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Title: Hyperscanning MEG for understanding mother–child cerebral interactions

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Abstract: Child development is strongly affected by social interactions with caregivers, which may lead to molding of later social behaviour in our daily life. However, the underlying neural mechanism for such interactions has not yet been revealed. We introduce a magnetoencephalographic (MEG) hyperscanning system to examine brain-to-brain interactions between a mother and her child.
We used two whole-head MEG systems placed in the same magnetically-shielded room. One is a 160-channel gradiometer system for an adult and the other is a 151-channel gradiometer system for a child. We developed an audio-visual presentation system, which enabled a mother and her child to look at each other in real time. In each MEG system, a video camera was placed behind a half-mirror screen for visual presentation to obtain the subjects' facial expressions. The visual presentation system is capable of displaying not only real-time facial expression but also processed facial expression such as a still face or delayed facial expressions. A projector system displays the side-by-side face images of the mother and child, and the images are divided into each face using splitting mirrors and each face is displayed on the half-mirror screen in front of the other subject.
To the best of our knowledge, our system is the first MEG hyperscanning system in a single shielded room, and may contribute to elucidating brain-to-brain interactions not only between a mother and her child but also in general inter-individual, brain-to-brain interactions.