

Two Papers about Infant Development¹⁾

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Two Papers about Infant Development

In the first paper the author presents his hypothesis about infant development. He claims that the data of his studies are suitable for neither continuity theory nor discontinuity theory. His hypothesis is named the scallop hypothesis in this paper.

In the second paper the author discusses *Interaction*. From the interactional viewpoint we can gain much information about infant-mother relationships. But from the data of his studies the author claims that we can not use the same *Interaction* patterns for both Japanese infant-mother relationships and American infant-mother relationships.

I. The scallop²⁾ hypothesis about infant development

1. Two theories of human development

There are many theories of human development. But we can combine them into two large groups, continuity theories and discontinuity theories. Shaffer (1979) describes them as follows: "Continuity theorists view development as an additive process that occurs in small increments without sudden changes in behavior. They describe the course of development with a relatively smooth growth curve (pp. 15-16)." "In contrast, discontinuity, or 'stage' theorists argue that the developing child proceeds through a series of abrupt changes (p. 16)." And he says social-learning theory is one example of continuity theories, and psychoanalytic and cognitive-developmental theories are examples of discontinuity theories. After that he claims that both of these approaches are correct, because "continuity theorists and discontinuity theorists emphasize different aspects of development (p. 17)." Can we agree with him?

2. From the author's studies

The author has been studying the development of social behaviors in infancy. All of his studies are longitudinal studies. One trait of his studies is to group many behaviors in categories of 'social behavior' or 'non-social behavior'. 'Social behavior' is defined as behavior toward someone while looking at him. For example, to smile at someone is called 'Social Smile'. 'Non-social behavior' is not a true name of behavior, but only the name of a category exclusive of 'social behavior'. So, to smile at an object is called 'Smile'. From this viewpoint we can study the social development of infants not by single manifestations of behavior but by multiple behaviors. The merit of this approach is shown by Lewis & Starr

(1979): "The utilization of single responses in exploring continuity is filled with risks (p. 661)."

Under continuing studies the author thought again and again that the development of infants is neither monotonous as in continuity theory nor progressing in fixed patterns as in discontinuity theory. It is more dramatic and dynamic! There are many results supporting this.

Before showing the results, the methods of the studies will be summarized:

Study 1: Subjects were two institutionalized infants (A. N.: girl, M. S.: boy). Observations of them were continued during their first year of life twice every week.

Study 2: Subject was one home-reared boy (T. M.), and observations of him were the same as Study 1.

Study 3:³⁾ Subjects were fourteen home-reared infants (8 boys and 6 girls), and observations of them were continued from one-month-old to 24-months-old once per month.

(1) Percentage of social behavior⁴⁾

Table 1 shows the percentage of social behavior in Smiles (includes Laughs) at each month of age. The desired percentage is calculated by $(\text{Social Smiles}) / \{(\text{Social Smiles}) + (\text{Other Smiles})\} \times 100$. The percentage of Social Smiles increased dramatically at 3 months of age.

(2) Socialization curve⁵⁾

In Studies 1 and 2 two infants' first appearances of social behavior were compared. In Figure 1, the horizontal axis shows the first appearances of T. M.'s behavior in terms of weeks of age, and the vertical axis shows those of A. N. (represented by solid marks in the figure) or M. S. (represented by blank marks in the figure). Soc. Pre. means Social Prehension; Soc. Negaeri, rolling over towards a person; Soc. Cre., Social Creeping; Cling, clinging to a person; and Imi., Imitation. If all the marks were to be joined by a curve line, it would be called a Socialization curve.

Table 1 Percentage of Social Behavior

Months	Study 1 (A.N.)	Study 3*
0	0.0	—
1	8.7	30.2
2	42.9	63.3
3	72.0	82.3
4	51.2	93.9
5	86.4	94.1
6	76.3	98.1
7	93.8	98.3
8	85.0	93.2
9	82.2	96.2
10	90.9	94.9
11	100.0	95.4
12	—	95.9

* fourteen infants

From Figure 1 we find 30 weeks of age to be a critical point in development. After 30 weeks of age the development of a home-reared infant overtakes and surpasses the development of institutionalized infants.

