Development of communicative gestures in French infants from 8 to 16 months

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Abstract

This paper presents the development of communicative gestures in French-speaking children aged from 8 to 16 months. The study is based on the French adaptation of the well-known MacArthur Communicative Development Inventories. Data show how many gestures are acquired, of what kind, contribute to the gender effect debate, and finally, show the link between gestual and verbal communications.

Introduction

The study we present is part of a larger project focusing on the communicative development of French children from 8 to 16 months. The CNRS and the Rhône-Alpes region have financially supported these research.

This larger project is based on the adaptation and the norming of a questionnaire for parent report known as the MacArthur Communicative Development Inventory (Fenson et al., 1993). The goal of this study is twofold: to analyze first words understood and/or produced by children, the number as well as semantic and grammatical nature of these words, and also to examine the gestures children are able to perform. In this present paper we will focus on the latter.

This article is composed of 3 main parts. In the first part, we will give some theoretical background. Secondly, we will explain the methodology used in this project. Finally, in the third part, the results will be presented and discussed from a crosslinguistic perspective.

1. Theoretical background

In the theoretical part, we will first outline some of the major findings concerning gestures and their development in infancy with a particular focus on gender differences. Then, we will present the main findings concerning a possible relationship between non-verbal communication and development of words during the two first years of life.

1.1. Gestures and their development during infancy

Following McNeill's argument: "gestures are an integral part of language as much as are words, phrases, and sentences – gesture and language are one system" (1992:2), Volterra

& Caselli (1985) propose the following 4 fundamental stages of language acquisition in which they integrate development of gestures.

According to these authors, from birth to approximately 7 months of age, infants produce motor and vocal behaviors that are not communicative. From 7 to 12 months, children produce a greater number of intentional communicative signals. These signals are predominantly deictic gestures and have been defined as following: the semantic content or more precisely, the undifferentiated referent of the deictic gestures can be identified only by inspecting the physical context in which communication takes place.

Usually, between 12 and 16 months, gestures become decontextualized and are used by the child for symbolic reference. These gestures have been called symbolic or representational gestures and include a larger set of conventional hand or body movements or facial expressions that come to be associated with relatively stable meanings across different contexts of production (bringing a closed fist to the ear to mean telephone for example). In the same time, the first words appear.

Finally, typically between the ages of 16 and 20 months, children combine two symbols (two words or 1 word and 1 gesture), which can be viewed as emergence of morphosyntax.

What is also worth mentioning is a debate concerning the existence of a gender effect on the development of gestures. Using different methodologies, several research (Bates et al. 1975 and 1988; Eriksson & Berglund, 1999; Fenson et al. 1993; Klackenberg-Larsson & Stensson, 1968; Laakso et al. 1999; Nordberg et al. 1991) have shown that there is a difference between boys and girls in terms of number of gestures produced: girls scoring higher than boys. Two explanations are provided.

The first postulates a different maternal interactional sensitivity depending of the gender of the child. Laakso et al. (1999) use 11 variables to assess different aspects of maternal interactional sensitivity (e.g. attention directing and maintenance, versatility of motivational strategies, emotional availability, cognitive guidance) in mothers of 14 months old children. The mean score for the different variables is somewhat higher for the girls than for the boys.

The second explanation underlines a difference that can be due to methodological factors. By using the Swedish Early Communicative Development Inventory "words and gestures" Eriksson & Berglund (1999) notice a superiority of girls only for two subscales "first communicative gestures" and "pretending to be parent". Insofar as category "pretending to be parent" is mostly composed of activities typical of playing with dolls, they explain this difference by an effect of selected items.

However, the gender difference has been criticized for several reasons. First of all, it appears that the difference between boys and girls is only a tendency which is not always statistically significant. The superiority of girls is due either to individual differences or to specific tasks. Moreover, this gender effect seems to be less important nowadays. Nordberg et al. (1991) compare the results of 4-year-olds from the standardization of the Griffith's scales in the 1970s with their data collected in the 1980s and find on the one hand, a significant increase in test scores for boys; on the other hand, that the average test score of boys increases more than the average test score of girls. The authors explain this observed difference by structural changes which could have occurred in the society, that is to say a less differentiated social role between boys and girls nowadays, at least for the culture studied.

