Mariella Pazzaglia from the IRCCS Fondazione Santa Lucia and University of Rome ‘La Sapienza’, in Rome describes a rapidly growing body of clinical research on the complex interplay of both production and comprehension mechanisms in actions derived from gesture comprehension studies described in patients with apraxia

The inextricable link between action perception and action execution was reported for the first time in a neuro-psychological study of apraxia patients published 27 years ago in this journal. In that article, Rothi et al not only provided the first direct evidence of the existence of a bidirectional relationship between action perception and motor activity, but also provided causative information on the neural structures involved in the visual mapping of actions in patients with brain damage. Using a non-verbal paradigm, the authors identified a clear association between a deficit in performing gestures and the ability to recognise the pantomime of gestures appropriately in left hemisphere lesioned patients with apraxia but not in those with aphasia. These observations suggest that the representational aspects of gestures prevent action imitation and influence the execution of a given movement, typically affected in apraxia. Patients with apraxia presented lesions centred, mainly on the parietal cortex, but extending into the frontal regions. The authors revealed that, although both frontal and parietal structures are involved in the execution of actions, the left posterior regions seem to be primarily linked to the ability to specifically comprehend the meaning of pantomime.

This anatomical and functional investigation of apraxia patients highlighted, for the first time, a series of unexpected characteristics of these sensorimotor areas.

In fact, a decade later, neurophysiological research performed in monkeys showed that these two areas, which likely host mirror neurons, are the core regions of the system of action observation and execution. In particular, it has been claimed that direct matching between action perception and execution is enabled by neural activity that overlaps largely in the inferior frontal gyrus and the inferior parietal lobe. One interpretation of such data is that motor system modulation during action perception facilitates and assists the reading of the actions of others and promotes readiness to predict movements and perform actions.

The differential impact of parietal and frontal lesions on the recognition of gestures depicted by Rothi et al is well supported by clinical advances afforded by further research on apraxia.

Although lesions in the premotor cortex lead to impairment in judging the errors of the immediate purpose of an action performed by a model, it has been suggested that patients with lesions that affect the parietal lobe fail to recognise the spatial motor and kinematic components of actions. The precise neuroanatomical substrates involved in gesture discrimination in patients with apraxia remain unclear. In accordance with hierarchical modelling, via which an observed action can be ‘understood’ on the basis of simulation mechanisms, action discrimination deficits (similar to action executions) in patients with apraxia can be described on multiple levels involving a complex neural network rather than a single structure. Therefore, although the parietal node may be more important for action simulation under conditions involving major kinematics and proprioceptive

PANTOMIME COMPREHENSION AND IDEOMOTOR APRAXIA

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