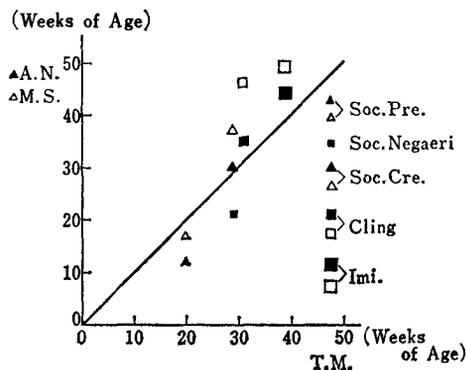


Figure 1 Socialization curve

(3) The emergence of Formal Communicating Behavior

In the early period of infancy we can describe infant's be-

havior with our two categories, 'social behavior' and 'non-social behavior'. But at about 7 or 8 months of age we can find different kinds of behavior in almost all infants. They are 'Pointing', 'Presenting', 'Showing' etc. For example, one infant points at a toy car. He looks at a toy, so we can not call this behavior 'social'. But we can understand that he wants to communicate with someone by this behavior. So we can not call it 'non-social' behavior. We made a third category of infant behavior, 'Formal Communicating Behavior (FCB)'.

Figure 2 shows one boy's appearances of 'Pointing (plus Presenting)' in Study 3. There is nothing before 7 months of age, and after 8 months of age we can find a sharp curve line indicating increases of these behaviors.

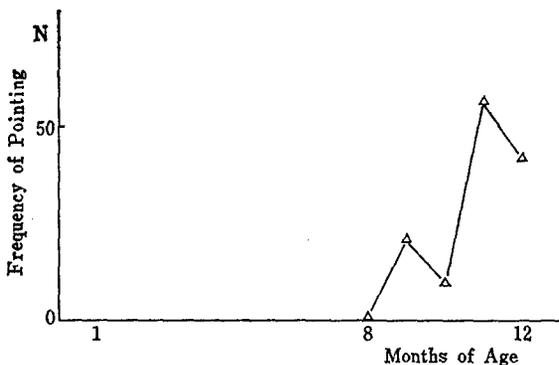


Figure 2 The results of Pointing

(4) Development of 'Verbalization'

We are now considering whether we can include 'Verbalization' in 'FCB' or not. In the second year of life we can say that the development of an infant is determined by 'Verbalization'. But we can not describe clearly the origins of 'Verbalization'.

Figure 3 shows one girl's appearances of 'Verbalization' in Study 3. There are dramatic increases after 20 months of age.

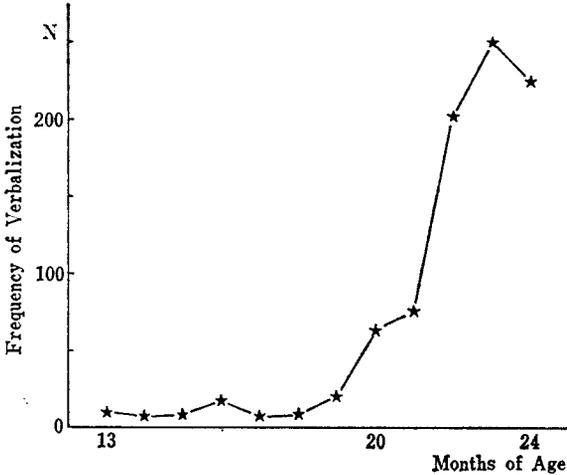


Figure 3 The results of Verbalization

3. The scallop hypothesis about infant development

In the paper presented at the 22nd International Congress of Psychology in Leipzig (Kawakami 1980), the author showed his hypothesis about development of social ability in infancy as Figure 4. Now he can extend it to 24 months of age as Figure 5. His hypothesis can be included neither with continuity theories nor

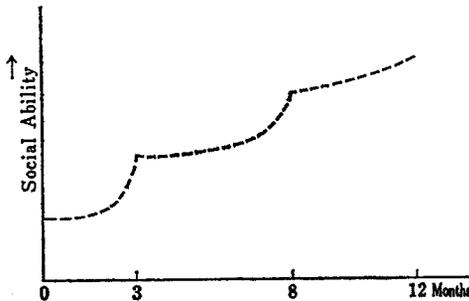


Figure 4 The author's hypothesis I

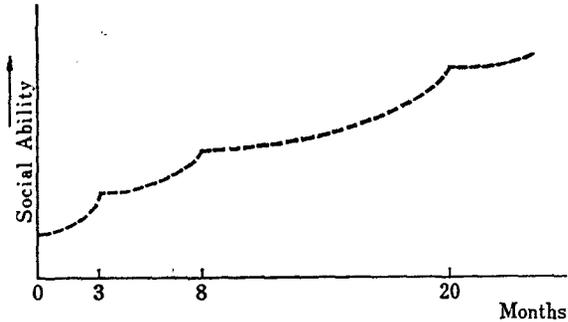


Figure 5 The author's hypothesis II

discontinuity theories of human development.