1.2. Link between gestures and words

For several years, it has been assumed that there was no continuity between prelinguistic behaviors and linguistic development. Although language researchers have often noted the frequency with which gestures accompany children's first words (Dore, 1974), only

recently have they begun to explore the acquisition of these gestures and more importantly the role they may play in children's transition to early verbal communication. This conception, represented by Bruner (1975) and Bates et al. (1975, 1977 and 1979), is the classical point of view, in which gestures are gradually replaced by verbal means of communication.

A recent position stipulates that "while the child's first words are indeed preceded by communication via gestures, some of these gestures do not disappear from the child's repertoire even when speech has become the privileged means of communication" (Iverson & Golding-Meadow, 1998:2). Guidetti observes 30 French-speaking children aged from 16 to 36 months in everyday settings and draws up an inventory of the conventional gestures used alone or in conjunction with vocalizations or words. She concludes by saying that "children still continue to produce conventional gestures even during the linguistic period, as the size of their repertoire increases from 16 to 36 months" (2000:3).

The importance of gestures in language development has also been reported in the transition form one-word utterances to two-words utterances by Capirci et al. (1996). By studying spontaneous productions of 12 Italian-speaking children, they indicate that the production of gesture-word combinations seems to mark an important intermediate phase in the transition to the two-words stage and underlines that gestures continue to play an important role in children's communication beyond the prelinguistic and one-word stages. Moreover, these results show a link between gesture and production, insofar as number of gestures and gesture-word-combination produced at 16 months are predictive of total vocal production at 20 months.

Finally, data from Bates et al. (1995) and Fenson et al. (1993 and 1994) indicate that development of gestures is correlated with production and even more with comprehension of words. Similar findings have been reported by Bates et al. (1989), Thal & Bates (1988) and Tamis-Lamonda & Bornstein (1990). All of them explain this tendency by arguing "a closer relationship to what the child knows about language than how the child uses language at this stage of development" (Fenson et al. 1993:64).

1.3. Research questions

Taking these findings into account, we have analyzed quantitatively as well as qualitatively the gestures performed by French infants, in order to answer the following questions:

- How many gestures are they able to perform from 8 to 16 months?
- What type of gestures (Deictic or representational ones) is used?
- What are the ages of appearance of each type?
- Are some gestures easier than others?
- What can we contribute to the gender effect debate?
- And finally, what can these gestures tell us about the verbal ability of infants, in other words, is there a relationship between gestures and words development?

2. Methodology

2.1. French Communicative Development Inventory "words and gestures"

This study is based on the French adaptation (Kern, 1998) of the well-known American parental reporting, the MacArthur Communicative Development Inventory, developed by Bates and colleagues and Fenson and colleagues in 1993.

Parental reporting is an appropriate technique for gathering representative data of sufficient size to generalize to a normal population and to create age based-norms for different

skills. Among the disadvantages of parental reporting are limitations on what kinds of phenomena can be reported, memory limitations and a potential risk that parents overestimate some of their children's skills. In fact, parents can easily report about gestures and we limited the problem of memory by asking mothers only to report on the emergent and current gestures performed by children. Furthermore, several studies have previously demonstrated the validity and the reliability of the parental reporting instrument we used by showing for example high positive correlations between results obtained by parental reporting and laboratory measures (Dale, Bates, Reznick & Morisset, 1989; Dale, 1991; O'Hanlon & Thal, 1991).

This parental reporting consists of two questionnaires: the first one called "words and gestures" concerns infants from 8 to 16 months, the second one called "words and sentences" toddlers from 16 to 30 months. For this study we used the first one.

After modifications the French questionnaire "words and gestures" is composed of the following questions: questions concerning the comprehension and/or the production of 414 items and 62 questions concerning gestures. We asked mothers to answer 62 questions concerning the gestures performed by their children. In the French Communicative Development Inventory (FCDI) these gestures are organized in five sections[1]:

- Section 1 is called "first communicative gestures" and contains 12 gestures. These gestures signal the onset of intentional communication and include the deictic gestures of *giving*, *pointing* or *reaching* and a number of conventionalized communicative gestures as *shaking the head "no"* and *raising arms to request being picked up*, etc.

