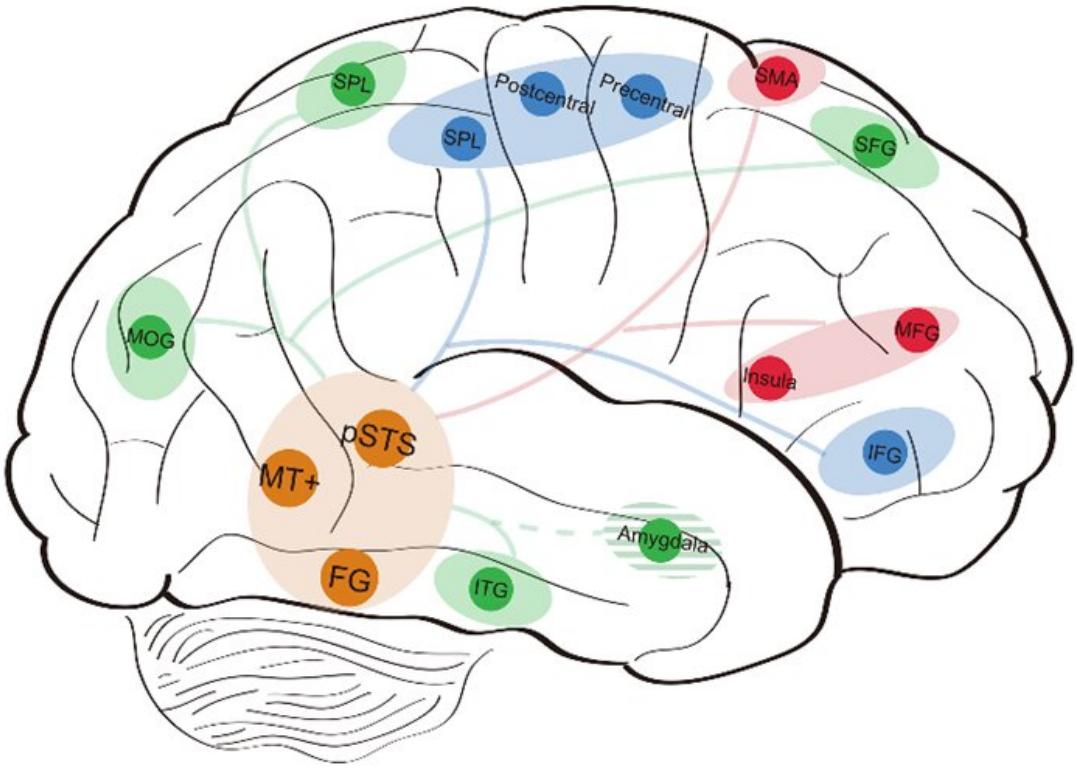
# Researchers discover distributed brain network underlying neural representations of biological motion attributes

May 31 2023, by Zhang Nannan




The model of a distributed and hierarchical system for BM attribute representations. Credit: Wang Ruidi

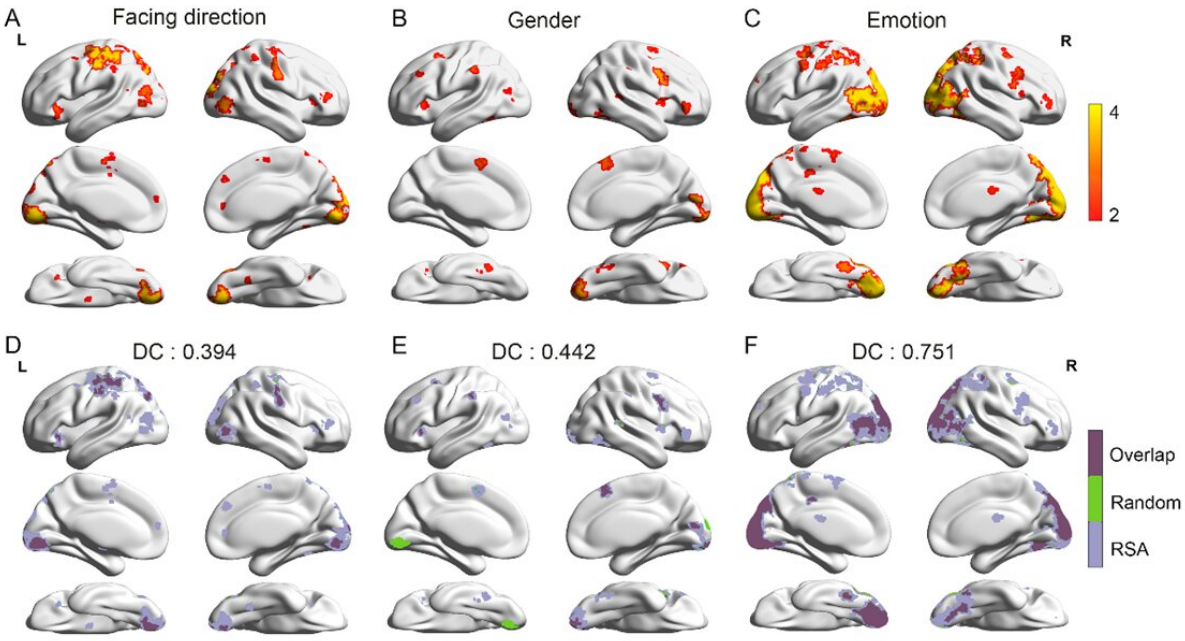
Biological motion refers to the kinesthetic information of living beings

(i.e., humans and animals). The ability of biological motion perception is crucial for the organism's survival and social interaction. Biological motion contains multidimensional attributes, including physical, biological and social attributes. How does our brain extract each attribute from multidimensional biological motion stimuli, and what is the relationship between the processing of different attributes?

