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## EMOTION ATTUNING SYSTEMS : ITS MICRO-ANALYSIS IN INFANCY AND EARLY CHILDHOOD

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### Abstract

In the Japanese tea-ceremony, in the Eucharist of the Catholicism, or in the contemplation of Zen practice, we can see sequential acts. These activities are composed of postural, imaginative, or breathing forms. Within these self-quieting activities, there are secret skills to introduce the emotion into quiet and consoled state.

It is recently that developmental psychologists are beginning to show a great interest in emotion attunement or emotion regulation (Campos & Barrett, 1984; Campos, Campos & Barrett, 1989). However there are a variety of ways to grasp this phenomena.

Today systems view proposes a basic framework for explaining this phenomena: the child is assumed as a behaving system which flexibly seeks to attune emotional state. Here "system" involves the bio-informational-behavioral interplay, which is composed of three components: the organized overt acts (i.e. emotion expression), physiological emotional state, and subjective feeling which is expressed in the language report (Lang, 1984; Lewis & Michalson, 1983).

Suppose that a child is placed in the stress-arousing context. He/she is assumed to attune his/her emotional state by resorting to a number of behavior elements: coping with an interference or self-quieting over-activated state, etc (Suda, 1991). These behaviors are observed even in the very young infant (Suda, in preparation), and they develop with age when the child acquires new behaviors.

Therefore, I will define emotion attunement as micro-process to self-generate a quieter state where a new cluster of behaviors emerges. This micro-process, which means real-time change, is named "self-organization" implying autonomic process of generating a state or a pattern of behaviors without prescription or a set of commands in the child's structure.

This phenomena involves a wide range of activities. It includes at least four characteristics. (1) A shift of emotional state is not seen as a point along continuum of behavioral activation, but rather seen in emergence of discrete state where a new and motivationally different series of behaviors are seen. (2) There are two sides in an attuning process; modulating an unpleasant state and activating a quiet state. The child is to resort to what he/she can operate and try to find an appropriate state of

emotion. (3) In process of interpersonal interaction, the pattern is flexibly determined by the conditions between two persons. (4) Emotion attunement develops with age. Acquiring new repertoire of behaviors, such as emergence of language, resets the way that the child resorts to. Accordingly this produces a different microprocess of emotion attunement.

A new theory, self-generating model of the behaving system provides a more progressive perspective on the explanation of a structure and its flexible shift in emotion attunement. Now the infant or young child is beginning to be viewed as a self-generating system. This view rejects an idea that the system is static, or is assembly of independent behavior elements that are determined by initial prescription or formation rules.

"Self-organization theory", or dynamic systems view, is proposing a new framework for explaining how a new phase stems from instability of behaviors. This is a new perspective on child development, which are originally born in the field of Physics, Biology or other natural sciences (e.g., Prigogine & Stengers, 1984). This theory is being introduced to developmental psychology, especially to the field of the motor skills, for example emergence of walking from stepping (Thelen & Ulrich, 1991), and infant communication (Fogel & Thelen, 1987). These researchers are explaining how "a new form" of behavior emerges. However this theory is applicable to a wide range of developmental phenomena, because the theory is composed of a set of general principles.

Thus I will apply its limited principles to the field of emotion attunement. This paper therefore aims to recast this theory and to point out the significance of this framework.

### 1. Today's Understandings of Emotional Development

A new and most distinctive feature in the recent researches is, I believe, the hypothesis of mind in young infants. Though there is a long history that researchers have believed emotion is undifferentiated continuum at the beginning of life, and that it differentiates into a number of segments when the child acquires the language or cognition.

But it is widely accepted today that the young infant can display many emotions. Different and distinct facial expressions are displayed in the interpersonal interaction, which is reported in infants at six to eight weeks of age (Traverthen, 1979; Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). At this age, eight basic emotions are assumed as innate systems (Campos & Barrett, 1984). Accordingly, researchers are beginning to assume discrete emotions in the young infants.

Izard (1984) has assumed discrete emotion systems for displaying overt behaviors, each of which serves for inherent adaptive functions from very young infancy. This is called differential emotion theory. In this theory, the emotion is believed as separate organismic systems, which are organizers of overt emotional behaviors. "As indexes of discrete emotional state", action tendencies are proposed (Campos & Barrett, 1984). For example "avoidance and retreat have been used to index fear" (ibid.).