- Section 2 contains 5 "games and routines" like *playing chasing games* or *playing peekaboo* which can be viewed as indices of the child's social interest. They form an important part of the early social interactive basis for communicative development.

- Section 3 and 4 called respectively "actions with objects" and "imitating other adult actions" contain 17 and 15 different gestures. For example, the mother is asked if the *child does or tries to eat with a spoon or fork*, *put on hat* or for section 4, if the *child tries to wash dishes*, *write with a pen*. They express a growing understanding of the world of objects and the uses of things. The target gestures on both of these sections suggest the emergence of a representational capacity.

- Finally, the 13 gestures in section 5, "pretending to be parent" are among the first types of true symbolic gestures. Are included in this category, gestures like *putting the dolls to bed* or *talking to dolls or stuffed animals*.

2.2. Sample and sampling procedure

The questionnaires were distributed by pediatricians, members of the AFPA (French Association of Ambulatory Pediatricians) to mothers during a visit.

Two major selection criteria should be mentioned. On the one hand, French monolingual children from different social backgrounds were included. On the other hand, children with repeated ear infections, children with diagnosed as having developmental delays, premature children as well as twins were excluded from the sample.

The sample is composed of 238 males and 229 females, for a total of 467 subjects. Table 1 presents the subjects according to age and gender.

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Age	8	9	10	11	12	13	14	15	16	Total
Male	19	35	17	26	46	22	28	30	15	238
Female	9	35	18	24	45	28	18	28	24	229
Total	28	70	35	50	91	50	46	58	39	467

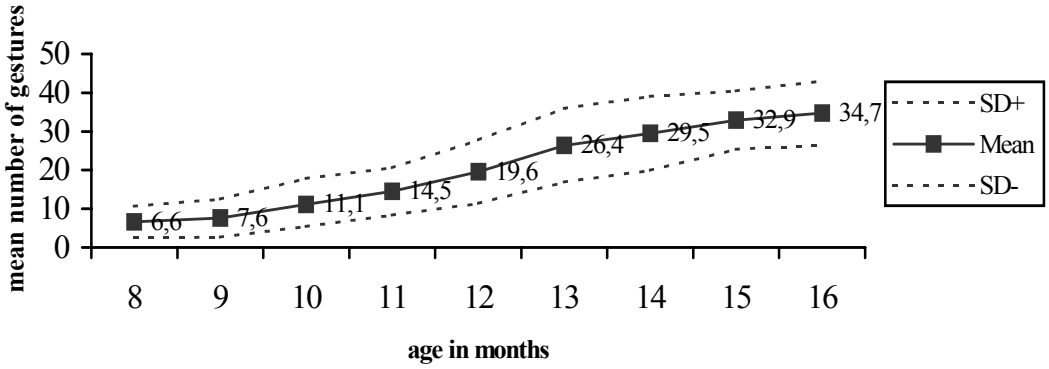
Table 1: Subjects repartition according to age (in months) and gender.

3. Results

3.1. Number of gestures boys and girls combined

First of all, we will describe our results in terms of quantity of gestures used. Figure 1 shows mean number of gestures (out of 62) performed by girls and boys combined over the age range of 8 to 16 months.

Figure 1: Mean number of gestures per age



Mean number of gestures reveals a significant increase with age ($F=95.064$; $p<0.0001$): at 8 months of age, only 9% of total gestures are performed, whereas 55% are observed in the oldest subjects. Moreover, by looking more closely at standard deviation, data reveal more individual differences with age and the differences are particularly high for age groups 12, 13 and 14 months. Finally, analysis of variance isolates 3 groups: 8 - 9 months, 10 to 14, and 15 – 16 months.

