Understanding others: By age three, we can do this with mirror neurons

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By the age of three, children are capable of understanding others, "mirroring" those they are with to imitate and anticipate their intentions. They are able to do it thanks to the sophisticated neurofunctional

architecture that is necessary to understand others' intentions, the mirror neurons, that are already active at this age.

This is according to a study published in the journal *Proceedings of the National Academy of Sciences*, led by the collaboration between Giacomo Rizzolatti of the University of Parma, the scientist who discovered mirror neurons, and the research group composed of Cinzia Di Dio, Laura Miraglia, Giulia Peretti and coordinated by Antonella Marchetti, Director of the Department of Psychology at the Università Cattolica, Milan Campus.

"This is a very important discovery," explains Professor Marchetti, "as it demonstrates that even at such a young age, children are equipped with the 'resonance' system constituted by mirror neurons, which are the building blocks upon which a more complex and articulated understanding of the social world will be built with development and experience."

Although preschoolers are capable of planning goal-directed motor action sequences, their understanding of the intentions of others engaged in motor tasks had not been thoroughly investigated until now. The group from Università Cattolica, along with Professor Rizzolatti, measured the ability of preschool children to organize a sequence of motor actions by understanding the intention behind another individual's chain of actions.

To verify this ability, the researchers measured the activation of the mylohyoid muscle, involved in opening the mouth, while the children grabbed a piece of food to eat or a piece of paper to put into a container. When grabbing the food, the mylohyoid muscle activation began several milliseconds before the action was completed.

The muscle did not activate when grabbing the paper, suggesting a planned sequence of motor events focused on the action's goal. Even

when the children observed an experimenter performing the same grabbing tasks, the mylohyoid muscle activated during the observation of the eating task.

However, as Professor Marchetti explains, "We discovered that the muscle activation occurs more slowly compared to older children, aged 6-9 years (examined in previous studies), who are supported by the emergence of more sophisticated cognitive processes."

According to the authors, the results suggest that understanding others' motor intentions is a developing ability in preschool children.

"In conclusion," Professor Marchetti emphasizes, "the current data provide further support for the evidence regarding the various stages of child development in this domain, in continuity with research on infants that show early attunement to goal-directed motor acts."

"Overall, these results are also relevant from the perspective of early diagnosis, for example, in the case of children with autism spectrum disorder, as they would make it possible to implement a psychophysical instrumental assessment of an eventual deficit in understanding intentions and a possible impairment of fundamental precursors for the development of social skills," she concludes.