Here we can see a new understanding about action and action tendencies. "By action and action tendencies, we do not necessarily mean responses with a distinctive morphological structure" (Campos, Campos, & Barrett, 1989). But rather, "action tendencies" implies the preparation to execute flexibly a family of motor behaviors which are morphologically different but functionally the same (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983; Barrett & Campos, 1989). To explain action tendencies, an alternative view is proposed by the self-organization theory, where the initial state is assumed to generate nonlinear process that shifts into a new state (Fogel & Thelen, 1987).

Now we will turn to developmental data. Discrete emotional systems are becoming to be assumed to display the child's internal states even in very young infancy. Traverthen (1979) presumed that even young infant is able to express his/her emotional state. He believed that the infant was able "to exhibit to others at least the rudiments of individual consciousness and intentionality". He called this ability as "subjectivity".

In the early infant-adult communication, the young infant aged two months is able to display "Affective self" to the adults (Suda, 1991). Expressed emotional state is mind-read by adults. "Affective self" is the adults' initial perception about the infant's emotional minds. So, the infant's emotional expression is regulator of the tempo and intensity of interactive response in the adult (Gianino & Tronick, 1988).

A dramatic phase shift in infant communication emerges in the later half of the first year of life. It begins, I believe, at around six months of age or older, after the period the infant acquires creeping or crawling. The infant of this stage begins to be perceived as "Noetic self", because the acts he/she execute begin to be read by others as displaying intention (Suda, 1991). The message from the infant is now perceived as meaningful in this stage. Then, later the child is going to express his/her intention by using signals and symbols.

Piagetian psychologists have assumed that this intentionality is based on the means-end differentiation which emerges after eight months of age (Frye, 1981). In this stage, the infant begins to use a means to attain a goal that he/she sets. If an obstacle exists, he/she is now able to change the means into a more appropriate one. This is the emergence of a new intentionality, which will provide the capability to use tools or signals.

The child is now selecting the means to attain an expected impact on the environment. To do so, he/she must be aware of his/her actions and their impacts. And, to monitor the sequence of the behavior and to control it, he/she needs to refer to some standard action rules (Carver & Scheire, 1985). Action rules are a set of rules or policies to provide decisions at the sequential points of script-based actions (Abelson, 1981). Action rules are the knowledge to execute a motor program.

The child will increase the capability to control his/her actions with acquisition of action rules. In the emotion attuning process, action rules are the standard to canalize socially acceptable actions. A cluster of action rules are therefore programs where society's standards of do or don't-do are reconstructed. Social experience is the source for the child to construct this knowledge (Suda, 1991).

Thus the emergence of intentionality has been viewed as feedback-loop of information processing, as I referred to above. Until today the intentionality has been assumed as the output of information processing. However, intentionality may be viewed in an alternative way: that is, as the output of the dynamic systems which stems from the development of emotional and motor systems as well as from that of the cognitive-information system.

The self-organization theory proposes this dynamic view. In this theory, intentionality is viewed as self-generation of behaving system. Emotion is an organizer of this process. Thus the role of the self-organization theory is to cast a new emphasis on dynamic systems process, which may explain the real-time process of the behaving system.

## 2. Emotion Attuning Model

Now I will recast a few principles of the self-organization theory into a new framework for understanding of the child's emotion attunement. The role of this paper is to apply this perspective to the micro-process in the stress-arousing context. While in many articles, basic concepts of the this theory are explained in details (e.g., Thelen, 1989; Thelen & Ulrich, 1991).

It is notable that this theory involves two perspectives to view the behaving structure and developing structure: that is, as explanation of a structure, and as that of its genetic process. These perspectives are necessary to explain how a new system of emotion attunement emerges.

### A) *Self-Organizing Process*

Analyzing the video-taped data, one can presume the real-time process where the child is attempting to attune internal states. The micro-analysis describes this process based on real-time sequential data. The behavior systems fluctuate and develop in micro-genetic level.

For instance, an infant less than two months of age seeks and tries to suck the mother's nipple. Sets of behavior patterns and reflexes, such as finger sucking, are switched on to modulate over-activation (Suda, in preparation). The two-year-olds are also found to resort to coordinative patterns of behaviors under stress-arousing context (Suda, 1986).