3.2. Number of gestures according to gender

Figure 2: Mean number of gestures per gender

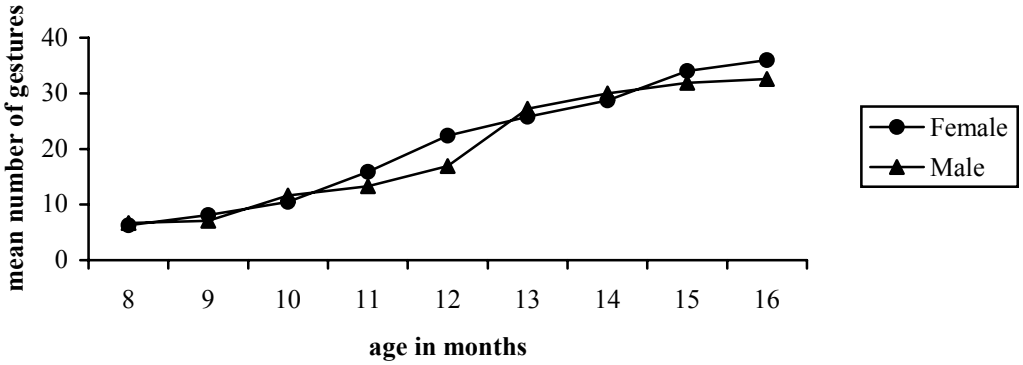
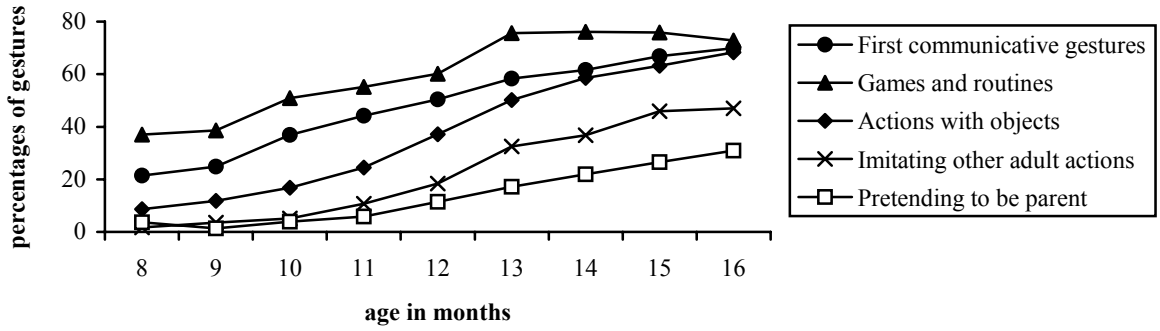


Figure 2 shows mean number of gestures according to gender. These results reveal differences between boys and girls but exclude the hypothesis of a superiority of girls over boys, insofar as this superiority is only noticed at 9, 11, 12, 15 and 16 months and is only statistically significant at 12 months ($t=3.424$; $p=0.0009$).

In the next qualitative analysis, we examine the development of gestures in each category according to the sections described in methodology.

3.3. Development of gestures per category

Figure 3: Percentages of gestures per category and age



The trends shown in figure 3 are neatly parallel. All scales display clear developmental patterns, but vary with regard to both onset and difficulty.

The gestures, which belong to "games and routines", seem to be the easiest gestures to produce insofar as even 8 month olds are able to perform 37% of these gestures. They are followed by "first communicative gestures" with 21.4%. For these two types of gestures, three groups emerge: 8 and 9 month olds use these kinds of gestures significantly less than 10 to 12 month olds, which in turn use them less than 13 to 16 month olds. Both of the categories concerning actions ("actions with objects" and "imitating other adult actions") follow each other closely: the percentage of performed gestures increases with age. Finally, "pretending to be parent" seems to be the most difficult category: up to 11 months, subjects produce less than 5%.

To confirm this complexity scale, it is necessary to examine the distribution of the different types of gestures according to age.

