

Infant and adult brains are coupled to the dynamics of natural communication

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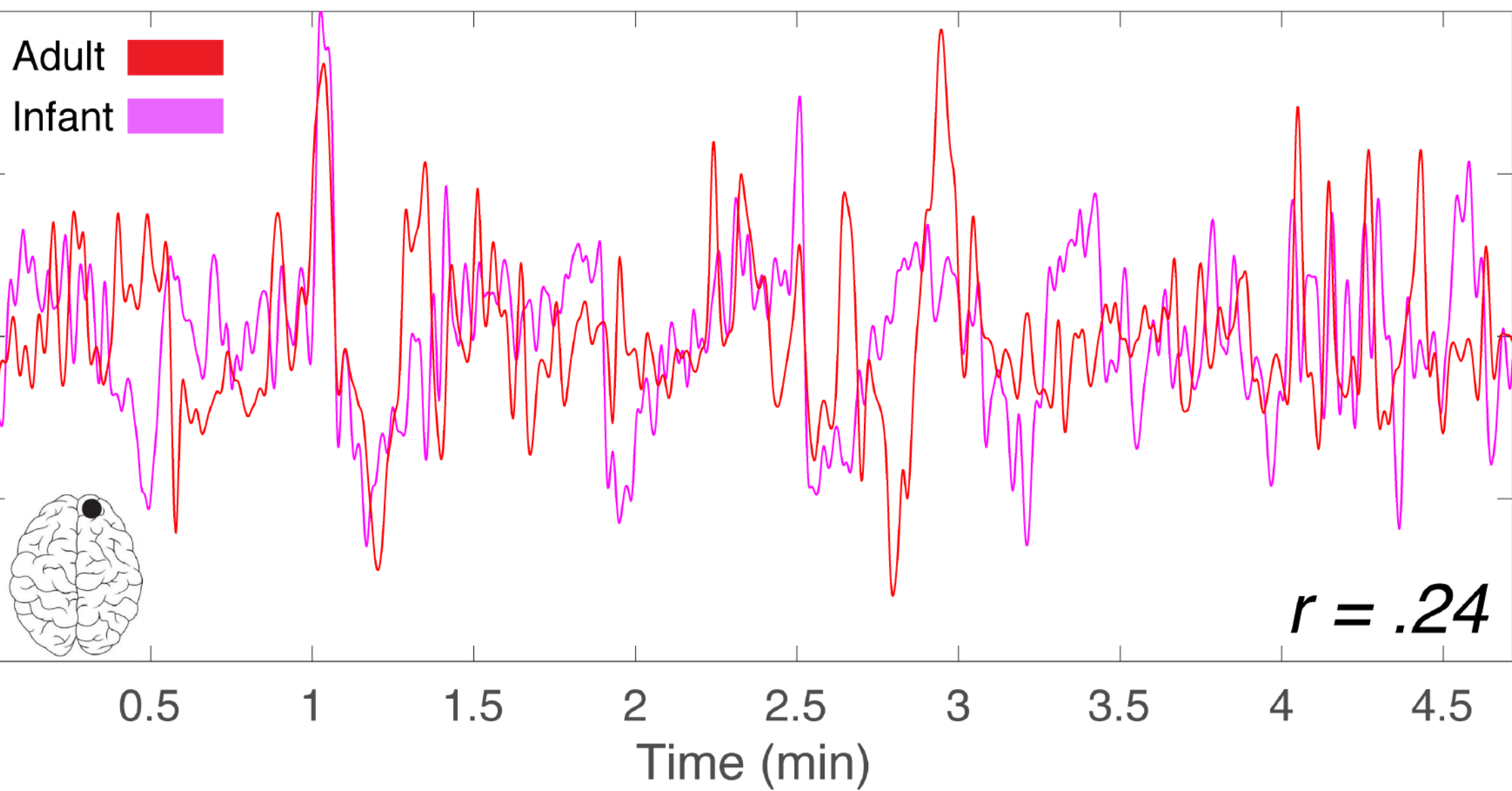
Neural coupling: a mechanism for communication

Neural coupling between the brains of adult storytellers and listeners predicts communication success in fMRI paradigms.