In the stressful context, the child generally resorts to a variety of behaviors. Some coping behaviors are observed as direct expression of emotional state, such as display of angry face, while some are more instrumental or intentional actions such as a threat or calling the mother. On the other hand, most of self-quieting or consoling behaviors are observed as touching or stimulating his/her own body (Freedman, 1977; Suda, 1987).

This process was explained with hypothesized model of underpinning biological structure. An example was given in the tension-reduction hypothesis, where the researchers assumed the cyclic shift of gaze at mother and gaze-aversion (e.g., Fogel, 1982). Other researchers attempted to adopt a feedback-loop model or inter-domain-regulation hypothesis (e.g., Lewis & Michalson, 1983; Campos & Barret, 1984; Carver

& Scheire, 1985).

However the self-organization theory is replacing the explanation by a new emphasis on behaving and developing process. A new framework is that the child is assumed as a flexible system which self-organizes the process of generating new emotional state.

There is not any specific prescription or command center assumed to predetermine the self-organizing process (Thelen & Ulrich, 1991). This process is not determined by initial conditions but rather by boundary conditions which the systems meet with at the final changing process (Prigogine & Stengers, Japanese translation, 1984, P. 178, P. 188, P. 200). In the human emotion system, boundary conditions involve a variety of variables: adult's response, social context or task. They include also, I believe, internal boundaries: morphological structure, sensory-motor feedback system, etc. (cf. Thelen & Ulrich, 1991, P. 24, : Suda, 1991). Emotion is, I assume, like a cloud which configures its new state or behavioral pattern when it meets with the ocean or the mountains.

In the self-organizing process, the initial state, where the activated child is expressing fluctuated behaviors, can self-organize to generate a new state. This is named as a phase shift, which implies a seemingly discontinuous transition, shift to a discrete emotional state where a new and different cluster of behaviors emerges. Within a emotional state, a number of morphologically different but functionally displaceable behaviors are expected to emerge (Suda, 1986). Thus the self-organization is often seen as nonlinear process.

When the infant is one or two months of age, he/she is expected to change easily from one state to another (Suda, in preparation). For instance, the infant sometimes exhibiting sad face in the small cradle, sometimes expressing happiness. However, when the child is at the age of three years or older, he/she comes to exhibit increasingly stable and unchangeable state (Suda, 1990). At those ages, I believe, the child comes to attune emotional state to meet with social context, by resorting to more refined motor skills and script knowledge stored in himself/herself.

### *B) Attractor State*

Supposing a genuine biological system, it is sure that emotion attunement in the stress-arousing context is essential for the child's biological survival. So, the system pursues microprocess of self-stabilizing into emotional equilibrium. This stabilized state into which a phase shift appears is called as "attractor state" (Thelen, 1989). The child's emotional system will settle into stabilized state "from a number of initial states and will tend to return to its attractor regimes when perturbed" (ibid, P. 85).

However when the child is placed in the open system, for instance the child being interacting with mother, the regulation seen in micro-process is expected to proceed different process from that seen in the child as an isolated system. There will be an increasing possibility for generating a variety of attractor states. Unexpected and alternative state is to emerge in such cases: sometimes it is difficult for mother to soothe her irritated infant.

### *C) Interpersonal Process*

There is a growing interest in the interpersonal perspectives to account for emotion regulation (e. g., Campos & Barrett, 1984).

Supposing interpersonal interplay, for example an infant vocalizing in mother's lap, the multiple levels of behaviors between the two may generate an interactive system. This open system has a wide range of potential possibilities within which the child's new state will be self-generated. The infant perceives the circumstance and shift emotion into a new state. Some children are flexible to attune oneself, while some are vulnerable against the distress-arousing context. In this process of generating a new state, we can expect a variety of solutions, since this shift in the behaving system is often assumed as nonlinear process (Thelen & Ulrich, 1991). Here is, I assume, background to accept developmental relativism: difference in the form of behavior within an individual or between individuals.

We may see a conceptual idea that qualitative changes emerge in emotional regulation (e. g., Salovey & Rodin, 1985). However self-organization theory casts an emphasis on bottom-up approach, in which the process of how the system is attuned to generate a new state is explained with specific and descriptive data of each shift point (Thelen & Fogel, 1989). And it also provides an explanation of its morphological variation among individuals.

