

# **EARLY ‘LANGUAGE HOMOLOG’ BRAIN ASYMMETRY IN NEWBORN MONKEYS PAVES THE WAY FOR THE DEVELOPMENT OF GESTURAL COMMUNICATION’S LATERALIZATION**

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The Planum Temporale (*PT*) is a key language area and is structurally and functionally left-lateralized in pre-linguistic infants (Dehaene-Lambertz et al., 2002; Dubois et al., 2010). Therefore, the *PT* was considered a marker of the uniquely human pre-wired brain for language acquisition. This latter hypothesis has been questioned by recent studies reporting similar structural asymmetries in newborn baboons (Becker et al., 2021; 2022). Nevertheless, its functional implication in monkeys, and their potential shared properties with any language features related to *PT* asymmetry in humans remains unknown.

In the present followed-up study in the same baboons (*Papio anubis*) living in social groups at the Station de Primatologie CNRS, we found a clear link between this early brain feature and communicative gesturing. In fact, we show that direction of early *PT* grey matter asymmetry in newborn baboons predicts the development of later communicative gesture’s manual lateralization once juveniles (but not of handedness for non-communicative manipulative action).

Specifically, we investigated intra-individual brain/behaviour correlates within 26 healthy infant baboons (10 females, 16 males). Behavioral measurements included both handedness for communicative gestures *versus* handedness for non-communicative bimanual object manipulation from data collected from 9 months to 3 years old. Brain measurements included previously published MRI data on *PT* grey matter volume interhemispheric asymmetry at the earliest “newborn” age class (i.e., 4 days to 2 months old before the full maturation of myelin, synapses and cell bodies + an outlier of 165 days of age, see Becker et al., 2021 for the full MRI acquisitions and region delineation procedures). Handedness for manipulative actions was assessed using the bimanual coordinated “Tube task” (Hopkins et al., 1996). Communicative gesture was defined as a movement of the hand directed to a specific partner or audience in order to affect its behavior (Molesti et al., 2019). The “Hand slapping” gesture was previously found optimal for measuring such gestural communication’s lateralization in the baboon (Meguerditchian et al., 2013). For each subject and both behaviors, a handedness index of the left (L) and the right (R) hand was computed  $HI = (R - L) / (R + L)$  with the sign indicating the direction of asymmetry (negative: left side, positive: right side) and the value, the strength of asymmetry. Subjects were classified into two groups, according to direction of *PT* asymmetry at birth (19 typical left-lateralized, 8 atypical non- or right-lateralized). One sample t-test highlighted a significant positive handedness for communication for the typical *PT* biased group ( $p < .006$ ), which was not found for the atypical *PT* biased group ( $p > .3$ ). Two-sided t-test demonstrated a significant difference between groups ( $p < .042$ ). No effect was found for non-communicative actions ( $p > .5$ ). Logistic regression significantly modeled the effect of the asymmetry quotient of the Planum Temporale at birth on the likelihood of becoming left or right-handed in communicative gesture ( $p < .028$ ). In other words, newborn monkeys with an early larger left-than-right *PT* were more likely to developed right-handed gestural communication once juvenile.

This finding suggests that early *PT* asymmetry in both monkeys and humans might be a pre-wired brain marker of a shared functional feature between human language and monkey’s gestural communication.

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