Developmental Patterns of Communicative Gestures and Speech in Japanese-Speaking Children

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Abstract: This paper investigated the transitional phases of children's communicative development between their pre-verbal and verbal periods. Children's communicative attempts during interactions with their mothers were identified and the expression of communicative intention was analyzed. The data suggest that during the phases of development children use different communication modalities: gestural and vocal, which are integrated to express their communicative intentions. Qualitative evidence drawn from the data also supports that, at the level of communicative intention, the transition from pre-verbal to verbal communication is continuous.

Key words: Communicative intention; gestures; pointing, pragmatics; early language development

The expression of communicative intention The nature of early communication is pragmatic in that young children use various context embedded ways of expressing what they mean. Preceding the emergence of linguistically well-formed utterances, vocal and gestural modalities are used intentionally to communicate with adults. This has been well recognized in child language research literature (Bates, 1976; Bates, Camaioni, & Volterra, 1975; Bloom, 1983; Coggins & Carpenter, 1981).

Bates *et al*. (1975) examined communicative gestures, particularly pointing, and identified two distinct types of communicative function, namely proto-declarative and proto-imperative pointing. Bates *et al* further argued that communicative intentions expressed by proto- declarative and imperative gestures are the precursors to linguistically expressed statements as well as several forms of directives and requests.

More recently another line of research examining the relationship between gestures and speech (Goldin-Meadow, 2003; McNeill, 1992) suggests that, in general, gestures and speech integrate to make unified meanings. With respect to early communication, Goldin-Medow and her colleagues investigated the development of gestures and speech by focusing on the timing and semantic structure of the two modalities (Butcher & Goldin-Meadow, 2000; Goldin-Meadow, 1998, 2003; Goldin-Meadow & Butcher, 2003; Morford & Goldin-Meadow, 1992). Young children's communicative attempts initially comprised gestures that were independent of any vocal modality. As children start to produce meaningful speech

together with gestures, their gesture-vocal combination, regardless of the meaningfulness of speech, becomes more synchronized than previous communicative attempts. This evidence strongly supports that both gestural and vocal modalities, albeit in different forms of representation, contribute to represent a speaker's intended meaning as a single communication system (McNeill, 1992).

However, other perspectives that view a language as an autonomous system disagree with the idea of continuity between preverbal and verbal communication systems. Dore (1974; Dore, 1975) regards the early expressions of intention as primitive speech acts drawing on the Speech Act theory (Searle, 1969, 1976), and distinguished this stage of communication from those expressed with language proper that incorporates grammatical components for the production of speech acts. Although Dore recognizes that children's early communicative intention is expressed non-verbally, he claims that verbal and pre-verbal expression of communicative intention are fundamentally distinct in nature because those that are expressed non-verbally do not draw on the mechanisms of reference and prediction that are unique to linguistic expressions.

It maybe difficult to accept that language and gesture are parts of the same system with respect to their forms of representation. However, it is possible to consider that, despite different forms of representation, both verbal and non-verbal communicative acts could be derived from the same intention. Moreover the continuity at the level of communicative intention may also involve a more fundamental

level of understanding about how to communicate. For example, by understanding the ways in which different intents can be expressed in different means, even though these expressions may be context-dependent in early stages.

Further support for continuity at the level of communicative intention comes from the observation of early interactive play in which a young child participates in specific interactive formats, such as give-and-take and peek-a-boo. Pre-verbal children's active participation in such interactive activities shows a manifestation of their communicative intention in a contextually-embedded way. Bruner regards young children's understanding of such shared experiences and active participations as a provision for constructing the foundations for verbal communication.

Thus, it is important to view that the transition from pre-verbal to verbal communication involves some kind of continuity. However, the question of continuity still needs to be examined empirically in order to clarify which aspects do or do not support this continuity hypothesis.