To begin to understand its role in early communication, we compared the strength of coupling between 9-to-15-month-old infants and an adult when they were interacting with each other versus with other people.

Additionally, we quantified the relationship between each person’s brain responses and dynamic communicative cues (gaze, smiling, and prosody).

Design



Pre-processing and analysis

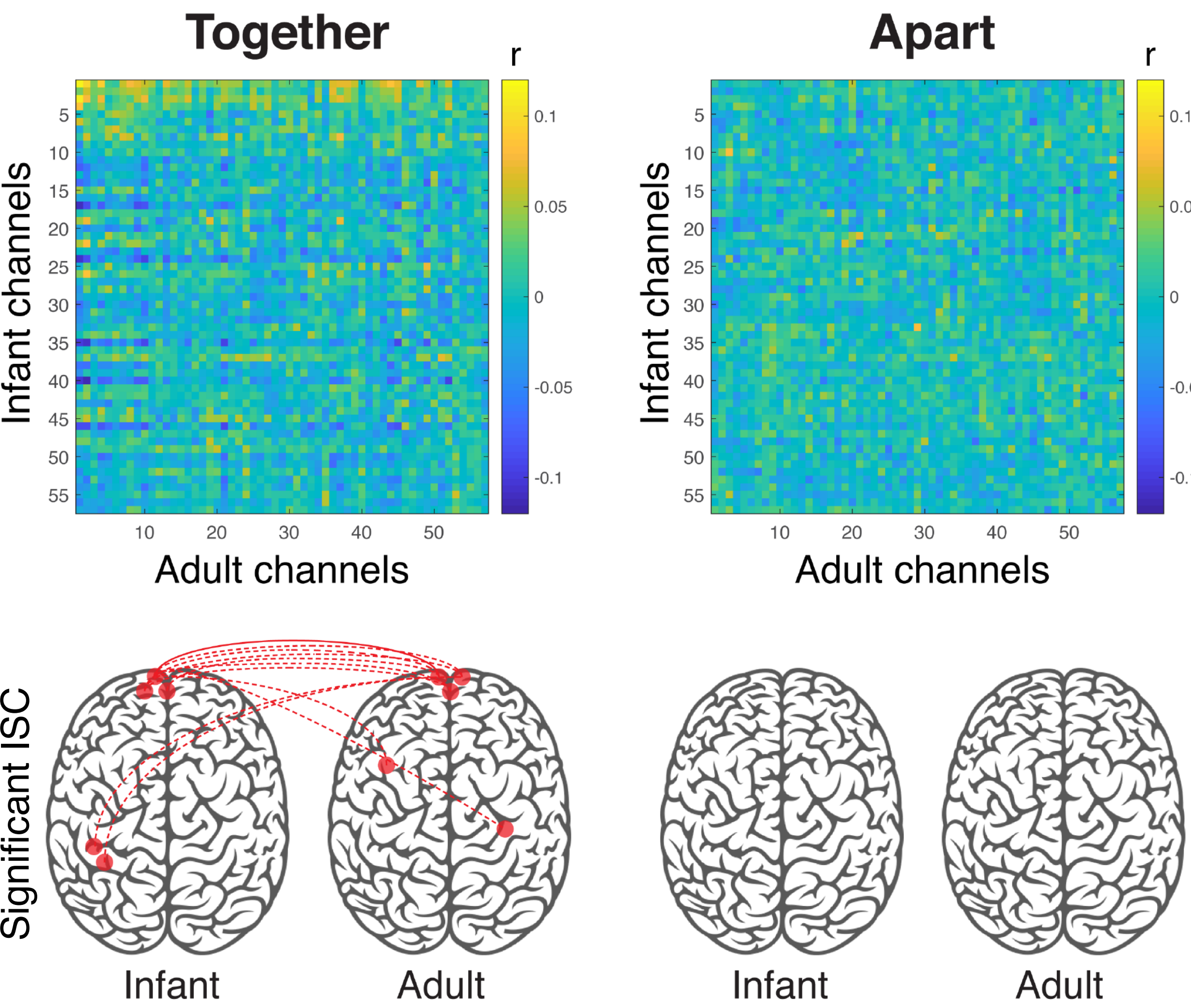
Record at ~8 Hz with Shimadzu LabNIRS (57 channels/subject)