3.4. Distribution of gestures per age

Figure 4: Distribution of gestures per category and age

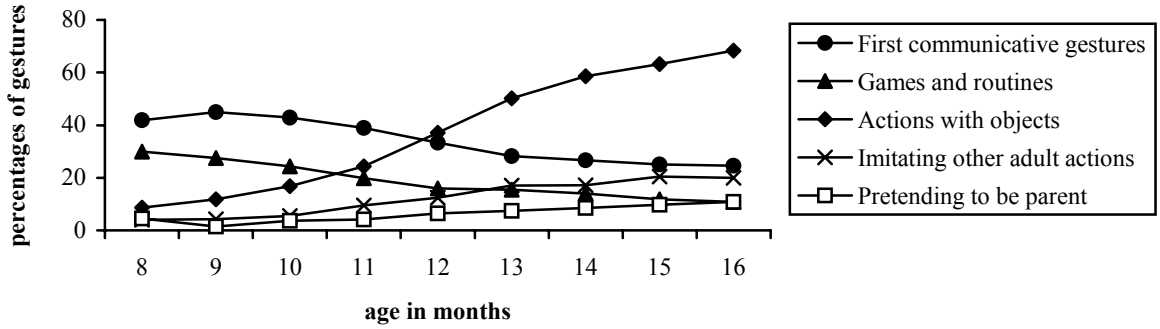


Figure 4 shows a completely different distribution according to age.

For the three first age ranges, we observe the same category distribution, that is to say "first communicative gestures" and "games and routines" are the most represented categories, as opposed to the last three categories ("actions with object", "imitating other adult actions" and "pretending to be parent").

From 11 months of age, subjects present completely different profiles. In fact, on the one hand, the percentages of the two most represented categories for 8, 9 and 10 months begin to decrease. On the other hand, the percentages observed for the three other categories increase, and this tendency is particularly sharp for "actions with objects" as opposed to "imitating other adult actions and "pretending to be parent".

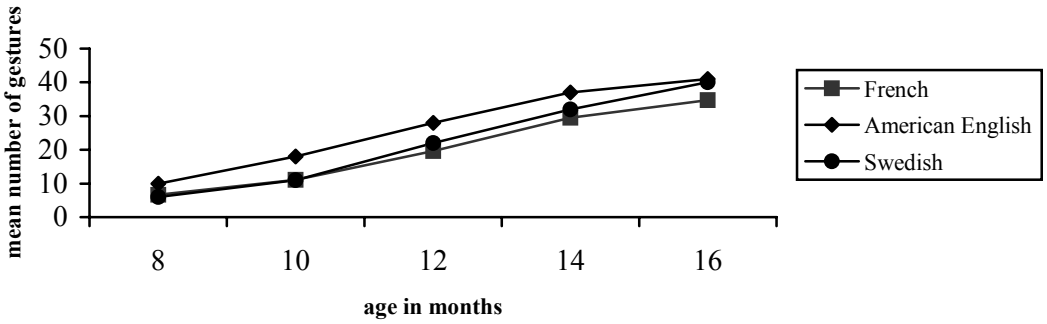
From 14 months of age "actions with object" obtain 60%, whereas "imitating other adult actions" and "pretending to be parent" represent respectively around 20% and 10%. These results confirm those obtained in figure 3: taking the age of appearance as well as percentage of use in consideration, it seems that some categories are more complex than others.

As it was shown in figure 1 of this study, no gender difference was found for the total number of gestures up to the age of 16 months. However, if we consider the results according to the different categories, girls score significantly higher than boys for "pretending to be parent" ($F=6.422$; $p=0.016$). Moreover, boys score significantly higher than girls for "imitating other adults actions" ($F=7.079$; $p=0.0081$).

3.5. Crosslinguistic comparisons

In the next analysis, we compare our results with those obtained by children acquiring other languages: American English and Swedish. Therefore, we use the data collected with the American version of the MacArthur Communicative Development Inventory "words and gestures" developed by Fenson and colleagues (1993) as well as with the Swedish adaptation from Eriksson and Berglund (1998). Both quantity of gestures and order of gestures emergence are examined.

Figure 5: Mean number of total gestures per language and age



The comparison between the American, Swedish and French subjects in terms of mean number of gestures performed by children from 8 to 16 months reveals the same developmental pattern. However, French and Swedish results appear to be lower than American results. On the one hand, these observed differences are statistically significant between American English and Swedish ($t=4.468$; $p=0.0111$) and between American and French ($t=-7.655$; $p=0.0016$). On the other hand, there is no significant difference between French and Swedish. These trends may be attributable to sampling differences and especially to differences in the educational level of mothers: the American mothers were more educated than both the French and Swedish ones.