This paper examines continuity at the level of communicative intention, in other words, the reason to make a communicative attempt (Chapman, 1981). If the development of a child's communication system is continuous, at least in respect of expressing communicative intention, it is possible to observe a transitional phenomenon, whereby gestural and vocal modalities develop closely to allow a child to express communicative intention.

The present study investigates the expression of communicative intention that was

manifested by the means of vocal and gestural modalities, by drawing on longitudinal data of children's communicative acts. The expression of communicative intention is regarded as a social communicative act that comprises intentional and overt communication of some information to the partner (Ninio & Snow, 1996).

The questions addressed in this study are:

1) How do children's gestural and vocal modalities integrate to express their communicative intention during the transition from pre-verbal to verbal communication?

2) What kind of qualitative evidence is found to support the hypothesis that the same communicative intention is being expressed using different modalities at different developmental points in time?

Method

Participants

10 children (7 males and 3 females) and their mothers living in a town in the Kansai area of Japan participated in this study. Observations were carried out at monthly intervals while they were all attending parent and toddler groups at a community-funded family centre.

The mothers were full-time caregivers to their child and native speakers of Japanese. None of the children were first-born or had any developmental problems. The ages of the children at the onset of the study are given in Table 1. For some dyads, a child's illness or a family holiday prevented them from attending one of their observational sessions.

Procedure

A monthly video recording of the interactions took place at the family centre where the weekly parent and toddler groups were held. Each mother-child dyad was invited into a room where picture books were arranged for book-sharing activities. For the first few sessions, recording started after a few minutes when the dyad had settled into the context. Once recording started, each dyad was left alone so that they could interact freely without the presence of an observer. After 10 minutes of interaction, a box of toys was brought into the room and they were instructed to play with these toys for another 10 minutes. Thus each recording session, comprising two types of interactional contexts, lasted approximately 20 minutes. The picture books used in the book-sharing context contained very few

Table 1　Children's birth order, sex, age and number of sessions observed

Child's ID	Birth order	Sex	Age range during observations (age in months)	No. of sessions observed
A	Second born	Female	12.0 to 22.6	11
B	Third born	Male	12.9 to 23.6	12
C	Third born	Male	13.7 to 24.3	11
D	Second born	Male	13.4 to 24.2	12
E	Second born	Male	13.6 to 24.9	11
F	Second born	Male	14.1 to 24.3	11
G	Second born	Female	14.4 to 25.2	12
H	Second born	Male	15.8 to 26.3	11
I	Second born	Female	12.0 to 23.0	12
J	Third born	Male	13.7 to 23.4	11

words; some of them were designed to elicit play-like activities, such as placing picture stickers within a story context. For the toy play context, the following toys were used: plastic cups and saucers, spoons, forks, plates and a tea pot; miniature fruits and vegetables; a miniature bath tub, a hair brush, a washcloth and a miniature soap bottle; a toy chair and 3 stuffed animals (two bears and a rabbit); a plastic watering can, planting pots and a trowel; a toy car; a towel; a toy telephone and a hand puppet.

One video-recording device (digital wide-angle camera: Sony DCR-TRV20) was used and it was set up in the corner of the room at a height of 1.2 meters. Some recording sessions had to take place at the dyad's homes because of maintenance work at the family centre. However, the same books and toys were used in their homes and there were no identifiable differences in the behaviors observed.

Transcription

Video-taped mother-child interactions were transcribed onto computer files in CHAT formats; the convention of Child Language Data Exchange Systems (MacWhinney, 2000). Transcriptions of video-recordings started when each dyad had settled into the context and began interactions initiated by either member of the dyad. Utterance boundaries were based in turn, intonation contour and pause. Unintelligible utterances were marked following the transcription convention.