Why have there been only two theories until now? The author thinks the reasons can be explained by Figure 6. Three curves show three infants' development (A, B, and C). The development of A is faster than B and C. The dots in the figure show the average scores of three infants. We can understand these dots show a linear line after some period. So when we consider the development of infants by average scores, it will be like a continuity theory. The dynamic changes of development are hidden by that approach. Next, if we observe infants only at two time points (T1

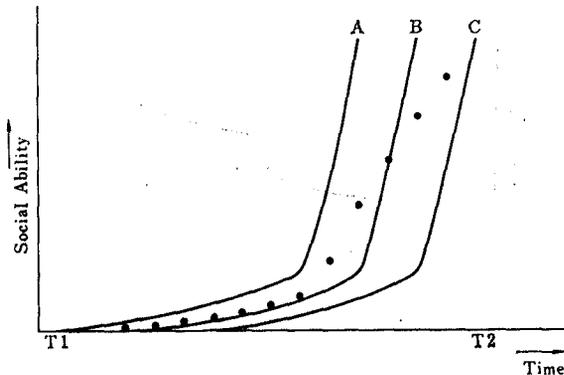


Figure 6 Models of development

and T2), we will think the development of infants is like discontinuity theory. The process of development must be neglected by that approach. As Lewis and Starr (1979) say, "the choice of time frames in which observations take place will affect assessment of continuity and discontinuity (p. 655)."

In conclusion, the author wants to claim two things. First, when we use the technics of longitudinal study in detail, we can understand that discontinuity theory is not suitable to the true development of infants. Second, when we analyze case results in detail, the development of infants is more dramatic than the gradual changes indicated by continuity theory. So, the author presents his scallop hypothesis about infant development here.

Footnotes

- 1) These papers were presented at Professor M. Lewis's seminars in Japan, the first paper in Sapporo and the second in Tokyo. The author thanks Professor Lewis for his very important and kind comments. The author can not make full use of his comments now, but will do so in the future. The author thanks also Professor K. Miyake & Professor K. Takahashi for giving him the opportunity to make these presentations, and Dr. T. Yanaihara for his assistance with Study 5. The author dedicates these two papers to our charming babies and their kind parents.
- 2) This name was suggested by Professor Lewis.
- 3) This study was done with Y. Kanaya (Keio Univ.), O. Suda (Toyoko Gakuen Women's Junior College), and K. Takai (Japan Women's Univ.).
- 4) cf. Kawakami (1980).
- 5) cf. Kawakami (1980).

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II. Can we use *Interaction* to describe Japanese infant-mother relationship?

— The results of three studies —

1. Introduction

In this paper the author wants to describe *Interaction*. As shown in the first paper, the author had been studying the development of social behaviors in two institutionalized infants (Study 1), one home-reared infant (Study 2) and 20 sets of twin infants (This study is not referred to here. cf. Suda & Kawakami 1980). At that time the author saw a paper written by Lewis & Lee-Painter (1974)—An Interactional Approach to the Mother-Infant Dyad—, and he learned the importance of *Interaction*, behaviors exchanged between two (or more) persons. Then the author started Study 3 referred to in the first paper.

We can learn about the development of infant behaviors from the frequency of behaviors during observation sessions. But we can gain much more information when we take an interactional viewpoint as described in Lewis & Lee-Painter. For example, we can know the different aspects of various forms of behavior from this viewpoint, because "Observation of infant behaviors indicates that smiling occurs most in interaction. . . . The next highest interaction is vocalization. (Lewis & Lee-Painter p. 36)"

The author agrees with Lewis & Lee-Painter that "Frequency of occurrence, interaction direction density, and sequence must all be incorporated for us to understand truly the dynamics of the interaction (p. 45)." But the author always takes the approach that frequency analyses are the first step, and the interactional analyses the second, because his main interest is the development of infant behaviors.

2. The results of Study 3¹⁾

The author wants to use Study 3 as a comparative study with Studies 4 & 5, so the results from the interactional analyses will be presented later. Here, the other results will be summarized.

(1) The developmental changes of behaviors

As shown in the first paper we can describe infant behavior with our two categories — 'social behavior' and 'non-social behavior' — in the early period of infancy. But from about 7 or 8 months of age we need to use the third category 'Formal Communicating Behavior (FCB)'. Figure 1 shows our hypothesis about the development of behaviors during the first year of life. We can not claim that 'FCB' comes from 'social behavior' or 'non-social behavior' at this point. So they are connected with dotted lines. After the emergence of 'FCB', it becomes the main category of infant behaviors.