Remove motion artifacts using MARA; LPF (0.5 Hz); HPF (0.02 Hz)

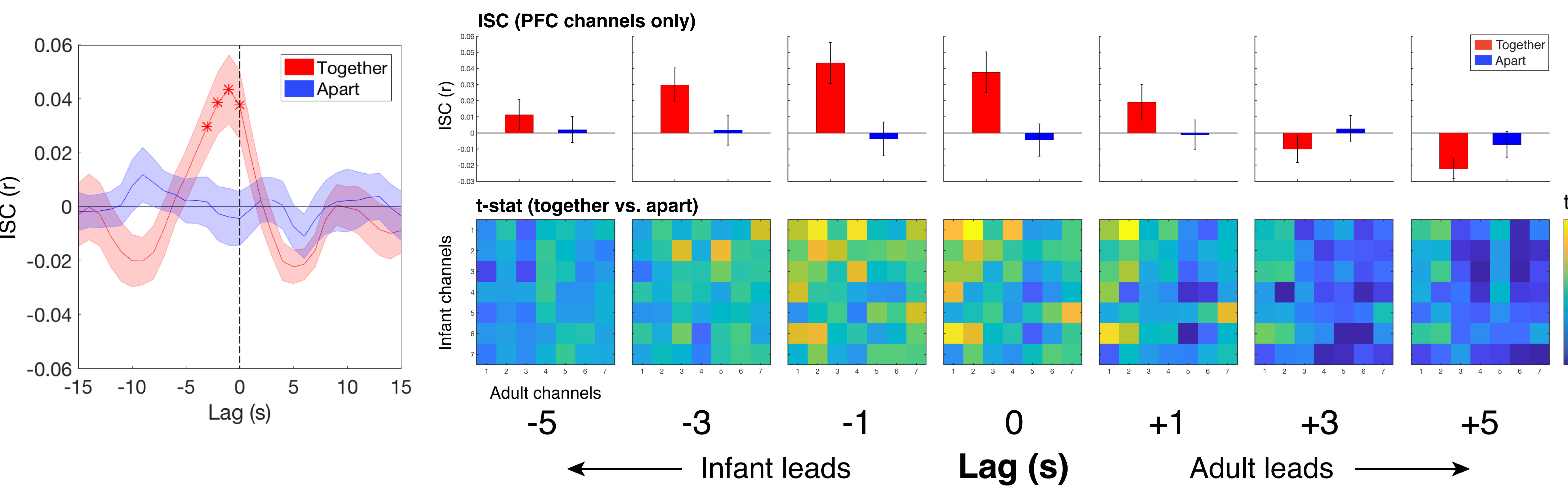
Inter-subject correlation (ISC) measure for each dyad (N = 18)