Coding of gestural modality

Gestures that met the following criteria were regarded as communicative gestures: gestures that were used with communicative intentions; gestures that are conventional; and gestures that referred to some external object or event (Caselli, 1990). The act of spontaneous object use, such as pretending to drink tea with a toy tea cup, was not included in communicative gestures because this type of behavior does not necessarily convey a clear intention to communicate, other than presenting spontaneous object manipulation by the child. The forms of gestures were classified into six categories: 1) pointing, 2) extending of objects (showing/giving an object), 3) reaching for objects, 4) symbolic gestures that were used like iconic gestures through a child's body enactment, 5) social ritual and routine gestures that are conventionalized through cultural and/or social routine and 6) other gestures that did not fall into the categories above, but were used to indicate communicative intentions. This category included mainly nodding or shaking the head to mean "yes" or "no" and some variations of gestures signifying agreements or refusals.

Coding of vocal modality

Children's communicative attempts by means of vocal modality were also categorized drawing on the Inventory of Communicative Act- Abridged：INCA-A (Ninio, Snow, Pan, & Rollins, 1994). Although detailed coding with reference to a specific communicative intention was not the focus of the current investigation, use of this coding system enabled the differentiation of children's verbal attempts between interpretable and uninterpretable, in a given communicative exchange. Those communica-

tive attempts that were categorized as "uninterpretable" were then called "vocalization", whereas those that were coded as specific categories other than "uninterpretable" were referred to as "speech". When a communicative attempt was made through both gestural and vocal modalities simultaneously within a communicative attempt, these were regarded as a combination of gesture and vocalization/speech. In this way, all communicative attempts were differentiated into the following communication modalities: "gesture", "vocalization", "speech", "gesture-vocalization", and "gesture-speech".

In order to check the accuracy of coding, inter-rater reliability scores were obtained by having a second independent observer code 9% of the entire sets of videotapes, selected randomly from the collection for each dyad. The agreements between two coders were 90% for

the categories of gesture form, and 84% for the verbal communicative acts. Although no calculation was made on the agreements for identifying communicative acts, these agreements provide some indication for the consistency of coding.

Results and Discussions

The developmental trajectory of communication modalities

The rate of each communication modality at each point in time was examined for individual children and the means and standard deviations are presented in Table 2. Overall, the rate of communicative acts involving gestural modality was less than for those involving vocal modalities and accounted for 21% of all communicative acts over time.

Figure 1 presents the mean frequency of the

Table 2　Means and standard deviations for the rates of communicative acts produced in different modalities