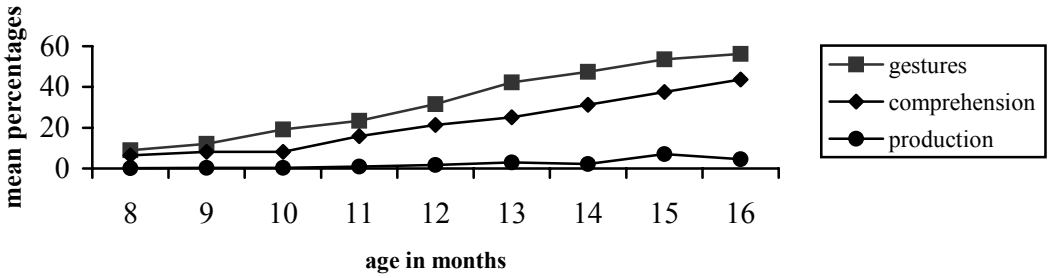
For order of emergence, Fenson et al. (1993) for American and Eriksson and Berglund (1998) for Swedish establish the following order: the items from "first communicative gestures" and "games and routines" tend to emerge earlier than those from "actions with objects" and "imitating other adult actions", which in turn, appear before the items from "pretending to be parent". Our data reveal the same order of emergence.

3.6. Correlations between gestures, production and comprehension

Finally, previous studies have shown correlations between gestures and the number of lexical items understood or produced. It is this issue that we address.

Figure 6 gives mean percentages of performed gestures, of understood words and of produced words according to age.

Figure 6: Mean percentages of performed gestures, of understood words and of produced words



Two findings are important to notice. On the one hand, comprehension of words and gestures show almost parallel development. On the other hand, word production has barely started at the age of 12 months. If we do not take age into consideration, there is a positive correlation between gestures and comprehension ($z=19.4$; $p<.0001$) as well as between gestures and production ($z=7.9$; $p<.0001$). However, if we consider these correlations according to the different ages, the results are different. The correlation between gestures and production is only significant for the youngest age groups (8 to 12 months). This is probably due to the fact that the number of gestures as well as understood or produced words are very low for these age ranges. On the contrary, the correlation between gestures and comprehension is positive for all age groups.

4. Conclusion and discussion

To conclude, we will summarize the main results and discuss them by comparing the observations made in the literature about the same domain.

First, the data show a clear increase in terms of total number of gestures according to age. This developmental trend is comparable to the trends for other languages: Fenson et al. (1993) for American English and Eriksson and Berglund (1998) for Swedish. However, as noticed before, the French and the Swedish results are lower than those obtained in the American studies. This difference can be explained by population differences. It appears that in both studied languages, educational level of mothers is lower than in the American English data. This hypothesis will be verified for French by comparing the results obtained by children belonging to either low social classes or high social classes. However, another explanation can be considered: the possibility of an overestimation of children's behaviors by American mothers as it has been noticed in previous studies.

Second, several research have reported significant differences in language development between boys and girls (Hardy-Brown, 1983; Klackenberg-Larsson and Stensson, 1968; Maccoby, 1966; Plomin, 1989). Fenson et al. (1993 and 1994), using the American CDI "words and gestures", find significant differences between girls and boys on all subscales of the gesture scale except for "imitating other adult actions". Fenson et al.

(1993) stress, however, that although an advantage in favor of girls is consistently found in their analyses, the magnitude of the difference is very small. This tendency has not been confirmed by Eriksson and Berglund (1998) on the Swedish data. Moreover, only two subscales "first communicative gestures" and "pretending to be parent" yield a significant effect for gender ($p<0.01$): girls score higher than boys on these scales. The authors explain this effect for "pretending to be parent" by the type of activities contained in this category. In fact, this category focuses on many activities typical of play with dolls. According to them, it is therefore likely that this difference reflects different plays and interests between girls and boys rather than a genuine gender difference in communicative abilities. For the category "first communicative gestures" however, the question remains unanswered.