In the distress regulation context, the mother tries to coordinate her supports to generate a new interaction pattern (Thelen & Fogel, 1989). Generally these efforts help the child's emotion attunement. The child's behaving system initially exhibits irritable state, where a number of morphologically different but displaceable behaviors are executed. However, this fluctuation is often led to flexibly organize a new interaction pattern with the mother's aids. Sometimes an aggressive state stems from this phase shift, sometimes a self-quieting state. This shift is guided without any prescription.

In my observation, the infant before two months of age resorts to a large number of behaviors and reflexes: such as reflexes relating to postures, self-stimulating behavior such as finger sucking, facial expression, vocalization such as crying or laughing, or activation of stepping responses etc. In the later half of the first year, the action tendencies emerge in the child's behavior repertoire. Though action tendencies sometimes include intentional and instrumental behavior elements, they reflect emotional state and play the similar function to other behaviors within the emotional state.

As pointed out in the recent article, emotion is the organizer of actions (Campos & Barrett, 1984). The emotional state spread within the whole system may interplay with the high-level activities at central nervous system. Thus a shift of emotional state is presumed to regulate the intentional behavior or action tendencies. However, researchers of cognitive development have neglected the explanation of interplay between emotion and cognition until recently.

The child interact with the person directly before the earlier half of the first year. However mediator of interaction will change with increasing age.

## 3. Understanding Real-Time Process in the Child

### *A) Descriptive Data Reconsideration*

Today bottom-up study is becoming more easy to handle, so the role of descriptive data is becoming more important in the developmental research. Its fruitfulness is reevaluated firstly in exploring a new theory.

Recent innovation of video-recording systems and development of computer soft wares for micro-analysis greatly facilitate research. A frame-based analysis is prevalent in recent articles. In the field of emotion regulation, data describing the real-time shifts are necessary for us to understanding the child's behaving system.

The descriptive data will present a concrete profile of each child. Understanding of a behaving system is based on this type of data. Estimation of the distance from the standard of the population is often invalid to realize the child's behaving system. But rather, the data on the detailed real-time process is necessary in explaining a hidden structure, since functional interplays of behaviors often fluctuate to organize the wholistic adaptation process of an individual. So, I believe, it is important to evaluate the role of analyzing and explaining the real-time data of the child's behaving system in self-organization theory.

### *B) Emotion Education In Autonomic System*

According to an anthropological report, Bedouins believe that life is composed of three components: that is working, playing and resting (Katakura, 1985). They believe that selfquieting activities, namely "resting" is the most important matter of their life. "Resting" here refers to staying with family, meditation, praying to God, composing a poem, sleeping etc.

Our life is guided by the beliefs like this. The knowledge about the emotion system is important for parents. The data may canalize the parents' acts at the stress-arousing context. Parents therefore require reliable knowledge, and try to correct the way they interact with the child. In this sense, a family is assumed as an autonomic system for emotional education.

If we recall the idea suggested by George Kelly (1955), we can believe that ordinary parents collect appropriate data and analysis to regulate their acts towards child's emotional process. If they can access only the data about the averages features, they will not realize the variation of emotion attuning activities which the child generates through non-linear process.

To realize the concrete nature of the child's emotion, knowledge about structure are meaningful for the parents. The content of the child's interplay of behavior patterns, and explanation of the shifts between system in emotional systes are coming to increase the importance as a proposing knowledge.

For example, we already have the following idea about the development of interaction. However we do not have idea about real-time process and its structure:

In the neonate period, the parent and the infant begin to regulate mutually their interplaying acts. In this dyadic process, infant emotional behavior is direct expression of his/her internal state. So, the parents may assume "affective self" in the infant. But how the infant changes their behavior in the process of emotion attunement?

At the later half of the first year of life, the infant comes to organize a triadic relationship among infant, object, and adult. Traverthen & Hubley (1978) pointed out

that it begins with the increase of infant's interest in objects in the communication context. The infant begins to manipulate a thing then later symbols to share reference to it with the other. The "noetic self" is assumed in the child's intentional acts by the parents. At this stage, the infant also begins to express intentional behaviors during the process to attune his/her emotion. We have abstract idea about that, but how the child regulate himself/herself in the real-time process? Self-organization model will propose a framework for describing these phenomena.

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