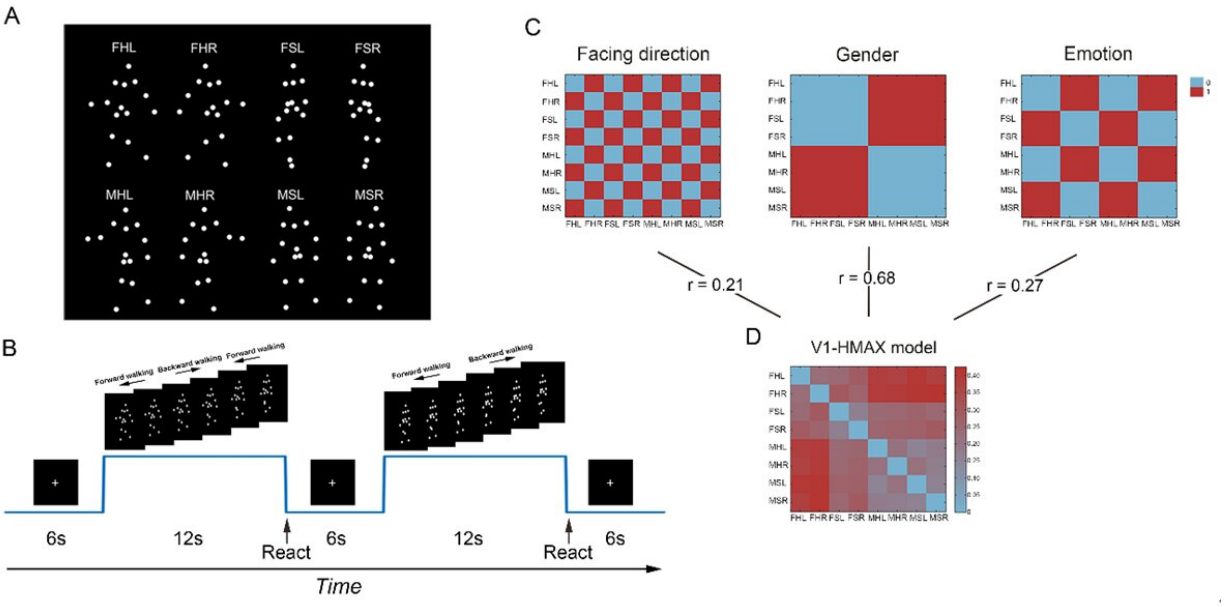
A research team led by Prof. Jiang Yi from the Institute of Psychology of the Chinese Academy of Sciences used functional magnetic resonance imaging (fMRI) to investigate the neural mechanisms underlying the processing of multidimensional biological motion attributes in the human brain. They used point-light displays as test stimuli, in which only the movement trajectories of a person's major joints are represented by a set of dots. They systematically manipulated three attributes of biological motion: walking direction, gender, and emotional state.

Using multiple regression representation similarity analysis (RSA), the researchers identified the brain networks involved in the processing of these three attributes. The brain areas that encode the walking direction attribute are mainly located in the dorsal cortical areas, those that represent the gender attribute are located in the frontal and temporal lobes, and the neural representations of the emotional state attribute widely involve the dorsal and ventral cortical areas.

In addition, they conducted an analysis in which the target attribute was maintained while other attributes randomly perturbed. This method was used to analyze how the processing of one attribute is affected by the processing of other attributes.




Results of multiple regression RSA. Credit: Wang Ruidi



Stimuli and procedure of the study. Credit: Wang Ruidi

The results showed that the processing of walking direction is more influenced by the other dimensions, followed by the processing of gender, while the processing of emotional state is least influenced by the other dimensions.

These results suggest that the processing of multidimensional biological motion does not simply proceed from the low-level physical attributes to the higher-level biological and social attributes, as previously assumed, but rather involves more complex recurrent processes. Based on the present findings and previous literature, the researchers proposed a brain processing model for the multidimensional attributes of biological motion.

In summary, this study identifies for the first time the brain network underlying the processing of multidimensional attributes of biological motion, and reveals its hierarchical structure. These findings shed new light on gait recognition research and biological motion computation modeling.

The findings are published in the journal *Cerebral Cortex*.

**More information:** Ruidi Wang et al, Distributed and hierarchical neural encoding of multidimensional biological motion attributes in the human brain, *Cerebral Cortex* (2023). DOI: 10.1093/cercor/bhad136

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