Body Perception in Chimpanzees: A Comparative-Cognitive Study

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Bodies are important for animals. In many species, bodies convey social cues in their daily life. Humans use a specific way to visually process bodies, which is different from the way we process other objects. Humans' body recognition is significantly decreased when bodies are inverted (upside down), compared with when they are upright. This is called the inversion effect. The inversion effect is specific to bodies, but not other objects. This suggests that humans use a special way to process bodies, which is called configural processing. The aim of this study is to explore the evolution of humans' special body perception by examining humans' closest living relatives, chimpanzees (*Pan troglodytes*), and comparing these two species. I examined chimpanzees' cognition of whole bodies in Chapters 2 to 5, and Chapter 6 was about cognition of body parts. The first hypothesis is that chimpanzees have special processing for bodies, configural processing, which can be revealed by the inversion effect. The second hypothesis is that chimpanzees' body perception has similar properties to humans' body perception. I tested 6 or 7 chimpanzees in each experiment, and included human participants in Chapters 4 and 5. I used computer-controlled body recognition tasks on touch screens in Chapters 2 to 5 and eye-tracking tasks in Chapter 6.

Chapter 2: I tested chimpanzees' performance in recognizing different stimuli in upright or inverted orientations. They showed the inversion effect to chimpanzee bodies, but not houses. This suggests that chimpanzees use configural processing for bodies, as humans do. The results supported both the first hypothesis and the second hypothesis. I also found that faces and body contours are especially important for chimpanzees to invoke the inversion effect by using manipulated chimpanzee bodies.

Chapter 3: I examined the properties of chimpanzees' body inversion effect. In humans, it was found that changes in body structures affect the inversion effect. I tested chimpanzees using scrambled and distorted bodies. The scrambled bodies had atypical body part arrangements, and the distorted bodies had atypical body proportions. They did not show the inversion effect to scrambled bodies, suggesting that their configural body processing is based on correct body part arrangements. They showed the inversion effect to distorted bodies, suggesting that body proportions do not interfere with their configural body processing. The results showed similar performances to humans and therefore supported the second hypothesis.

Chapter 4: I examined the possible origin of the inversion effect, expertise. It has been found that humans also show the inversion effect to objects that they have expertise about. However, it is not clear whether other species show this effect of

expertise. The chimpanzee participants had ample experience with humans. I tested their inversion effect to different types of human body stimuli. I also tested human participants who were chimpanzee experts using chimpanzee and human bodies. I then tested human participants who were chimpanzee novices using chimpanzee bodies. The chimpanzees showed the inversion effect in one condition of human bodies, while humans showed the inversion effect in four conditions of chimpanzee bodies, and the chimpanzee experts had a stronger tendency to use configural processing than novices. It is not clear whether the second hypothesis could be supported or not, because chimpanzees showed a rather limited effect of expertise.

Chapter 5: I continued to examine the effect of expertise, focusing on visual and embodied experience separately. Chimpanzees showed the inversion effect to human bodies that had more visually familiar postures, suggesting that they need visual experience to show the inversion effect to other species. They also showed the inversion effect to crawling humans and horses, which they have never seen but share the quadrupedal postures with them, suggesting that they also use embodied experience. These results supported the second hypothesis, although chimpanzees' expert effect is weaker than that of humans. I tested pre-school children for the development of body configural processing and the comparison across species in the expert effect. Children showed the inversion effect to human bodies and bodies of chimpanzees and horses, suggesting the configural processing emerges at least from the pre-school stage, and that children could generalize it to other species as well.

Chapter 6: I examined chimpanzees' knowledge about the morphology and locations of body parts by presenting abnormal body stimuli in eye-tracking tasks. Chimpanzees looked at body parts in strange positions and/or forms more and longer than normal ones. It suggests that they have the knowledge about morphology and locations of their body parts, as humans do. This supported the second hypothesis.

In conclusion, the results support the first hypothesis that chimpanzees have special processing, i.e., configural processing, for bodies. The results also add to this hypothesis that they also show the inversion effect to other species of expertise. The results support the second hypothesis, too. Albeit weaker in certain aspects such as the effect of expertise, chimpanzees' body perception has similar properties to humans' body perception, which were found in previous research and the current study. These results indicate that the common ancestors of chimpanzees and humans may already have the special cognition for bodies, which may have helped them to better adapt to the environment. This thesis provided a foundation to reconstruct the evolutionary path of body perception. These explorations contribute to our understanding of how we distinguish animate and inanimate objects, how we perceive the animate world, and how our mind is shaped by evolution.