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## Development of mother–infant interaction in tickling play: The relationship between infants' ticklishness and social behaviors

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### ABSTRACT

This study examined the development of mother–infant tickling interaction and the relationship between infants' ticklishness and social behaviors including infants' looking at mothers' face, mothers' narrative tickling, and mothers' laughter. Twenty-two Japanese infants aged 5 months ( $n = 10$ , five girls) and 7 months ( $n = 12$ , four girls) and their mothers were videotaped. Results revealed that the mothers' narrative tickling was more frequent at 7 than at 5 months and the infants' strong ticklishness showed the same tendency. The infants' strong ticklishness was linked with the occurrence of other social behaviors. In conclusion, infants' ticklishness was heavily connected with social behaviors. The mode of the tickling interaction at 7 months was different from that at 5 months especially in the increase of mother's narrative tickling. A possible function of such mother's narrative tickling to facilitate infant active communication at a higher cognitive level including anticipation, was discussed.

### 1. Introduction

During mother–infant face-to-face interactions, the infant and adult interact multimodally, using their facial, vocal, and tactile expressions. Researchers have typically analyzed mother–infant facial and vocal behavior; however, they have not sufficiently addressed touch (Stack & Jean, 2011; Stack, 2001) and the communicative functions of the tactile modality in infancy have been severely neglected by researchers (Hertenstein, 2002). However, touch or physical communication plays an important role in mother–infant relationship. For example, it was found that touch regulates infants' expression and attention (Jean & Stack, 2012; Jean, Stack & Fogel, 2009; Peláez-Nogueras, Field, Hossain, & Pickens, 1996; Stack and Muir, 1990; Stack and Muir, 1992). Prior research has suggested that parent–infant physical play involving touch elicit positive responses from infants (Dickson, Walker, & Fogel 1997; Fogel, Hsu, Shapiro, Nelson-Foens, & Secrist, 2006). Tactile games occur naturally in everyday life. Particularly, tickling play has been frequently observed; however, the details of how mother and child interact with each other are not clear and the function or meaning of tickling interaction is masked by its familiarity. Importantly, touch is also a channel of intuitive self–other differentiation. At this point, the development of tickling play is very interesting among parent–infant games that include physical contact because we cannot tickle ourselves (Blakemore, Wolpert & Frith, 2000) and ticklishness requires a perception of “otherness” (Negayama & Yamaguchi, 2005). In addition, ticklishness is usually expressed with laughter, but interestingly, it is not always pleasant. Provine (1997) pointed out, even invited and presumably pleasant tickling is often accompanied by fending away of the hand of the tickler; an initially pleasurable tickle may become aversive if intense or prolonged. When the tickling becomes too intense, the baby's laughter turns to crying or fussing, a signal to the mother to stop or reduce the vigor of tactile stimulation

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(Provine, 1997). Adults have also reported that tickling elicits both pleasure and displeasure (Harris & Alvarado, 2005). The experience may incorporate both pleasant and unpleasant sensations.

Taken together, a mixture of strong positive and negative emotions may be expressed by infants during tickling play. Therefore, subtle mutual behavioral adjustment may be needed to enjoy and maintain the tickling interaction. At the same time, the sensation of touch brings a bilateral, mutual, and simultaneous experience of “touch” and “being touched” (Negayama, 2011); therefore, tickling play is a shared emotional experience, and is important to understanding the development of mother–infant intersubjectivity.

The mechanisms underlying sensitivity to tickling are another important point. What is the crucial factor of infant’s ticklishness? Harris and Christenfeld (1999) examined whether ticklishness is elicited by physiological factors or social factors by conducting an experiment comparing ticklishness under two perceptual conditions: man-induced and “machine”-induced tickling. Participants were tickled twice, once by the experimenter, and once, they believed, by an automated machine. Participants laughed just as often in response to the “machine” as to the man. They concluded that tickling simply required unpredictability or uncontrollability and that ticklishness is a type of reflex or stereotyped motor pattern. On the other hand, Provine argued that tickling is not a simple tactile reflex, but a context dependent social interaction that involves both ticklee and tickler (Provine, 1996b). Simultaneously, tickling and laughter have a very important but unappreciated function, the establishment and maintenance of social interactions between the infant and mother (Provine, 1997). Ikeda and Itakura (2013) examined the influence of maternal social communication on ticklishness in infants comparing with being stroked. They revealed that tickling with maternal communication elicited positive reactions from the infants. On the other hand, a non-communicative mother and stroking tended to elicit a neutral response, whereas the combination of a non-communicative mother and tickling elicited negative reactions.