| Age in months (N)	Speech only	Vocalisation only	Speech -Gesture	Vocalisation -Gesture	Gesture only
13 (6)	1.066 (0.781)	1.870 (1.098)	0.131 (0.156)	0.191 (0.130)	0.222 (0.121)
14 (9)	1.244 (1.405)	1.481 (0.859)	0.210 (0.251)	0.303 (0.238)	0.375 (0.229)
15 (9)	1.608 (0.984)	1.284 (1.040)	0.252 (0.258)	0.208 (0.170)	0.433 (0.207)
16 (9)	1.931 (1.567)	1.375 (0.711)	0.400 (0.511)	0.284 (0.220)	0.330 (0.221)
17 (10)	2.678 (1.862)	0.825 (0.484)	0.452 (0.359)	0.141 (0.149)	0.304 (0.276)
18 (10)	3.029 (2.794)	0.474 (0.370)	0.466 (0.290)	0.162 (0.298)	0.333 (0.435)
19 (9)	3.789 (2.497)	0.324 (0.223)	0.572 (0.182)	0.204 (0.392)	0.367 (0.427)
20 (10)	5.218 (2.952)	0.376 (0.210)	1.086 (0.523)	0.103 (0.239)	0.295 (0.245)
21 (10)	4.733 (1.996)	0.108 (0.156)	0.588 (0.321)	0.109 (0.240)	0.269 (0.258)
22 (10)	5.226 (2.073)	0.075 (0.133)	1.004 (0.779)	0.059 (0.114)	0.215 (0.209)
23 (10)	5.759 (2.090)	0.058 (0.183)	0.963 (0.532)	0.082 (0.225)	0.144 (0.178)
24 (7)	6.881 (2.672)	0.020 (0.035)	1.173 (0.562)	0.034 (0.058)	0.376 (0.518)
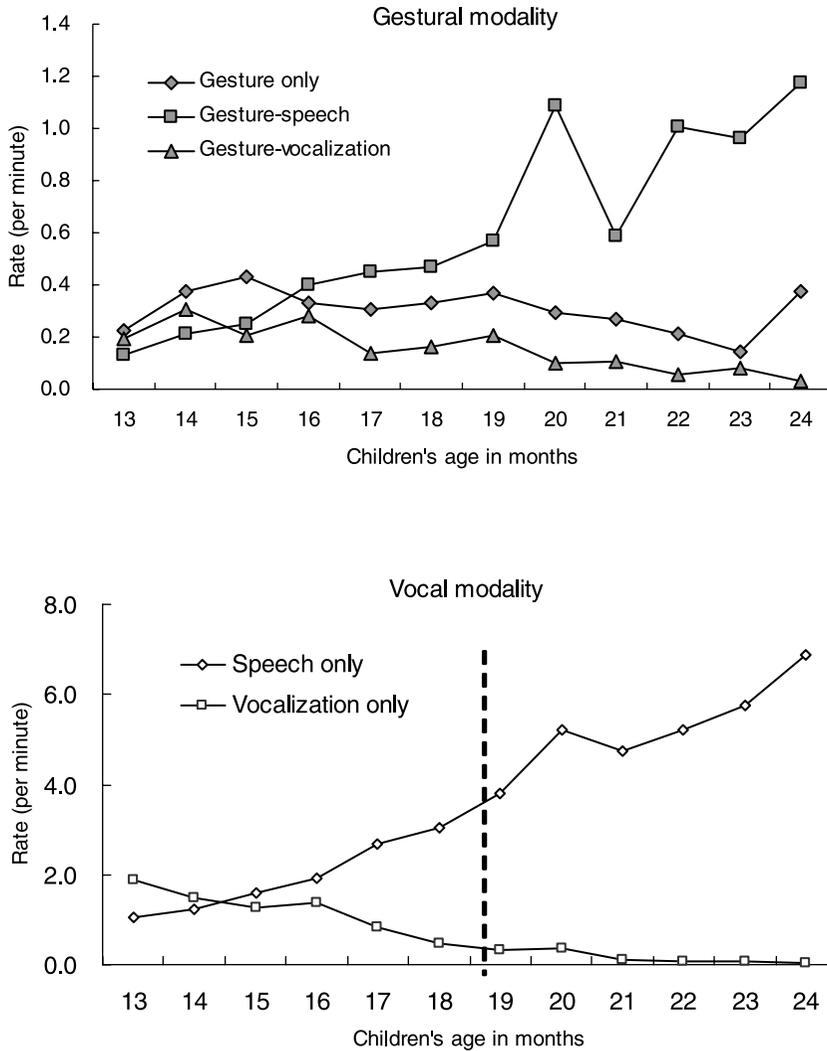
Figure 1   Mean frequency of the children's communicative acts in gestural and vocal modalities over time.

children's communicative acts in both gestural and vocal modalities over time.

The data revealed that there were clear developmental trends for both gestural and vocal modalities. As expected, vocalization decreased and interpretable speech became the dominant vocal domain. In addition, from all the transcriptions of the children's communicative acts, it was possible to identify the emergence of two word speech in their vocal modalities. The mean age of this milestone was 19.7

months (SD＝2.3) and is marked with a dotted vertical line in Figure 1.

