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THE TWO-MONTH & THE NINE-MONTH REVOLUTION VS. THE SCALLOP HYPOTHESIS IN INFANT DEVELOPMENT

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Abstract

Two viewpoints on infant development, Rochat's 'Two-month and nine-month revolution (2001)' and Kawakami's 'Scallop hypothesis (1989)' are compared. Developmental turning points are consistent within them, but the aspects of changes are not. New data, which will support the 'Scallop hypothesis', are presented in this paper.

1. Scallop hypothesis

Fifteen years ago I published a book entitled "Social relationships in infancy" (Kawakami, 1989). In the book, I presented the 'Scallop hypothesis'[1] on social development in infancy. Figure 1 shows the hypothesis. An infant's social development has three dynamic turning points (3, 8, & 20 months). In Figure 1, I stress two points. At birth, infants might have some abilities already. So, the line does not start from zero in the vertical axis. And infants' social development might be different among individuals, so the dotted line is used.

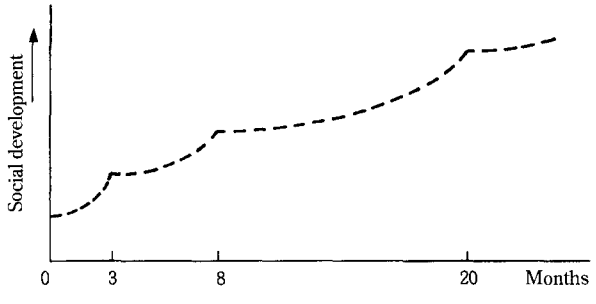

Figure 1 Scallop hypothesis

First, I will present the data which led to this hypothesis. I observed 3 infants 150 minutes per week during their first year. And my colleague and I observed 20 sets of twins 1 hour every 2 months during their first year and 1 hour every 3 months during their second year. We had determined observational indexes. In our observational indexes, there were 2 big clusters: social behaviors and non-social behaviors. Social behaviors

[1] This name was suggested by Michael Lewis.

mean 'behaviors occurring while looking at someone'. The percentages of social smiles among all smiles (almost all non-social smiles were 'spontaneous smiles') became larger from about 3 months of age. Table 1 shows the percentages of social smiles among all smiles.

Table 1 Percentages of social smile

name / month	A.N.	M.S.	T.M.
0	0.0		
1	8.7	0.0	
2	42.9	16.7	
3	72.0	10.3	72.4
4	51.2	44.0	91.9
5	86.4	44.2	100.0
6	76.3	85.0	97.8
7	93.8	100.0	100.0
8	85.0	100.0	94.9
9	82.2	91.7	94.1
10	90.9	81.8	93.3
11	100.0	100.0	90.3
12			96.9

We observed 13 infants 1 hour per month during their first 2 years. As noted above,there were 2 big clusters in our observational indexes: social behaviors and non-social behaviors. But from about 8 months of age, we should add the third type of behavior. For example, infants began to present 'pointing' & 'showing'. When an infant points at something, she/he mainly watches something. So we can not count it as a social behavior. But the infant wants to communicate with someone. So we do not want to count it as a non-social behavior. We made the third cluster of infant behavior: Formal Communicating Behaviors (FCBs). Figure 2 shows the results of 'pointing' plus 'showing' in one male (only in his first year).

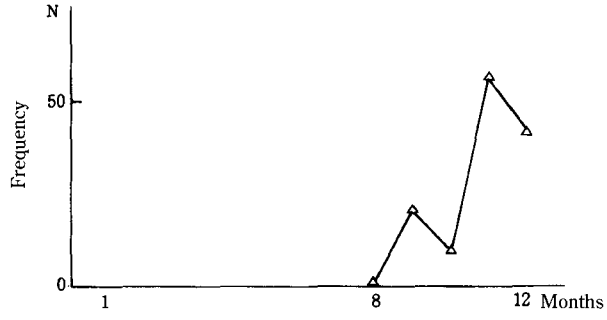

Figure 2 Development of pointing & showing

Figure 3 shows the results of 'verbalization: vocalization with meaning' of one

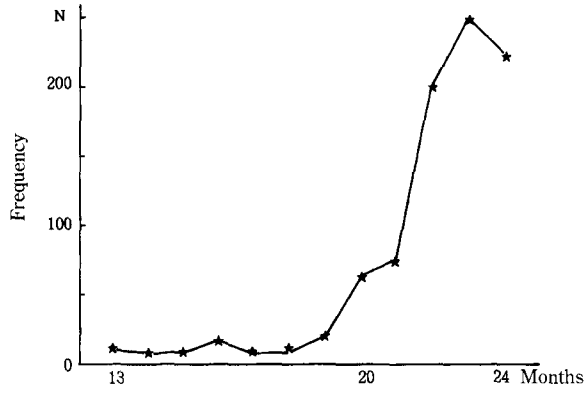

Figure 3 Development of verbalization

female (one of 13 participants in our study) in her second year. The frequencies of her 'verbalization' changed suddenly after 20 months.

Scallop hypothesis (Figure 1) is based on the data in Table 1, Figure 2, and Figure 3. What is an important point in this hypothesis? There are two types of theory in human development according to Shaffer (1979). They are continuous theories and discontinuous theories. For example, social learning theory is a typical type of the former and Piaget's cognitive development theory is the latter. Kawakami (1989) explained that the Scallop hypothesis integrates continuous and discontinuous theories according to Figure 4. In Figure 4, A to C are developmental traces of individuals according to the Scallop hypothesis. Black triangles show the means of A, B, and C. When a researcher fixes her/his viewpoints at T1 and T2, she/he will have data like a discontinuous theory. But when he/she gets only averaged data, he/she will think of development as like a continuous theory. When we pursue the developmental changes individually and longitudinally, we will see them like a Scallop hypothesis.

