Longitudinal development of multimodal gesture sequences as early markers of cognitive empathy in preverbal infants

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Preverbal infants use gestures to communicate intentionally and referentially at around 8-9 months (Bates et al 1975), which further develops for more cognitively complex declarative and interrogative communication (Liszkowski et al 2006, 2008; Begus & Southgate 2012). Pointing gestures play a central role in the ontogeny of symbolic communication, while iconic gestures (representing objects and actions) are suggested not to develop prior to speech acquisition (Pizzuto & Capobianco 2005) and might not play a significant role in the acquisition of symbolic language (Liszkowski 2010). Nevertheless, certain studies report productions of iconic gestures as early as in 11-month-old infants (Acredelo & Goodwyn 1988; Caselli 1990; Capirci et al 2005). In our study, we tested if preverbal iconic gestures could represent individual emotional states, the capacity to distinguish between- and within-valence emotions as well as channelize prosocial motivation towards other's emotional states.

We followed a longitudinal design to trace the development of infant gestures (10 – 15 months), employing an ethological approach. Coding ad-lib videos of naturalistic interactions between infants with parents, caregivers, and siblings available on the PhonBank French Paris Corpus (Leroy et al 2009) (n=4, 16h of recording), we first describe the physical forms of the gestures produced, associated eye movements, head movements, orientation of the body, social context of gesturing, outcome of the gestures, persistence in gesturing in case of failed attempts at communication. Secondly, we coded production of overlapping and/or sequential use of other gestures and nonverbal vocalisations within 1s of interval. Communicative functions of gestures were determined from Apparently Satisfactory Outcomes depending on the responses from social partners (Hobaiter and Byrne 2014). Our preliminary descriptive analyses (n=2, 7h of recording) provide critical insights into emotion representation developing especially through multimodal sequences (table1). 10-month-olds use single gestures to communicate individual emotional states (e.g., bouncing during happy-play). At 11 months, (1) same gestures produced in different contexts and different gestures produced in same context represent between- and within-valence emotions (e.g. leg-fling in surprise and dissatisfaction; sticking out tongue in surprise and embarrassment; arm-raising + bouncing when dissatisfied); (2) gesture sequences represent affective emotions directed towards others (e.g., holding telephone + blowing kisses to an imaginary caller). Around 15 months, gesture sequences express prosocial motivation towards other's emotional states (e.g., offer object + pat; hand-wave + sharp vocalization to offer consolation). Moreover, gesture sequences used by 15 month-olds often enable infants to engage in triadic interactions (directing gestures to two different recipients at the same time), therefore indicating early interactional dynamics in preverbal communication.

Complete analyses of available videos will be presented at the conference. Preliminary analyses suggest how multimodal gesture sequences, and not gestures in isolation, could inform us about the development of expression of emotions and empathic motivations. Thus, in addition to being proxies of symbolic communication development, gesture sequences could also be considered for tracing the early preverbal markers of cognitive empathy and capacities of cooperation.

Index words: preverbal gestures; development of empathy ; nonverbal multimodal communication; cognitive empathy; gesture sequences

Age (months)	**Object representation**	**Action representation**	**Emotion representation**	**Emotion directed to others**	**Prosocial motivation to other's emotion state**
10	--	Gesture-gesture sequence	Single gesture	--	--
11		Gesture-gesture sequence	Single gesture; Gesture-gesture sequence; Gesture-vocalisation sequence	Gesture-gesture sequence	--
15	Transition of pointing into handshapes	Gesture-gesture sequence	Single gesture; Gesture-gesture sequence; Gesture-vocalisation sequence	Gesture-gesture sequence; Gesture vocalisation sequence	Gesture-gesture sequence; Gesture vocalisation sequence Triadic communication

Table1: Preliminary description of longitudinal development of multimodal gesture sequences representing objects, actions and emotions in preverbal infants (n=4)

References:

1. Acredolo, L., & Goodwyn, S. (1988). Symbolic gesturing in normal infants. Child development, 450-466.
2. Bates, E., Camaioni, L., & Volterra, V. (1975). The acquisition of performatives prior to speech. Merrill-Palmer quarterly of behavior and development, 21(3), 205-226.
3. Begus, K., & Southgate, V. (2012). Infant pointing serves an interrogative function. Developmental science, 15(5), 611-617.
4. Capirci, O., Contaldo, A., Caselli, M. C., & Volterra, V. (2005). From action to language through gesture: A longitudinal perspective. Gesture, 5(1-2), 155-177.
5. Caselli, M. C. (1990). Communicative gestures and first words. From gesture to language in hearing and deaf children, 56-67.
6. Hobaiter, C., & Byrne, R. W. (2014). The meanings of chimpanzee gestures. Current Biology, 24(14), 1596-1600.
7. Liszkowski, U., Carpenter, M., & Tomasello, M. (2007). Pointing out new news, old news, and absent referents at 12 months of age. Developmental science, 10(2), F1-F7.
8. Liszkowski, U., Carpenter, M., & Tomasello, M. (2008). Twelve-month-olds communicate helpfully and appropriately for knowledgeable and ignorant partners. Cognition, 108(3), 732-739.
9. Liszkowski, U. (2010). Deictic and other gestures in infancy. Acción psicológica, 7(2), 21-33.
10. Leroy, M., Mathiot, E., & Morgenstern, A. (2009). Pointing gestures and demonstrative words: Deixis between the ages of one and three. Studies in Language and Cognition Cambridge Scholars Publishing. Editors: Jordan Zlatev, Marlene Johansson Falck, Carita Lundmark and Mats Andrén. 386-404.
11. Pizzuto, E. A., & Capobianco, M. (2005). The link (and differences) between deixis and symbols in children's early gestural-vocal system. Gesture, 5(1-2), 179-199.