As for the gestural domain, those communicative acts produced by gesture alone decreased, whereas combinatorial communicative acts (gesture-vocalization, gesture-speech) increased, and dominated during the latter half of the children's second year of life. When these two modalities are cross-referenced, it is possible to find that the increase of gesture-speech is closely related to the increase in

Child A

Child B

Child C

Child D

Child E

Child F

Child G

Child H

Child I

Child J

speech ◆

vocalization ■

gesture with speech ●

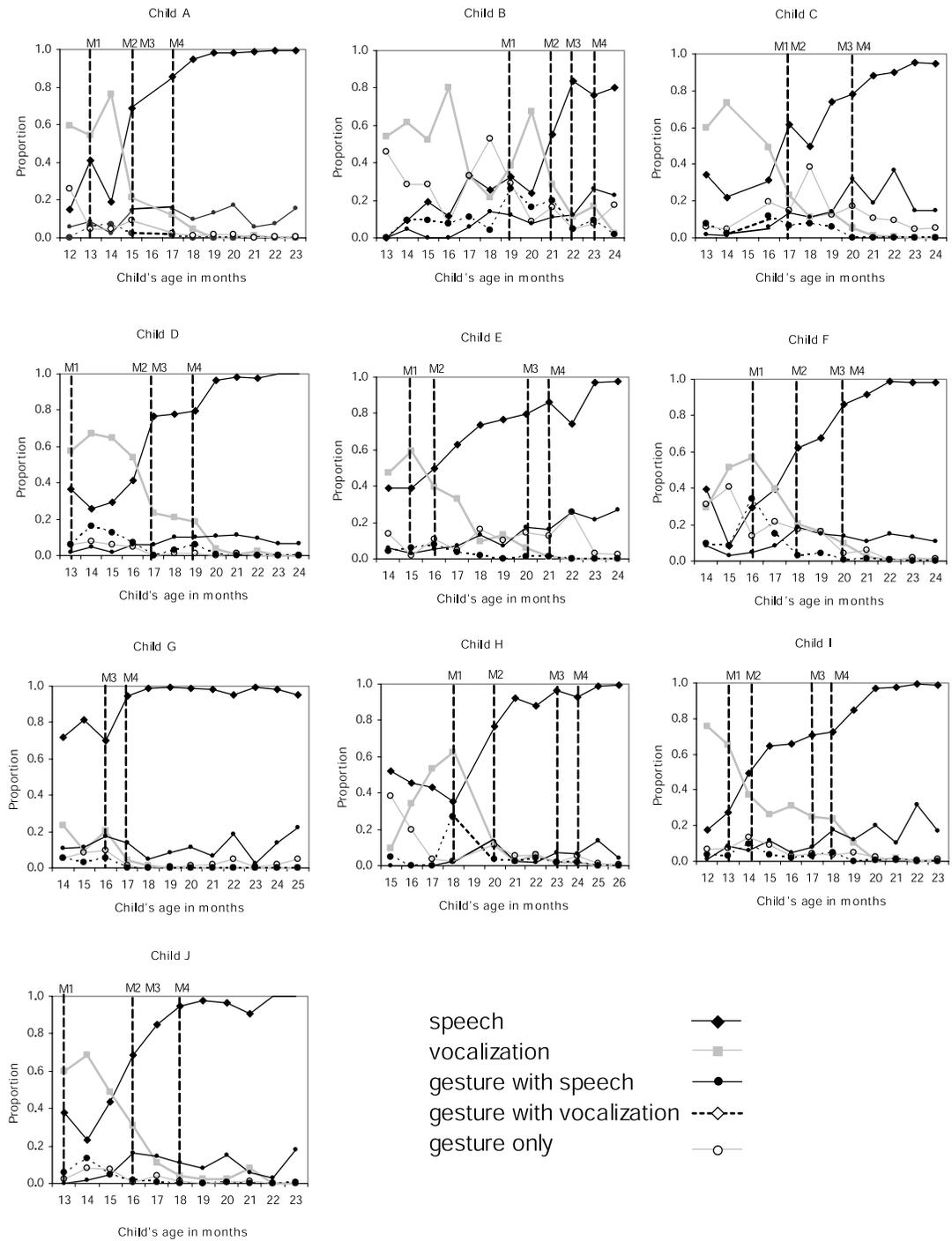gesture with vocalization ---◇---

gesture only ○

Figure 2　Developmental trends of the proportion of different modalities used by
individual children over time

speech. Moreover, regardless of interpretability of the acts in vocal modality, the combinatorial communicative acts were already present at the beginning of the second year. As speech became dominant in children's vocal modality, gesture-speech also became dominant in the gestural modality. From these trends, there appeared to be a possible developmental phase with respect to the integration of these two modalities during the early development of communication. These were: M1) the point when the combination of gesture and vocalization/speech became dominant in the gestural modality; M2) the point when speech became dominant in the vocal modality; M3) the point when the gesture-speech combination became dominant in the gestural modality; and M4) the onset of two-word utterance was first observed in the sessions.