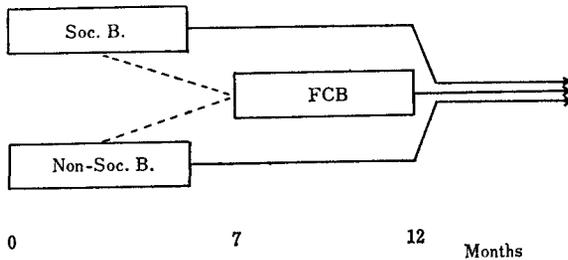


Figure 1 The developmental hypothesis

In the second year of life the development of 'Verbalization' is remarkable. We can not determine whether we can include 'Verbalization' in 'FCB' or not, as referred to in the first paper.

(2) The dynamic changes of development

The first paper's main theme is the dynamic changes of development, and many results which support it are included. Here, the author wants to add one further point.

During two years some infants in Study 3 showed dynamic changes of development. The development of one female infant (subject number 13) was slow in the first year of life. For example, her average frequency of 'Social Vocalization (SV)' during the first year of life was the 13th among fourteen infants. But the development of Sub. 13 in the second year of life was remarkable. For example, her average frequency of 'Verbalization (Verb.)' during the second year of life was the 6th among thirteen infants (one subject was dropped in the second year). Figure 2 shows the development of Verb. of Sub. 13. From Figure 2 we can expect the development of Sub. 13 will be continued in the third year of life.

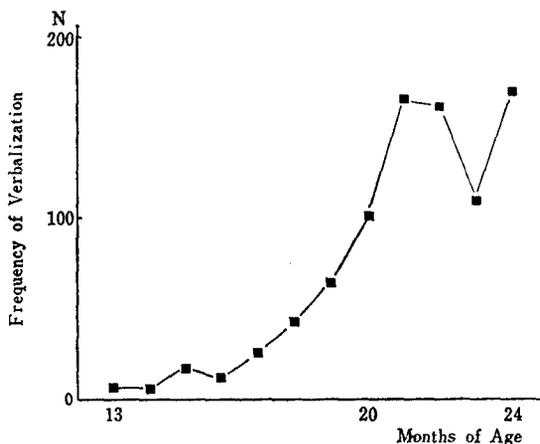


Figure 2 The results of Verbalization

(3) Analyses of terms of address

At two-years-old we asked our thirteen subjects' mothers how many terms of address they could use (Kawakami et al. 1982). Terms of address means 'Mama' for the mother, 'Mi-chan' for the friend, etc. We presented eleven categories for the mothers to

remember easily. The categories were 'Self', 'Mother', 'Father', 'Grand Mothers', 'Grand Fathers', 'Aunts', 'Uncles', 'Cousins', 'Other Children', 'Other Adults', and 'Toys (e.g. Snoopy. Excluding pets.)'. We call the first ten categories 'Human Calling Names (HCN)' and the last one 'Object Calling Names (OCN)'. When a child can use a term of address as a proper noun, we count it one point; if not as a proper noun, a half point. For example, 'Oba-chan (Japanese term for an adult woman)' is 0.5, and 'Mi-chan Oba-chan (meaning Mi-chan's mother)' is 1.

From this research we have some interesting results. First, the average number of HCN of girls was larger than that of boys. And in girls the number of female HCN was larger than male HCN. Second, Kendall's rank correlation coefficient between the numbers of HCN and those of OCN was significant ($P < .05$). Third, we find large individual differences. Figure 3 shows the results of two subjects (Sub. 7 & Sub. 13). A straight line rectangle means male and a dotted line rectangle, female. The number of lines between self and others is the number of HCN. A straight line is counted one point, and a dotted line a half a point.

