AUGUST 6

Masako Myowa

"Emergence of self: Development of social cognition from perinatal Ontogeny and its evolutionary foundation of human mind"

(Report by Kevin Ryan & Liza Solomonova)

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ISSA Presentation Summary: Masako Myowa-Yamakoshi (Kyoto University, Japan)

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Masako Myowa's presentation was structured around three general research questions: 1) evolutional specificity of human mind and what distinguishes human mind from non-human animals; 2) developmental aspects of human mind; and 3) based on developmental/evolutionary knowledge, how can we approach cases of atypical development.

In the context of latter research direction, Myowa has a particular interest in autism spectrum disorder (ASD), which orients her questions on evolution, ontogeny and normativity of human consciousness, primarily within the domain of social interaction. In particular, her research program aims at disentangling the gene-environment interaction processes in the formation of social difficulties in ASD individuals.

On the ontogenetic level, the social/animate dimensions of the world seem to be preferentially perceived very early in human development. Recent research has suggested that newborns prefer biological motion to random motion (Simion, Regolin, & Bulf, 2008), and prefer faces that look directly at them to faces looking away (Farroni, Csibra, Simion, & Johnson, 2002). On the more basic level of interaction, the most direct and first contact that a developing human being has with others is experienced through touch. Even in utero, proprioception, separation between endogenous and exogenous sensation (Myowa-Yamakoshi & Takeshita, 2006), anticipatory mouth opening (Reissland, Francis, Aydin, Mason, & Schaal, 2014) and even discrimination of mother's voice (Kisilevsky et al., 2003) can be observed. These and other yet unobserved processes of individuation in concert with social-affective contact with caregivers seem to be crucial for development, both in terms of social interaction, and in overall health. In fact, kinesthetic stimulation activates broader distributed cortical networks than other sensory modalities in infants (Shibata et al., 2012). Preterm infants, for instance, are at higher risk for developing a number of long-lasting difficulties, which include ASD (Lindstrom, Lindblad, & Hjern, 2011) and subtler social cues inattention. These considerations, in practical terms, should functions as pointers to the medical community in developing appropriate environments for ambulatory care of preterm infants. On a more fundamental level, this data points to the primordial importance of intercorporeal intersubjectivity for a full-fledged, typically human participation in the world.

The second part of the lecture was concerned with the evolutionary/developmental aspects of social perception. using non-human primates as a proxy for human evolutionary past. Chimpanzees are often used in this kind of experimental work because they show some similarities with human behavior,

such as tool using, observational learning, self-exploratory behavior (De Veer & van den Bos, 1999). The question, then, arises: how do we learn? Two important distinctions were made: newborns, both chimpanzees (Myowa-Yamakoshi, Tomonaga, Tanaka, & Matsuzawa, 2004) and humans (Gross, 2006), show what is referred to as "mirror behaviors", seemingly involuntary mirroring of another's facial expression. Additionally, human newborns show auditory-motor matching (opening mouth while hearing a vowel) (Chen, Striano, & Rakoczy, 2004). These similarities are true for the period between birth and 2 month of age, and they disappear for older infants. In fact, neonatal mirroring behaviors are replaced by full body intentional imitation activities by 9-12 month in humans. This process is unclear in chimpanzees. The really striking differences in how imitative/observational learning develops in humans and chimpanzees can be seen in gaze-tracking experiments. While humans tend to observe both the action and the face of the human agent, chimpanzees do not show any particular interest in attending to the facial expressions (Myowa-Yamakoshi, Scola, & Hirata, 2012). Studies performed by Masako Myowa's group suggest that human learning is heavily dependent on intersubjective and social context and contact, while this may not be so for non-human primates. The development of this kind of learning thus may be uniquely human. This has implications on how we see atypical social/intersubjective/empathic development, such as ASD profile, and on how we can develop coping/assistive strategies.

Group discussions and presentations for these lectures focused on several main themes, largely clustered around the questions of imitation, baby phenomenology, the relation between language and consciousness, the role of evolutionary thinking in consciousness studies, and potential future developments for the no report paradigm. These themes can be distilled into three points: limits and access to baby phenomenology, the uniqueness of human imitation, and the development of consciousness at phylogenetic and ontogenetic timescales.

As suggested during the discussions, there are at least four different dominant theories concerning the nature of infant phenomenology: 1) Organized, clearly defined experience, much like the standard phenomenology for most of those reading this report; 2) Synesthetic, where activity in a sense modality correlates with activity in one or multiple other sense modalities; 3) "Blooming Buzzing Confusion"; 4) "Sea of Unity" with no clear self/other distinction.