Results

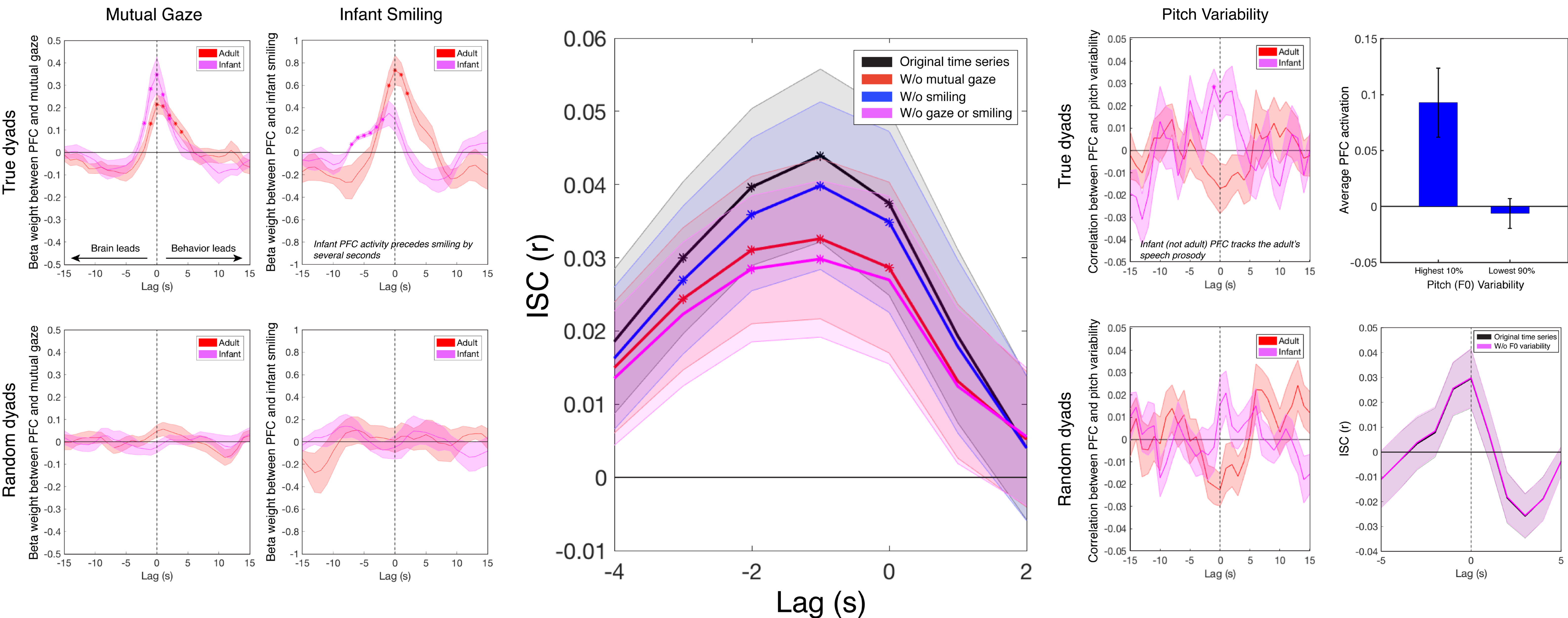
ISC (averaged across 18 dyads)



The infant’s signal slightly precedes the adult’s signal in prefrontal cortex



Relationship between neural responses in the PFC and continuous measures of social behavior



The brains of infants and adults are reliably coupled only when they communicate with each other

The prefrontal cortex of both the infant and adult continuously tracks the dynamics of social behavior

References Fernald, A., & Simon, T. (1984). Expanded intonation contours in mothers’ speech to newborns. *Developmental Psychology*, **20**, 104-113. Stephens, G. J., Silbert, L. J., & Hasson, U. (2010). Speaker-listener neural coupling underlies successful communication. *Proceedings of the National Academy of Sciences*, **107**, 14425-14430. Liu, Y., Piazza, E. A., Simony, E., Shewokis, P. A., Onaral, B., Hasson, U., & Ayaz, H. (2017). Measuring speaker-listener neural coupling with functional near infrared spectroscopy. *Scientific Reports*, **7**. Hasson, U., Ghazanfar, A. A., Galantucci, B., Garrod, S., & Keysers, C. (2012). Brain-to-brain coupling: a mechanism for creating and sharing a social world. *Trends in Cognitive Sciences*, **16**, 114-121. Piazza, E. A., Hasenfratz, L., Hasson, U., & Lew-Williams, C. (2018). Infant and adult brains are coupled to the dynamics of natural communication. *bioRxiv preprint*.

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