Making waves with groundbreaking brain research

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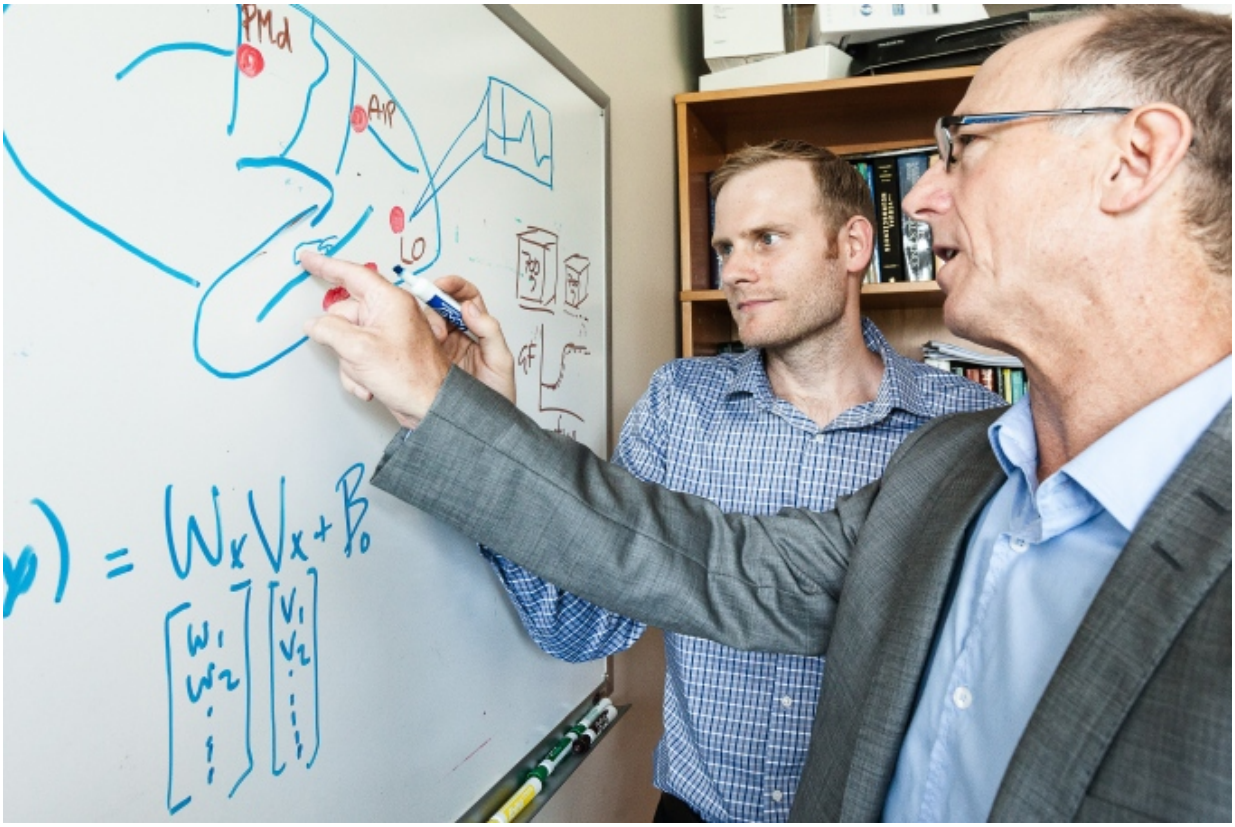

Jason Gallivan (l) and Randy Flanagan are exploring how the human brain works.

New research by Jason Gallivan and Randy Flanagan suggests that when deciding which of several possible actions to perform, the human brain plans multiple actions simultaneously prior to selecting one of them to

execute.

The findings by the Department of Psychology and Centre for Neuroscience Studies researchers challenge traditional theories that say people first decide what to do before planning an action to execute that choice.

"Understanding how the brain initially represents and decides between competing targets for action under natural conditions is a fundamental question in the neuroscience of decision-making and action planning and control," says Dr. Gallivan. "These findings could be critical for designing effective brain-machine interfaces that, for example, and might guide a robotic hand based on recorded neural activity."

During the research, participants were presented with two rectangles on a vertical screen in front of them. After a brief viewing period, one of the rectangles was filled in and the participant had to reach out and contact it with a rectangular stamp held in their hand. The orientation of one of the potential targets was "ambiguous" in that it could be contacted by turning the palms of the hands up or down (supination or pronation, both would be successful), while the orientation of the other "unambiguous" potential target required either supination or pronation (one or the other, not both).

The research found that the wrist orientation participants selected when the ambiguous target was cued was strongly biased by the wrist orientation that the participant would have had to use if the other target been selected.

"This finding strongly suggests that motor plans (specifically wrist orientation) were prepared in advance; had participants planned the movement after the ambiguous target was cued, we would not expect any influence of the other target," explains Dr. Gallivan.

The next stage in the research is understanding how and where these plans are formed in the brain and what regions are involved in selecting one plan over the other.

Dr. Gallivan and Dr. Flanagan's research was published in *Nature Communications*.

More information: Action plan co-optimization reveals the parallel encoding of competing reach movements, *Nature Communications* 6, Article number: 7428 DOI: 10.1038/ncomms8428

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