In order to examine individual children's profiles with reference to these developmental milestones, the proportions of different modalities used by individual children at each point in time were calculated. Figure 2 presents the developmental trends for both gestures produced independently and those that were produced in combination with vocal modalities (vocalizations and interpretable speech).

As was inferred from the averaged data, each of the individual children's profiles also confirms to the trend of increasing use of gestures combined with interpretable speech, which dominated during the latter half of the children's second year of life. On the other hand, as one can expect, there was a decreasing trend of using gestures only, as a larger percentage of children's verbal communicative acts became interpretable.

With respect to the integration of gesture and speech, the age at which any combinatorial communicative acts between gestural and vocal modalities began to dominate any of the communicative acts relating to gesture ranged from 13 to 19 months. Similarly, the age at which gestures combined particularly with speech became dominant varied from 15 to 23 months. These results suggest that there are individual differences. However, a close examination of the order of the four developmental points, which were identified in each individual's data, marked as M1 to M4 in Figure 2, suggest that there is a close relationship between these points. A test with Kendall's coefficient of concordance confirmed that there is a significant level of concordance in the order of these milestones: χ^2 (3, N＝10)＝16.27, p<.001. Spearman's correlation analyses also suggest that there are significant relationships between M1 and M3: r_s (8)＝0.93, p<0.001; and M3 and M4: r_s (8)＝0.98, p<0.001.

The results indicate that developmental trends for both gestural and vocal modalities as well as their integration phases are similar, regardless of different rates of development across the children.

Qualitative evidence for gesture and speech integration

The results above suggest that communicative acts produced using different communicative modalities change as children develop. The integration of the gesture and vocal domains happened in a certain order over their development. In order to support the quantitative evidence, the ways in which children produced communicative acts using different

Table 3　Transition from gestures to gesture-speech combinations that were used to express the same communicative intentions at different points in time

Communicative intentions	Illustration of the use of gesture only	Illustration of the use of gesture-speech
Discussing joint focus	(1)　The mother and child B (13;00) are looking at a book. C: **points** at the book then looks at mother. M: "nani kana?" [what are they] looking at child C: opens the book and looks at mother. M: smiling to child	(2)　The mother and child B (18;21) are talking about a picture and a picture sticker in a book. C: **"kore" [this]** + **points** at a different picture M: "kore wa e" [this is a picture]
Negotiating the immediate activity	(3)　The child E (13;18) approaches the mother. C: picks up a teapot then **holds it out** to M M: "ocha(cha) jaa te tsugou ka?" [shall we pour tea into a cup?] pretends to pour tea into the cup.	(4)　The mother and child E (20;00) play at having a tea-party C: **"doozo" [here you are]**+**holds out** the cup to M. M: "jaa to shite" [pour tea into the cup, please].
Marking	(5)　The child I (14;00) picks up a sticker and puts it on the picture book M: " a soko hatta!"[that's it] M: "joozu ya na." [good girl] C: **clapping hands** M: "un."[right] M: "a joozu joozu joozu"[very good]	(6)　The child I (17;00) plays with a miniature teapot. C: "waa!" [oh!] takes a lid off the teapot C: "tore<u>ta</u>(cha)tta."[came off] M: "toretan da"[it came off] C: "waa"[oh!] C: "tore<u>ta</u>(cha)tta." [(it) came off] looks inside the pot and put the lid on. M: aa hamatta hamatta [oh, you've done it]+ clapping hands C: **"yatta!"[(I) did it] + clapping hands** M: a joozu hamatta hamatta [yes, you did it] + clapping hands.

modalities were investigated. How a particular child tried to express the same communicative intention at different times were identified and illustrated in Table 3.