While it is uncontroversial to note that many other organisms have a phenomenology of some kind, especially infants, the problem of access may seem insurmountable. Explaining the intricacies of one's phenomenology is difficult enough when communicating with others who have mastered the basics of a language to report with. On the other hand, it was suggested that further developments to the no report paradigms may provide at least some inroads towards infant phenomenology. Exploring models that map highly connected brains, largely akin to newborn infants, as well as related situations with

overlapped brain regions may provide additional bridges between an observer and her non-linguistic subject.

A point that came up concerning infant imitation was the issue of how to explain the apparent disappearance of imitative behavior between three months and nine months of age. One proposed suggestion pushed against the view that this gap came about when a first kind of imitation vanished, to be replaced after six or so months with a second kind. Instead, it may be the case that the development of an inhibition capability, ultimately allowing for the suppression of spontaneous mirror imitation after a few months, developed first. The original mirror imitation process, with the help of this inhibition capability or mechanism, would then play a distinctive role in later, full-body simulation capabilities, instead of no longer being present.

The explanation of human imitative capacities and consciousness can be explained in both phylogenetic and ontogenetic terms. In both of these timescales, the importance of language was emphasized and debated. In addition to the role of language as a reporting tool, as noted above, several theorists have suggested that it is a necessary prerequisite for certain forms of conscious thoughts. Empirical evidence for self-awareness in chimpanzees, including mirror tests discussed in the lecture, puts pressure on strong versions of the language-consciousness relation. Unresolved questions in this area that were discussed include the possibility that concepts may have an impact on a person's phenomenology, that learning language may scaffold or reorient a sense of self-awareness, and that developmental work on various neonatal and infant abilities may offer another window into the world that they experience.

Bibliography

Chen, X., Striano, T., & Rakoczy, H. (2004). Auditory-oral matching behavior in newborns. Dev Sci, 7(1), 42-47. doi: http://www.ncbi.nlm.nih.gov/pubmed/15323117

De Veer, M. W., & van den Bos, R. (1999). A critical review of methodology and interpretation of mirror self-recognition research in nonhuman primates. Anim Behav, 58(3), 459-468. doi: 10.1006/anbe.1999.1166

Farroni, T., Csibra, G., Simion, F., & Johnson, M. H. (2002). Eye contact detection in humans from birth. Proc Natl Acad Sci U S A, 99(14), 9602-9605. doi: 10.1073/pnas.152159999

Gross, L. (2006). Evolution of neonatal imitation. PLoS Biol, 4(9), e311. doi: 10.1371/journal.pbio.0040311

Kisilevsky, B. S., Hains, S. M., Lee, K., Xie, X., Huang, H., Ye, H. H., . . . Wang, Z. (2003). Effects of experience on fetal voice recognition. Psychol Sci, 14(3), 220-224. doi: http://www.ncbi.nlm.nih.gov/pubmed/12741744

Lindstrom, K., Lindblad, F., & Hjern, A. (2011). Preterm birth and attention-deficit/hyperactivity disorder in schoolchildren. Pediatrics, 127(5), 858-865. doi: 10.1542/peds.2010-1279

Myowa-Yamakoshi, M., Scola, C., & Hirata, S. (2012). Humans and chimpanzees attend differently to goal-directed actions. Nat Commun, 3, 693. doi: 10.1038/ncomms1695

Myowa-Yamakoshi, M., & Takeshita, H. (2006). Do Human Fetuses Anticipate Self- Oriented Actions? A Study by Four- Dimensional (4D) Ultrasonography. Infancy, 10(3), 289-301.

Myowa-Yamakoshi, M., Tomonaga, M., Tanaka, M., & Matsuzawa, T. (2004). Imitation in neonatal chimpanzees (Pan troglodytes). Dev Sci, 7(4), 437-442. doi: http://www.ncbi.nlm.nih.gov/pubmed/15484592

Reissland, N., Francis, B., Aydin, E., Mason, J., & Schaal, B. (2014). The development of anticipation in the fetus: a longitudinal account of human fetal mouth movements in reaction to and anticipation of touch. Dev Psychobiol, 56(5), 955-963. doi: 10.1002/dev.21172

Shibata, M., Fuchino, Y., Naoi, N., Kohno, S., Kawai, M., Okanoya, K., & Myowa-Yamakoshi, M. (2012). Broad cortical activation in response to tactile stimulation in newborns. Neuroreport, 23(6), 373-377. doi: 10.1097/WNR.0b013e3283520296

Simion, F., Regolin, L., & Bulf, H. (2008). A predisposition for biological motion in the newborn baby. Proc Natl Acad Sci U S A, 105(2), 809-813. doi: 10.1073/pnas.0707021105