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Cross-sectional and longitudinal observations of pointing gestures by infants and their caregivers in Japan

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ABSTRACT

In two studies, I investigated the impacts of caregivers' pointing gestures on the developmental increase in the frequency of infants' index-finger pointing. In Study 1, I replicated Liszkowski et al., (2012) study, wherein infants and caregivers engaged in 5-min interactions in a decorated room. In Study 2, younger infants and their caregivers who participated in Study 1 were observed about 7 months later in a similar decorated room as in Study 1. Both studies showed that caregivers produced index-finger pointing more frequently than did younger infants, whereas older infants' index-finger pointing was comparable to caregivers'. Study 2 demonstrated that caregivers' contingent pointing—namely, index-finger pointing less than 6 s after young infants' pointing—led to an increase in infants' frequency of index-finger pointing 7 months later. These results suggested that caregivers' contingent pointing has the function of promoting active production of index-finger pointing by infants.

1. Introduction

Although infants in their second year of life cannot use language adequately, they can communicate with caregivers via pointing gestures. Empirical studies have demonstrated that 12-month-old infants produce pointing gestures *declaratively* to share their attention and interest with their caregivers (Bates, Camaioni, & Volterra, 1975; Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004), and *imperatively* to ask caregivers to fetch desired objects (Bates et al., 1975; van der Goot, Tomasello, & Liszkowski, 2014). Moreover, when infants are faced with people having difficulty in finding their belongings, those infants use pointing to inform that searcher where his/her belongings are (Liszkowski, Carpenter, Striano, & Tomasello, 2006). There is also evidence that infants produce pointing gestures *interrogatively* to solicit information about indicated objects from caregivers (Begus & Southgate, 2012; Kishimoto, Shizawa, Yasuda, Hinobayashi, & Minami, 2007). Infants have even been found to communicate about absent entities using pointing gestures (Liszkowski, Schäfer, Carpenter, & Tomasello, 2009). To achieve the above goals effectively, infants must produce pointing with consideration of caregivers' attentional or epistemic state (Liszkowski, Albrecht, Carpenter, & Tomasello, 2008; Meng & Hashiya, 2014). Thus, infants who have acquired pointing gestures are already equipped with the motivation and socio-cognitive abilities shared by those able to communicate linguistically (Liszkowski, 2008; Tomasello, Carpenter, & Liszkowski, 2007; but see D'Entremont & Seamans, 2007).

Despite the rich body of evidence on the motivational and socio-cognitive aspects of infants' pointing gestures, few studies have looked at the ontogeny of pointing gestures. It is well-known that infant index-finger pointing emerges around their first birthday (Butterworth, 2003; Carpenter, Nagell, & Tomasello, 1998), and increases in frequency during their second year of life (Leung & Rheingold, 1981; Liszkowski, Brown, Callaghan, Takada, & de Vos, 2012; Lock, Young, Service, & Chandler, 1998). However, the developmental accelerator of the emergence and increase in infant pointing gestures remains unclear.

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Recent studies (e.g., Liszkowski & Tomasello, 2011) have suggested that the emergence of pointing gestures by infants is not predicted by their frequency of social engagement with caregivers, but by the maturation of infants' socio-cognitive abilities. For example, the training study by Matthews, Behne, Lieven, and Tomasello (2012) revealed that caregivers' regular social engagement, such as pointing to pictures when reading a picture book, with their 9- to 11-month-old infants for 1 month did not accelerate the onset of infants' pointing gestures. However, infants' prior ability to follow their caregivers' gaze direction did predict the onset of their pointing gestures.

Thus, what about the developmental increase in frequency of the infants' pointing gestures? In contrast to the onset of such gestures, their frequency appears to be positively predicted by social factors. Two lines of research support this idea: one comparing the development of infants' pointing gestures among several cultures, and the other experimentally identifying the behaviors of caregivers that provoke infant pointing gestures.

One of the studies in the former line, conducted by Salomo and Liszkowski (2013), involved natural observations of 8- to 15-month-olds and their interlocutors in three different cultures—Yucatec-Mayans (Mexico), Dutch (Netherlands), and Shanghai-Chinese (China). They found that the highest frequency of infant deictic gestures, including pointing gestures, was found in the Chinese sample, while the lowest frequency of gestures occurred in the Mexican sample. The frequency of deictic gestures that adults around the infants produced indicated a similar pattern (highest in China and lowest in Mexico). Furthermore, after controlling for both infant age and cultural differences, it was revealed that the more frequently the adults showed deictic gestures around the infants, the more frequently infants produced deictic gestures. These results suggest that the increase in the frequency of prelinguistic deictic gestures is socially mediated; in other words, the deictic gestures produced by the interlocutors around the infants influence the formation of deictic gestures by the infants (Salomo & Liszkowski, 2013).