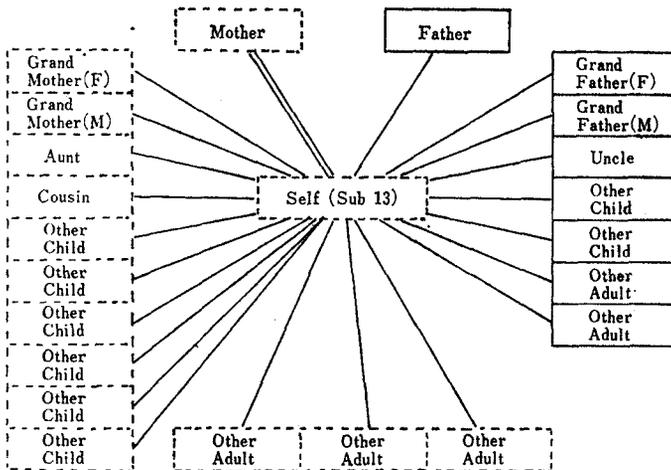


Figure 3 a Social network

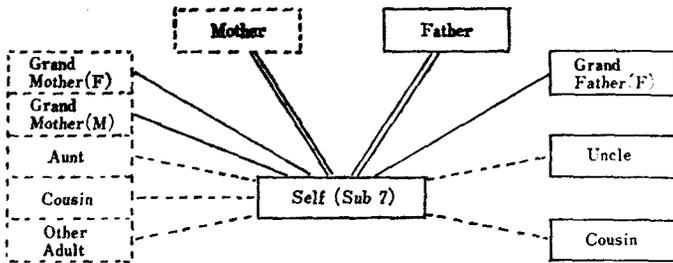


Figure 3 b Social network

We think these differences show the different social worlds in which children have been living. The author thinks these results manifest the 'Social Network' described by Lewis & Feiring (1979).

3. The results of Study 4²⁾

At about three-years-old two of our subjects in Study 3 (both female) had a younger sister. We wanted to know the differences between the first born infant-mother relationship and the second born infant-mother relationship. So, we are now continuing observations of the second born infant-mother relationship by the methods of Study 3. When comparing these two studies we have to pay attention to several points. There was no child in the first born infants' house, but this is not true for the second born infant. And their mothers have become more and more friendly to us (observers).

For exact comparisons the following method of data analyses are adopted. Observation time is 90 minutes per month. In our observation sheet 10 seconds is one unit. So we have 540 units per month. When the infant falls asleep, we continue observations. But sleeping units are omitted here. Then we use the following formula to get the exchange scores:

$$x = \frac{\text{Frequency}}{540 - \text{Sleeping units}} \times 1000$$

This exchange score means the frequency if 1000 units observations were made. We use this exchange score in the following in order to establish comparisons from one study to another.

We are continuing Study 4 now. So only the results from one-month-old to six-months-old will be analyzed here.

We call the first born infant A and the second born infant B. The four subjects in this study will be called Sub. 6A, Sub. 6B, Sub. 13A, and Sub. 13B.

(1) Comparisons in frequency of behaviors

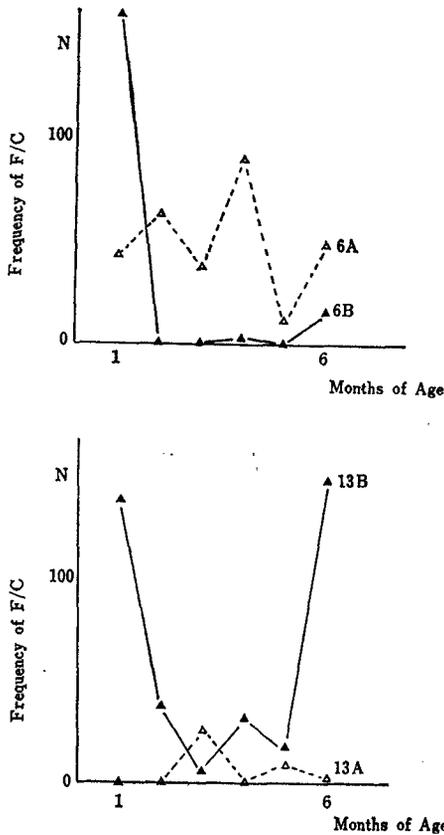


Figure 4 The results of F/C

Here, we want to discuss only seven types of infant behavior and four of caregiver's behavior. They are 'Vocalization(V)', 'Social Vocalization(SV)', 'Smile(S)', 'Social Smile(SS)', Laugh (L)', 'Social Laugh(SL)', and 'Fuss or Cry(F/C)' for infant, and 'Caregiver's Vocalization(CV)', 'Caregiver's Smile (CS)', 'Caregiver's Laugh(CL)', and 'Caregiver's Touch(CT)' for caregiver.

First, we want to consider infant behaviors. The frequency of F/C of Sub. 6A is higher than Sub. 6B. And the frequency of F/C of Sub. 13B is much higher than Sub. 13A. Figure 4 shows these differences.

We can not find any differences in other infant behaviors.

In caregiver's behaviors Sub. 6A received more CV and CT than Sub. 6B. And Sub. 13B received more CS and CT than Sub. 13A. But the reverse is true in CL. Figure 5 shows one sample of these differences.

