



**Mount  
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## **Our Brains May Think Two Steps Ahead When Trying to Sway Others**

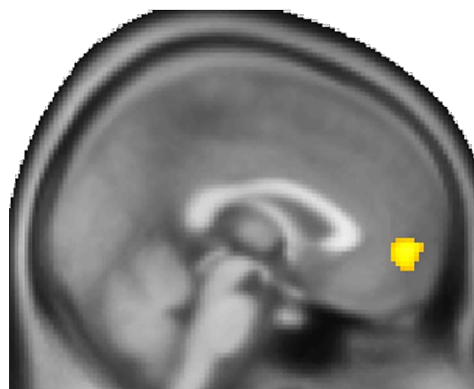
*Mount Sinai-led study suggests the brain uses forward thinking in social situations*

**New York, NY (November 1, 2021)** – Humans are able to think a few steps ahead in non-social situations, such as navigating a new hiking trail or planning a vacation. A Mount Sinai study now shows that we may also do this when interacting with other people.

In an effort to understand how a sense of control over others may influence the brain's decision-making processes, researchers at the Icahn School of Medicine at Mount Sinai tested the ability of healthy human subjects to play a bargaining game. For the first time, they found that people used "forward thinking" when trying to sway others. Forward thinking happened regardless of whether the subjects could actually influence others and appeared to be driven by neural activity in a well-known decision-making center of the brain.

"Humans are social beings. And, in our view, many psychiatric disorders are the result of problems with how the brain's software is programmed to handle social situations. In this study we tried to understand the rules that govern how that software is programmed," said Xiaosi Gu, PhD, Director of the Center for Computational Psychiatry at Mount Sinai. "Our results suggest that in certain social situations the brain draws on the kind of forward thinking often used when playing chess."

The study was led by Soojung Na, PhD, a former graduate student in the Gu lab and Dongil Chung, PhD, a principal investigator at the Ulsan National Institute of Science and Technology in South Korea.



### **Mapping out how the brain tries to sway others**

Scientists at the Icahn School of Medicine at Mount Sinai showed that the ventromedial prefrontal cortex (yellow spot), a well-known decision-making center in the brain may help use forward thinking when trying to influence others. *Courtesy of Gu lab, Mount Sinai, N.Y., N.Y.*

The researchers specifically investigated whether forward thinking is used during times when we try to influence others, or exert “social control.” Decades of research have shown that social control can have profound effects on well-being and mental health. Although several studies have shown that forward thinking is used in non-social situations, few have investigated its role in how we interact with others.

To test this idea, the researchers initially had 48 healthy volunteers sit in a brain scanner and play different versions of the “ultimatum game,” a well-known bargaining exercise in which the subjects were asked to split \$20 with an opposing team. Initial offers always started at \$5. In one, “controllable,” version of the game the rules were predictable. If the subject accepted the \$5 then the next offer would be one or two dollars lower. Conversely, a rejection of the \$5 led to raising the subsequent offer by the same amounts. For the second, “uncontrollable,” version of the game, a subject’s initial decision had no effect on the following offers. Instead they were chosen randomly and were thus unpredictable. Each subject played 40 rounds, alternating between the two different versions.

Initial results showed that there were differences between how the subjects responded to the games, which suggested that they perceived and exploited the advantages posed by the predictable version. Most notably, they received higher offers, took longer to decide, and felt a greater sense of control when playing the predictable version.

The participants reported a sense of control during the unpredictable game that was much higher—around 40 percent—than reality, which was zero chance of control. Moreover, in one subset of experiments, the subjects played the games against a computer instead of teams. Here the participants felt about 60 percent in control of the game regardless of which version they played and despite the fact that they received higher offers in the predictable version.

“These results highlight the complicated interplay between the actual controllability of social situations and our feelings of control,” said Dr. Gu.

Nonetheless, computational modeling experiments suggested that in every situation tested—predictable vs unpredictable and team vs computer—the subjects consistently used forward thinking to play the game. In other words, a computer algorithm which tested out whether a subject would think two, three, or four steps ahead before deciding on an offer recreated the initial results better than one that assumed the subjects just reacted or thought only one step ahead.

These findings were strengthened by the results of an online version of the initial experiments that was played by 1,342 participants. Again, the results showed that the predictable version of the game produced higher offers and a greater sense of control than the unpredictable one even though the simulation suggested that forward thinking was used for both.

Finally, the results of the brain scans suggested that these choices were being driven by neural activity in the ventromedial prefrontal cortex, a decision-making center known to be involved in forward thinking. For instance, the two-step forward thinking computer simulation helped

explain the changes in this area of the brain better than other simulations or when applied to other brain regions.

“These results expand the role of both the ventromedial prefrontal cortex and of forward thinking in our lives,” said Dr. Gu. “In the future, we plan to explore how problems in the brain’s forward thinking app may play role in depression, schizophrenia and other neuropsychiatric disorders.”

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### **Article**

Na, S.; Chung, D, et al., Humans Use Forward Thinking to Exploit Social Controllability, *eLife*, October 29, 2021, DOI: [10.7554/eLife.64983](https://doi.org/10.7554/eLife.64983)

### **About the Mount Sinai Health System**

The Mount Sinai Health System is New York City's largest academic medical system, encompassing eight hospitals, a leading medical school, and a vast network of ambulatory practices throughout the greater New York region. Mount Sinai advances medicine and health through unrivaled education and translational research and discovery to deliver care that is the safest, highest-quality, most accessible and equitable, and the best value of any health system in the nation. The Health System includes approximately 7,300 primary and specialty care physicians; 13 joint-venture ambulatory surgery centers; more than 415 ambulatory practices throughout the five boroughs of New York City, Westchester, Long Island, and Florida; and more than 30 affiliated community health centers. The Mount Sinai Hospital is ranked on *U.S. News & World Report's* "Honor Roll" of the top 20 U.S. hospitals and is top in the nation by specialty: No. 1 in Geriatrics and top 20 in Cardiology/Heart Surgery, Diabetes/Endocrinology, Gastroenterology/GI Surgery, Neurology/Neurosurgery, Orthopedics, Pulmonology/Lung Surgery, Rehabilitation, and Urology. New York Eye and Ear Infirmary of Mount Sinai is ranked No. 12 in Ophthalmology. Mount Sinai Kravis Children's Hospital is ranked in *U.S. News & World Report's* “Best Children’s Hospitals” among the country’s best in four out of 10 pediatric specialties. The Icahn School of Medicine is one of three medical schools that have earned distinction by multiple indicators: ranked in the top 20 by *U.S. News & World Report's* "Best Medical Schools," aligned with a *U.S. News & World Report* "Honor Roll" Hospital, and No. 14 in the nation for National Institutes of Health funding. *Newsweek's* “The World’s Best Smart Hospitals” ranks The Mount Sinai Hospital as No. 1 in New York and in the top five globally, and Mount Sinai Morningside in the top 20 globally.

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