Tickling play is naturally observed in mother–infant face-to-face tactile interaction. Negayama and Yamaguchi (2005) found that infant’s strong ticklishness is elicited at approximately 6 or 7 months. Moreover, the play becomes sophisticated at approximately 12 or 13 months with teasing using delayed tickling in the air and songs included in the interaction. In a preliminary case study on tickling and ticklishness, Ishijima and Negayama (2013) found that the mother showed delayed tickling in the air just before actual touch at approximately 6.5 months. In addition, the infant showed an anticipatory ticklishness before the actual touch and alteration of visual orientation between the mother’s tickling hand and face during delayed tickling like joint-attention at about 6.5 months. This suggests the infant’s active participation in the interaction with an anticipation of the mother’s intention and behavior. It could be an example of a “proto-triadic relationship” using a body as a target before an appearance of the genuine triadic relationship (Ishijima & Negayama, 2013; Negayama, 2011). The bodily sensation of ticklishness and joy seems to be a primitive and instinctive experience; therefore, it should occur earlier than the appearance of the so-called triadic relationship relating to the “9-month revolution” (Tomasello, 1995, 1999). Ishijima and Negayama (2013) also pointed out that the infant’s anticipatory ticklishness was shown in the phase of the mother’s delayed tickling accompanied by a gradual upping-the-pitch vocalization, just before actual tickling with the high-pitched vocalization and intensively repetitive tickling finger movement. Malloch and Trevarthen (2009) indicated that mother–infant interaction generates “communicative musicality,” composed of three parameters: pulse, quality, and narrative. The dramatic narrative structure of the exchange between infant and mother could be seen in the pitch contour of their exchange and the narrative composed of four parts: introduction, development, climax, and resolution. According to the narrative components of “communicative musicality” (Malloch & Trevarthen, 2009), the infant’s anticipatory ticklishness (Ishijima & Negayama, 2013) could be interpreted as occurring in “development” before the “climax,” and the infant seemed to actively share the narrative with the mother in tickling play. Before the “9-month revolution” (Tomasello, 1995, 1999), which is a time of significant development in intention-reading in a triadic relationship, it is possible that younger infants are aware of the narrative and actively adapt their behaviors appropriately. From tickle set-up to climax, 6- and 12-month-olds increased the duration and intensity of their smiles (Fogel, Nelson-Goens, Hsu, & Shapiro, 2000). It would also provide important evidence that indicates infants’ understanding of the narrative of tickling play. Participants could dynamically anticipate each other’s behaviors and sequentially attune their own behaviors in such context-based interactions (Negayama et al., 2015). In tickling play, an infant could anticipate when and what kind of the contact is going to happen through the narrative. At the same time, an anticipation of contact is a sign of awareness of the other’s intention in everyday-life interaction, such as holding (Negayama et al., 2015; Reddy, Markova, & Wallot, 2013) and tickling. Thus, infants’ narrative understanding should be important to the development from primary intersubjectivity (Trevarthen, 1979) to secondary intersubjectivity (Trevarthen & Hubley, 1978).

Consequently, these findings suggest that mother–infant tickling play is not just physiological, but far more psychological. However, little is known about the relationship between infants’ ticklishness, social behaviors, and its developmental change. Based on these previous researches, the period from 5 months to 7 months should be focused on because it could be the sprouting period of ticklishness and it is possible that the quality of the interaction changes, especially pertaining to narrative sharing during that period.

Therefore, in this study, we compared 5-month-old and 7-month-old mother–infant tickling play, a few months before the “9-month revolution” (Tomasello, 1995, 1999) and the infants’ ticklishness in connection with mediating socio-psychological factors. In addition, infant’s ticklishness and mother’s tickling behavior style were focused on. Infants’ strong ticklishness was defined as a sequence of behavior including bodily avoidance of the stimulation and strong positive emotion, indicated by laughter or smiling. Mothers’ tickling behavior style was classified into two types: non-narrative and narrative tickling. Non-narrative tickling was accompanied by actual touch of finger(s) with straightforward repetitive movements. Narrative tickling was defined as tickling with behaviors providing a sign of a “climax” tickling event to come in the next moment, such as tickling-like finger movements in the air before actual touch, tickling with a song, finger tracing of the infant’s body surface before full-fledged tickling, etc. The narrative tickling thus facilitates the infant’s anticipation.

We hypothesize that there would be two developmental differences as below. 1. The infant’s reaction would be different between 5 and 7 months. In particular, strong ticklishness would occur more often at 7 than 5 months because prior research revealed that

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