Liszkowski and his colleagues also attempted to identify which caregiver behaviors trigger infant pointing. Liszkowski and Tomasello (2011) and Liszkowski et al. (2012) both focused on caregivers' pointing gestures, because in the majority of experimental studies investigating the development of infants' pointing, caregivers were restricted from producing their gestures spontaneously. Therefore, the effects of such spontaneous gestures on the development of infants' pointing were unknown at the time (Liszkowski & Tomasello, 2011). Liszkowski and Tomasello (2011) used a semi-natural pointing-elicitation procedure called the "decorated room," whereby they observed the spontaneous interactions between infants and caregivers in a room decorated with numerous objects, such as dolls and posters. Using this procedure, Liszkowski and Tomasello (2011) found that both 12-month-old infants and their caregivers pointed spontaneously in the decorated room, and infants whose caregivers frequently produced pointing gestures also tended to frequently produce pointing. Additionally, also using the decorated room, Liszkowski et al. (2012) investigated the development of pointing gestures by infants aged 5–17 months and its relationship to caregivers' pointing across seven countries with differing cultures—Papua New Guinea, Indonesia, Japan, Peru, two regions of Mexico, and Canada. They found that both infant and caregiver pointing gestures were immediately followed by the other's pointing, which they reported as resembling a conversation. Moreover, although the frequency of pointing gestures by caregivers was higher than that of the infants of any age, this discrepancy diminished with the infants' increasing age. These results suggested that caregivers' pointing has some influence on infants' pointing. In particular, the "conversational structure" of pointing gestures by infants and their caregivers may have a special role in the development of pointing gestures among infants. Liszkowski et al. (2012) suggested that infants just beginning to produce pointing gestures tend to follow the pointing of caregivers, who subsequently follow infants' pointing as the infants increase in age. Thus, caregivers' responsive (or contingent) pointing to the pointing of infants might further encourage infants' production of pointing. Infants' accumulation of experience that their pointing is responded to by their caregivers (also through pointing) may underlie the development of pointing gestures among infants.

In summary, both cross-cultural comparisons and experimental studies have suggested that the developmental increase in pointing gestures by infants relates to caregivers' pointing. However, almost all of these past studies used a cross-sectional design and therefore yielded correlational data on the relationship between infants' and caregivers' pointing. The impact of caregivers' pointing on the developmental increase in pointing among infants can only be demonstrated by showing that infants who received pointing from caregivers exhibit an increased production of pointing gestures later on, regardless of how often they produced pointing gestures originally. Thus, to confirm the prediction that pointing gestures by caregivers leads to the developmental increase in pointing gestures by infants, longitudinal studies are necessary.

In this paper, using two related studies, I investigated the impact of caregivers' pointing gestures on the developmental increase in the frequency of pointing gestures by infants. In Study 1, I replicated Liszkowski et al., (2012) study using the same decorated room procedure. The aim of Study 1 was to confirm the changes in the frequency of pointing gestures by infants and their caregivers as a function of infant age cross-sectionally. Although Kishimoto (2014) checked the temporal relationship between infants' and caregivers' pointing gestures using the decorated room procedure, he did not investigate changes in the frequency of pointing gestures by infants and their caregivers as a function of infant age. Thus, in this study, I used a larger age range of participants and attempted to determine the developmental changes in these gestures. Moreover, to understand the effects of the contingency of caregivers' pointing on infants' pointing, the frequency of pointing among infants whose caregivers selectively produced pointing gestures soon after the infants' own was assessed. This was a novel aspect of this study.

In Study 2, the developmental changes in the frequency of pointing gestures by infants and their caregivers were investigated longitudinally. Specifically, younger infants and caregivers who participated in Study 1 were again observed about 7 months later in a decorated room. Moreover, to test whether caregivers' pointing promoted a developmental increase in pointing gestures by infants, I examined the relationship between the frequency of caregivers' pointing in Study 1 and pointing gestures produced by infants in Study 2.

Along the lines of Liszkowski and Tomasello (2011), I distinguished between index finger pointing and "whole-hand" pointing.