French data invalidate the well-known claim of a superiority of girls over boys: we notice no difference in terms of total number of gestures according to gender; for some age groups, girls score higher than boys, but for other age groups, the scores are inverted. The more qualitative analysis category per category reveals a different profile for French infants: boys obtain higher scores for "imitating other adult actions", whereas girls score higher for "pretending to be parent". For the second result, we can use the same argument proposed by Eriksson and Berglund. However, for the first one, we cannot argue the same way, insofar as in "imitating other adult actions" the proposed items are not gender specific.

Third, concerning the distribution of gestures per age-range, our data seem to reveal a kind of hierarchy between them: some gestures emerge earlier than others and are more frequently used by children. The two first categories contain items called deictic gestures as opposed to the later ones, which has been called symbolic gestures in the literature. This tendency has also been noticed previously for other languages like Swedish (Eriksson and Berglund, 1998), American English (Fenson et al., 1993 and 1994), Finnish (Laakso et al. 1999) and Italian (Capirci et al., 1996).

Finally, correlation analysis shows stronger positive relationship between gestures and word comprehension than between gestures and word production. Similar patterns have been reported by Bates et al. (1989), Thal & Bates (1988) and Tamis-Lamonda & Bornstein (1990). It would be interesting to compare the evolution of these correlations after 16 months. Capirci et al. (1996) underline indeed the importance of gestures for the transition from one-to-two-word speech. By comparing children at 16 months and 20 months, they show the following tendencies: increase of word number, no difference in terms of number of single words and increase of gesture-word combinations. Unfortunately our methodology is not appropriate to contribute to this discussion.

In the future, we intend to carry out a more qualitative study of our data, that is to say to look closely at each category in order to ascertain the order of gestures emergence. This will be done according to age, sex and educational level of mothers. Moreover, we plan a crosslinguistic and longitudinal comparison based on spontaneous data concerning the development of gestures in children acquiring typological different languages.

Notes

[1] Exhaustive list of gestures included in the FCDI "words and gestures"

Section 1: First communicative gestures
Extend arms to show you something he/she is holding
Reach out and give you a toy or some object that he/she is holding
Point (with arm and index finger extended) at some interesting object or event
Wave bye-bye on his/her own when someone leaves
Extend his/her arm upward to signal a wish to be picked up
Shake head "no"
Nod head "yes"
Gesture "chut" by placing finger to lips
Request something by extending arm and opening and closing hand
Blow kisses from a distance
Smack lips in a "mmmh" gesture to indicate that something tastes good
Shrug to indicate "all gone" or "where'd it go"

Section 2: Games and routines
Play peekaboo (coucou)
Play patty cake
Play chasing games
Sing
Dance

Section 3: Actions with objects
Eat with a spoon or fork
Drink from a cup containing liquid
Comb or brush own air
Brush teeth
Wipe face or hands with a towel or cloth
Put on hat
Put on a shoe or sock
Put on a necklace, bracelet or watch
Lay head on hands and squeeze eyes shut as if sleeping
Blow to indicate something is hot
Hold plane and make it "fly"
Put telephone to ear
Sniff flowers
Push toy car or truck
Throw a ball
Pour pretend liquid from one container to another
Stir pretend liquid in a cup or pan with a spoon

Section 4: Pretending to be parent
Put to bed
Cover with blanket
Feed with bottle
Feed with spoon
Brush/comb its hair

Pat or burp it
Push in stroller/buggy
Rock it
Kiss or hug it
Try to put shoe or sock or hat on it
Wipe its face or hands
Talk to it
Try to put diaper on it

Section 5: Imitating other adult actions
Sweep with broom or mop
Put key in door or lock
Pound with hammer or mallet
Attempt to use saw
"Type" at a typewriter or computer keyboard
"Read" (opens book, turns page)
Vacuum
Water plants
Play musical instrument (e.g. piano, trumpet)
"Drive" car by turning steering wheel
Wash dishes
Clean with cloth or duster
Write with a pen, pencil, or market
Dig with a shovel
Put on glasses

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