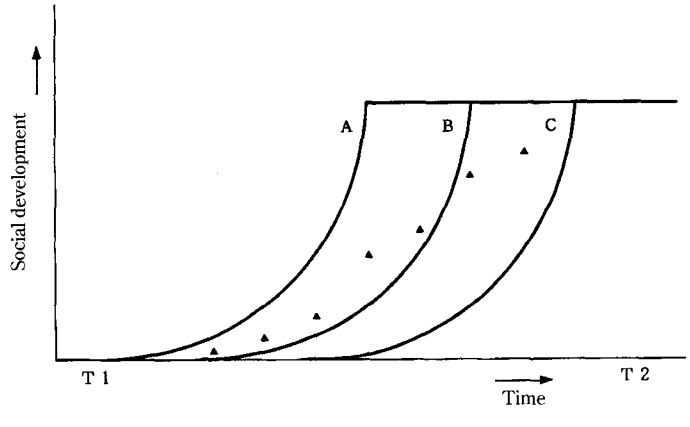

Figure 4 Models of development

Using smiling responses, Spitz (1965) described 3 points at which developmental changes emerged : 3-month, 7.5-month, and 14-month. These 3 points are very close to the Scallop hypothesis. Around eight months of age has been recognized as the important turning point in infant development by several researchers. Piaget (1953) thought infants have 'indication : a perceptible fact which announces the presence of an object or the imminence of an event (p.192)' from this age; Campos & Steinberg (1981) claimed the beginning of 'social referencing' behavior around here, and many researchers have been finding the phenomenon named 'joint attention' at this age (Moore & Dunkam,1995). And Lewis & Brooks-Gunn (1979) showed infants establish 'self recognition' by 21 months. As exemplified above, each turning point (3, 8, & 20 months) has been admitted as important by many researchers. We will see the new theory in the next section.

2. The Two-Month & the Nine-Month Revolution

Rochat (2001) reviewed the controversies on continuous and discontinuous theories in development, and remarked the different scales of the observation. Depending on the scale used in studies, we will observe different things. After reviewing the controversies, he presented one way to characterize changes in infant development : The Two-Month & the Nine-Month Revolution.

He claimed that the newborn behavior is not a collection of rigid stimulus-response linkages or automatic reflexes. But " newborns do not yet show any signs of planning their actions or systematically probing their environment (p.178)." At the second month, a radical change emerges. " Infants grow from being direct perceivers and actors to active thinkers, evaluators, and planners (p.183)." He pointed out that this second month revolution is represented by the emergence of the first socially elicited smile.

And the Nine-Month Revolution occurs at the attainment by the infant of a novel understanding of how people relate to objects in the environment. 'Social referencing' is exemplified as this revolution by Rochat.

I think that there are many similarities in Rochat's revolutions and the Scallop hypothesis. The most important differences between them might be aspects of developmental changes. Rochat used the term 'a radical change (p.182)'. Is 'radical' the same as 'discontinuous'? In 'Scallop', I want to imply continuous & dynamic changes in development. Which better represents an infant's development?

3. New data from our study

My colleagues & I have been studying 'spontaneous smile' in infancy (Kawakami et al., 2004). We observed 11 newborns in a hospital about 1 hour. And 6 mothers of infants recorded their infant's face in their home longitudanally about 175 minutes per infant. Over 100 spontaneous smiles were recorded. We found that spontaneous smiles appear in infants' unilateral face at first and change to bilateral later. Figure 5-1 shows the results at each month. It is linear. Figure 5-2 shows the results every ten days. It is like scallop curve.

From the results of Figure 5, we see that developmental changes are growing even

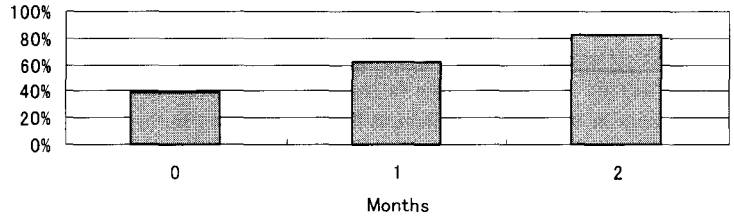

Figure 5-1 Percentages of bilateral spontaneous smiles

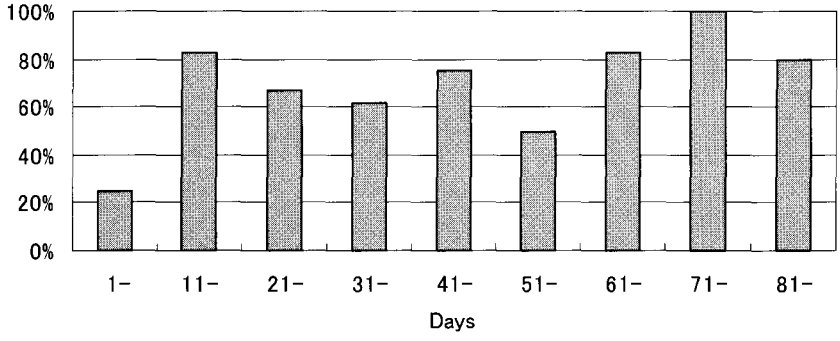

Figure 5-2 Percentages of bilateral spontaneous smiles

in the first 3 months. Developmental changes do not happen in the second month suddenly. Sroufe & Waters (1976) think that spontaneous smiles are correlated with spontaneous central nervous system discharge of subcortical origin. If this is true, the developmental changes of spontaneous smiles are influenced by developmental changes in brain. There is a possibility that we will be able to have information to solve our problems from brain sciences. I hope that the 'Scallop hypothesis' might be proved someday in the near future.

Acknowledgments

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