The extracts summarized in Table 3 are typical communicative intentions expressed by all children, although the ways of expression might differ across individuals. For discussing joint focus, children at younger ages used gesture only, and gestures such as pointing were used to refer to an object or an event. As can be seen in the right hand column, at later ages children used gestures as well as speech to express the same intention. The same explanation applies to the intention of negotiating

the immediate activity, in which a child extended an object to the mother to initiate a certain activity.

For both the intentions of discussing joint focus and negotiating the immediate activity, use of gesture-speech combination appeared to show some variations. One type of combination is shown in (2) in Table 3, pointing＋ "kore" [this] denotes the same referent. The other type is that a child's speech and gesture refers to different information such as pointing＋"totte" [give] (child F: 20;12) and pointing＋"shitai" [want to do] (Child D: 21;14).

As for marking of an event or a specific sentiment on an occasion, when a child used

gestures such as clapping hands, the gesture itself means praise. At later ages when a child used gesture-speech combinations, both gestures and speech refer to the same content. Other examples similar to this are the nodding gesture used alone and nodding＋"un" to mean "yes"; and holding up a miniature glass for a toast and the same gesture in combination with the utterance "kanpai" [cheers].

Compared with pointing and extending gestures discussed above, gestures relating to marking seem to differ in terms of the structures to which each modality contributes. This difference may be related to the differences in the nature of those gestures. Pointing and extending gestures are used as deixis where children intend to indicate an object, which eventually requires further information. On the other hand, those gestures that are used to mark the sentiments or the occurrence of an event tend to have pre-assigned meanings that are common to interlocutors. Therefore these gestures do not require further information. Although no further evidence was available from the current analysis to support this speculation, it is likely that gesture types may also be related to how children combine gestures and speech.

As seen in the example extracts, modalities used in the children's communicative acts changed as their ability to speak language proper increased, although what they mean by use of these communicative acts, i.e. communicative intentions, did not differ. However, it is worth noting that this study identified variations in the combinatorial modalities as argued by Morfold and Goldin-Medow (1992). Those combinatorial modalities in which each modality refers to different information could convey more detailed content to the communicative partner even though the fundamental intention is identical. In this respect, the combinatorial modality, gesture and speech, helps the construction of the meaning that might be conveyed using well-formed language later. Moreover, this study confirmed previous findings by Goldin-Medow (Butcher & Goldin-Meadow, 2000; Goldin-Meadow & Butcher, 2003) that the emergence of gesture and speech combination was significantly correlated with the emergence of two-word speech. Taken together with this confirmatory finding, it is possible that gestures play a role in expressing communicative intentions during the transitions to the mastery of language proper.

Summary

Quantitative analyses based on the frequency of different communicative modalities used to express early communicative intentions revealed that there were certain phases of development in the children being observed during their second year of life. As has been indicated elsewhere, the current results also found large individual differences. Despite different rates of development across individuals, a significant concordance in the way in which children increased the use of a particular communication modality provides strong support for the integration of gestural and vocal modalities.

Qualitative evidence provided here also illustrates how these two modalities are synchronized. When children's interpretable communi-

cative intentions expressed in the vocal modality became dominant, they added speech to the gestures that had already existed in their means of communication.

Although the present study has provided some clarification of the transitional phases in greater detail, whether or not the order of developmental points identified here is robust needs to be tested with further data if one expects these milestones to be used for describing finer developmental stages in early communication development. Nevertheless, it is clear that gestures and speech develop closely when young children attempt to express their communicative intentions. The expression of these intentions may be linguistically primitive; nevertheless, these are the manifestation of the motives that subsequently enable young children to learn to use formal language.

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