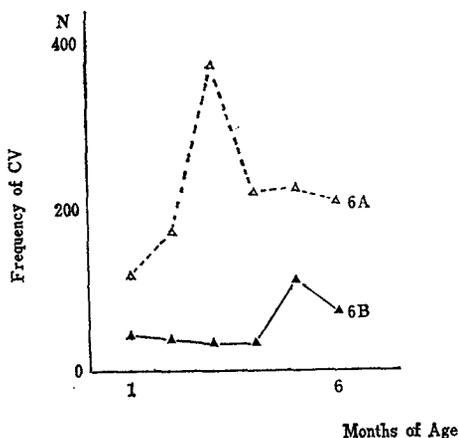


Figure 5 The results of CV

In short, infant who F/C more received more caregiver's attention expressed by behaviors.

(2) Comparisons in interaction

Here, we consider sixteen kinds of interaction. SS and SL are not observed many times, so they are combined. The same thing is true for CS and CL. We describe interaction as $V \rightarrow CV$, here V is the initiator and CV is the responder. Table 1 shows sixteen kinds of interaction. The right group is initiated by the caregiver and the left group is initiated by the infant.

Table 1 Interactions Analyzed Here

Initiated by Infant	Initiated by Caregiver
$V \rightarrow CV$	$V \leftarrow CV$
$V \rightarrow (CS + CL)$	$V \leftarrow (CS + CL)$
$SV \rightarrow CV$	$SV \leftarrow CV$
$SV \rightarrow (CS + CL)$	$SV \leftarrow (CS + CL)$
$(SS + SL) \rightarrow CV$	$(SS + SL) \leftarrow CV$
$(SS + SL) \rightarrow (CS + CL)$	$(SS + SL) \leftarrow (CS + CL)$
$F/C \rightarrow CV$	$F/C \leftarrow CV$
$F/C \rightarrow (CS + CL)$	$F/C \leftarrow (CS + CL)$

Figure 6 shows one of the results of interaction. Here, the infant's F/C is the initiator and CV is the responder. We can say that without exception the frequency of this interaction of Sub. 6A is higher than for Sub. 6B. And the frequency of this interaction of Sub. 13B is higher than for Sub. 13A.

Figure 7 shows the results of $V \rightarrow CV$ interaction by Sub. 6A and 6B. Beginning with 3-months-old, the frequency of Sub. 6A is higher than that of Sub. 6B.

We can find the same results in interaction SS plus SL as initiator and CV as responder in Sub. 6A and 6B.

But there are no clear results in interaction initiated by caregiver's behaviors.

After all we have the same results in comparisons of both frequency and interaction.

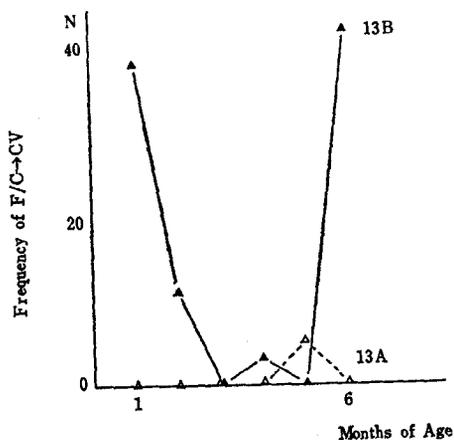
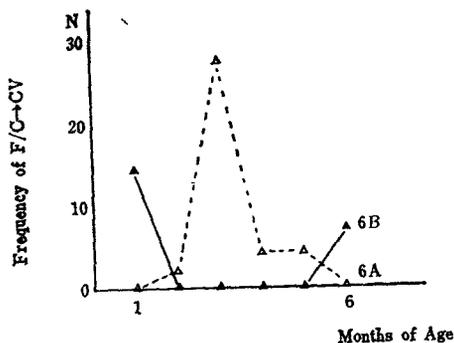


Figure 6 The results of F/C → CV

(3) Summary

So far we have only two cases, but here we can say that the birth order is not an important factor when considering infant-mother relationship. The tendency of F/C is a more important factor.

In comparisons of interaction we find the differences in interaction initiated by 'non-social behavior' except SS plus SL. The

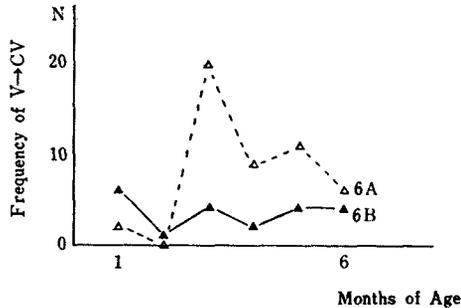


Figure 7 The results of V → CV

author thinks that the two mothers of this study attend carefully to infant behaviors, especially to behaviors by infants who express displeasure frequently.

