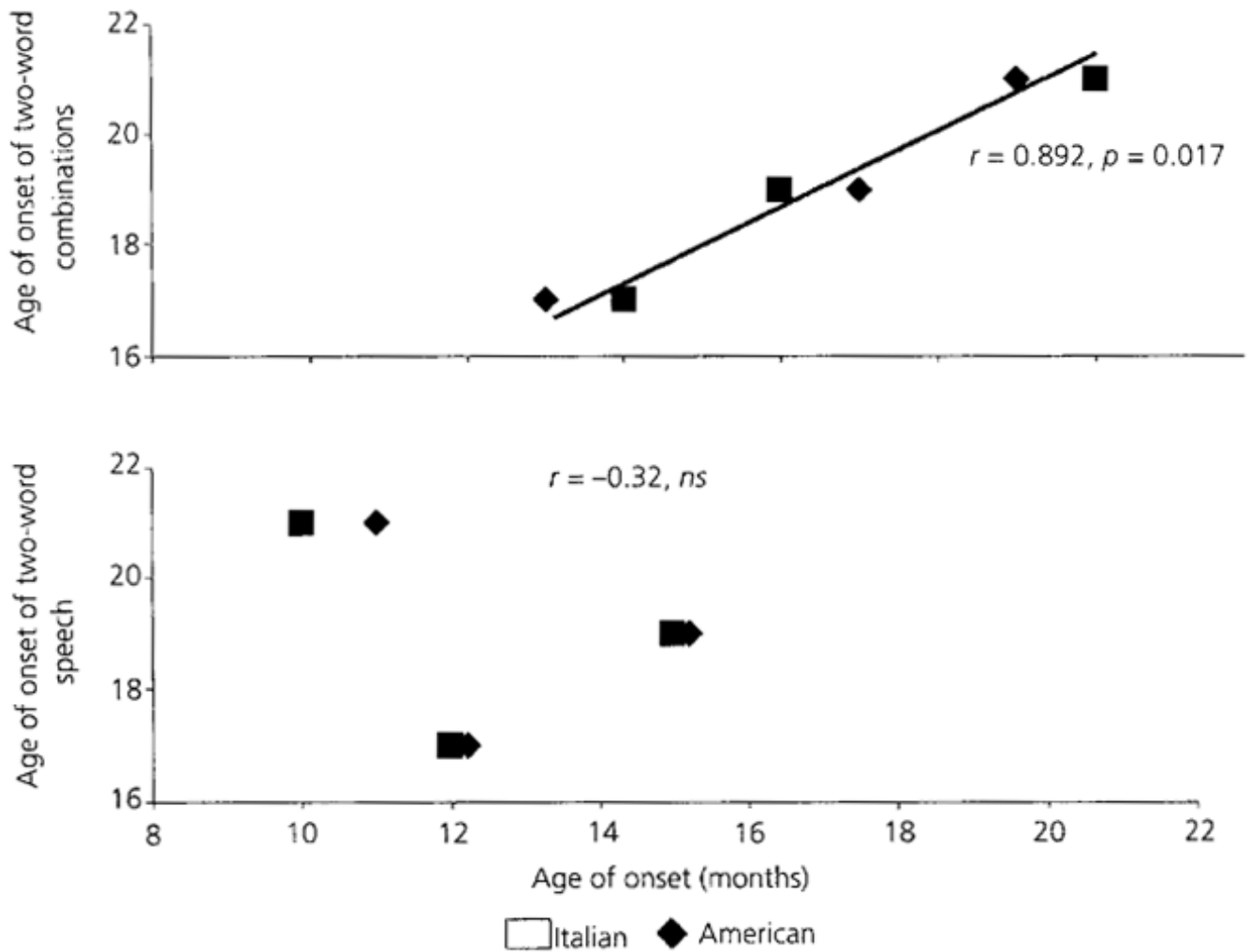




**Figure 2.** Mean number of deictic and representational gesture tokens produced by (a) Italian and (b) American children in the five sessions preceding, and the session coinciding with, the onset of two-word combinations; bars represent standard errors



**Figure 3.** Mean number of different word types produced by Italian and American children in the five sessions preceding, and the session coinciding with, the onset of two-word combinations; bars represent standard errors



**Figure 4.** Scatter plots displaying the relations between (a) age of onset of supplementary gesture-word combinations and age of onset of two-word combinations, and (b) age of onset of complementary gesture-word combinations and age of onset of two-word combinations