

Human brain may contain a map for social navigation

July 1 2015



White matter fiber architecture of the brain. Credit: Human Connectome Project.

The brain region that helps people tell whether an object is near or far may also guide how emotionally close they feel to others and how they rank them socially, according to a study conducted at the Icahn School of Medicine at Mount Sinai and published today in the journal *Neuron*. The findings promise to yield new insights into the social deficits that

accompany psychiatric disorders like schizophrenia and depression.

The study focused on evidence for the existence of a "social map" in the hippocampus, the part of the brain that remembers locations in physical space and the order in which events occur. While previous studies had suggested that the hippocampus records a 3-dimensional representation of our surroundings when a key set of nerve cells fires, how the hippocampus contributes to social behavior had not been previously described.

"By quantifying the response patterns of people making decisions based on social interactions, we found that the hippocampus tracks relationships, intimacy and hierarchy within a kind of 'social map'," says Rita Tavares, PhD, postdoctoral fellow in the Schiller Laboratory of Affective Neuroscience at the Icahn School of Medicine at Mount Sinai. "Our data suggests a common mechanism for how the brain codes for physical space, time and for social relationships."

Previous social psychology studies and theory had identified two main factors that define [social relationships](#): power (competence, dominance, hierarchy) and affiliation (intimacy, trustworthiness, love). In the new study, Mount Sinai researchers gauged participants' sense of affiliation and power using a social space model: in a role-playing game, healthy subjects were tasked with finding a new home and job through power and affiliation interactions with virtual cartoon characters.

To quantify social interactions, study investigators used power and affiliation as the x and y axes of a two-dimensional graph where they recorded the social coordinates of each interaction. Each time the participant interacted with a character during the game, that character's coordinates moved along a trajectory of greater or lesser intimacy or power. The researchers designed a mathematical analysis where they asked whether the brain activity being measured in the functional

neuroimaging (fMRI) scanner tracked those changing social coordinates. The research team found a correlation between hippocampal activity and movement through the abstract social "space."

"We found that participants who reported better social skills showed better hippocampal tracking of the movement of the game characters through that social space," says Daniela Schiller, PhD, Assistant Professor of Psychiatry and Neuroscience and Lab Director of the Schiller Laboratory for Affective Neuroscience at the Icahn School of Medicine at Mount Sinai. "Our results suggest that the hippocampus is crucial for social cognition and imply that beyond framing physical locations, the hippocampus computes a more general, inclusive, abstract and multidimensional social map."

Navigating through social space may be relevant to many disorders that impair social cognition, such as sociopathy, borderline personality disorder, schizophrenia, depression and autism. Many of these disorders are known to involve hippocampal dysfunction. The current study results predict that an impaired geometric representation of social space in the [hippocampus](#) may accompany social dysfunction across psychiatric populations. Further exploration of these hypotheses could lead to improved diagnostic and therapeutic options for several psychiatric populations.

Provided by The Mount Sinai Hospital

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