So, we can say that to take an interactional viewpoint is beneficial in Study 4.

4. The results of Study 5³⁾

From the results of Studies 3 & 4 the author thinks *Interaction* is important to describe the infant-mother relationship. We then ask, is this true universally, because we know from cross-cultural studies that there are many differences in infant-mother relationships. This is the first premise of Study 5.

Second, we have been using three categories — ‘social behavior’, ‘non-social behavior’, and ‘formal communicating behavior’ — to describe infant’s behaviors. Can we use these categories for non-Japanese infants? For instance, the author has been studying the development of Japanese infant’s behaviors for a long time. He found again and again that infants at an early period fix their eyes on other’s eyes but after 5 or 6 months of age they do not do so. Japanese adults have the social convention that to fix our eyes on other’s eyes for a long time is not good. Is the origin

Table 2 The results of Studies 5 and 3

		STUDY 5				STUDY 3			
		N	Σ	SD	ES	N	Σ	SD	ES
1M	CV	3	144	29.13	227	9	530	37.03	200
	CL	3	7	0.47	11	9	53	5.55	20
	CS	3	3	0.82	5	9	7	0.79	3
	CT	3	444	52.94	701	9	1741	151.70	657
	V	3	64	15.41	101	9	145	16.34	55
	SV	3	0	0.00	0	9	22	3.27	8
	S	3	0	0.00	0	9	0	0.00	0
	SS	3	0	0.00	0	9	9	2.49	3
	L	3	0	0.00	0	9	1	0.31	0
	SL	3	0	0.00	0	9	4	0.96	2
F/C	3	127	25.33	201	9	371	29.84	140	
2M	CV	2	169	41.50	202	10	799	31.47	224
	CL	2	5	1.50	6	10	79	7.63	22
	CS	2	1	0.50	1	10	34	3.53	10
	CT	2	391	46.50	467	10	1433	59.77	403
	V	2	5	0.50	6	10	134	9.38	52
	SV	2	2	0.00	2	10	230	23.26	65
	S	2	2	1.00	2	10	2	0.40	1
	SS	2	7	3.50	8	10	24	3.93	7
	L	2	0	0.00	0	10	0	0.00	0
	SL	2	0	0.00	0	10	0	0.00	0
F/C	2	20	4.00	24	10	421	52.93	118	
3M	CV	3	223	44.50	344	13	1221	45.51	228
	CL	3	11	2.87	17	13	109	6.98	20
	CS	3	11	5.19	17	13	63	5.02	12
	CT	3	484	106.55	746	13	1915	67.49	357
	V	3	16	3.40	25	13	380	20.08	71
	SV	3	29	7.36	45	13	308	27.76	57
	S	3	1	0.47	2	13	15	1.99	3
	SS	3	9	3.56	14	13	104	12.11	19
	L	3	0	0.00	0	13	1	0.27	0
	SL	3	0	0.00	0	13	5	0.84	1
F/C	3	21	5.35	32	13	369	22.47	69	

N: number of subjects Σ : Total of frequency SD: Standard deviation
 ES: Exchange score 1M-3M: Months of age

of this habit in the period of infancy? The author will watch for this point particularly when observing non-Japanese infant behaviors.

From the points described above we have started a new study on the development of infant behaviors in American families. Subjects are only three infants now, living in Tokyo. Their parents were born in the United States and have lived for a long time in the U.S.

The methods of this study are the same as in Study 3 except for observation time, which is 60 minutes. So exchange scores are again used in this study.

Study 5 is just started. So we can analyze and compare only the data of the first three months.

In the following, Japanese infants mean the subjects of Study 3 and American infants, those of Study 5.

(1) Comparisons in frequency of behaviors

Table 2 shows the results of Studies 5 & 3. From Table 2 we can say the following things.

In infant's behaviors there are no clear differences between Japanese and American infants except SV. Figure 8 shows the

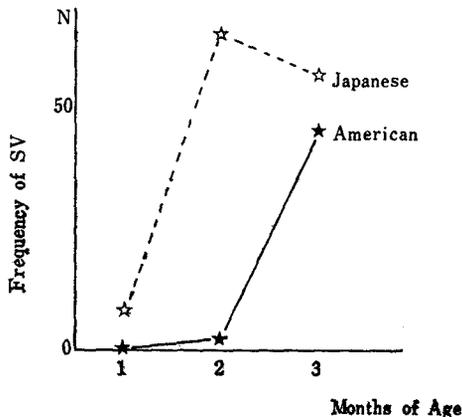


Figure 8 The results of SV

results of SV of Japanese and American infants. Japanese infants express more SV than American infants.

In caregiver's behaviors the frequency of CT by American mothers is higher than that by Japanese as is shown in Figure 9.

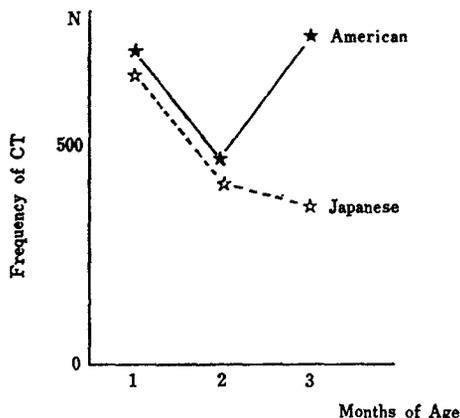


Figure 9 The results of CT

But the frequency of CL by Japanese mothers is higher than American.

So we can not say anything significant from these comparisons in frequency.

(2) Comparisons in interaction

There are only a few differences in interaction, also. But from these we can find very interesting things.

First, Figure 10 shows the results of interaction initiated by F/C and responded to by caregiver's behaviors (CV or CL). There are more interactions in the Japanese infant-mother dyads than in the American. The author thinks this is one of the remarkable differences from his impressions during observations. The Japanese mothers respond quickly to infants' F/C, but the American mothers do not always respond to it.

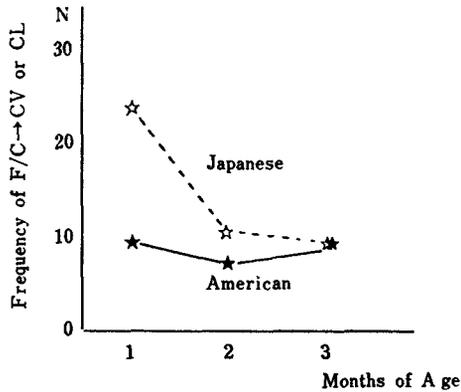


Figure 10 The results of F/C \rightarrow CV or CL

Second, in Study 3 we sometimes could not differentiate whether the initiator was the infant or the mother. At that time we recorded it using the mark \leftrightarrow . But in Study 5 this mark is not needed. We can explain this easily, because in the American infant-mother dyads interactions are very clear, but they are not so clear in the Japanese.

(3) Discussion

As described above, there are a few differences in the results of Studies 3 & 5 so far. But the author thinks there are many more differences between them in reality. Why can not we find them?

First, the author thinks more refined methods of observation are necessary. There are differences of interactional strength in Studies 3 & 5. Interactions by American infant-mother dyads are stronger than in Japanese. It may be possible to record these differences using different marks. For example, strong interaction recorded by a \Rightarrow , and weak interaction by a \rightarrow etc. The author thinks these differences correspond with direct and indirect interactions as described by Lewis & Feiring (1981).

Second, in the above analyses we do not consider the positions of the infant and mother. Most interactions by American infant-mother dyads have a face to face position. But this is seldom the case in the Japanese dyads.

Third, the number of cases is too few and the period of observations is too short. So the author hopes we will be able to have more clear data in the future.

- (4) Can we use *Interaction* to describe the Japanese infant-mother relationship?

When we considered the results of Studies 3 & 4, we thought *Interaction* was important. But here, do we think so again? Partly yes, and partly no. From the interactional viewpoint we can know the differences between infant-mother relationships of the first-born and those of the second born; and it seems as if we can also know the differences between Japanese infant-mother relationships and American infant-mother relationships. But in reality we can not use the same *Interaction* patterns for both Japanese infant-mother relationships and American infant-mother relationships. It is necessary to make better methods to describe *Interaction* more accurately.

Footnotes

- 1) The methods of this study can be found in the first paper.
- 2) This study is continuing with K. Takai (Japan Women's University).
- 3) This study is continuing with S. Iwatate (Gakushuin Univ.), Y. Kanaya (Keio Univ.), S. Shigemune (Sophia Univ.), K. Takai (Japan Women's Univ.), and M. Takeuchi (Tokyo Metropolitan Univ.).

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