NINDS Researches Social Decision-Making

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Imagine politicians using functional magnetic resonance imaging in focus groups to plot their campaigns and craft their messages. Or the marketers of everything from candy to Cadillacs using it to package and promote their goods.

That's not exactly what Jordan Grafman is striving for as chief of the Cognitive Neuroscience Section at the National Institute of Neurological Disorders and Stroke, but he readily concedes his research just might be translated into such activities some day.

Consider his research on social decision-making. "We're studying how people develop and execute cognitive plans," Grafman said. "How people recognize and engage in social interactions and use social attitudes." He uses fMRI on normal, healthy volunteers to watch how their brains respond to names, faces, and political statements on a monitor. "We try to use things they are already familiar with," he said, explaining why their brains are fed photos of George W. Bush and California's Gov. Gray Davis, among others.

What his researchers watch for are the subjects' associations between parties and politicians, platform statements and philosophies, and the emotional judgments that accompany each. "We're looking for implicit and explicit attitudes about social obligations, as well as individuals who are best at exploiting social obligations, or best at representing a point of view," Grafman explained. "What we want to see is how brain activation varies via these manipulations. We think this is a good context for this kind of study, because it's the sort of knowledge we are exposed to on a daily basis. At the same time, it has applications for both basic knowledge and applied."

He calls it political neuroscience. "We think that plans are stored in the pre-frontal cortex. The more we learn about this kind of knowledge, the more we can potentially put it to good use in a variety of ways, and eventually develop therapies based on the way knowledge is represented in the frontal lobes."

Then there's Grafman's companion research on economic decision-making, which found its way into the cover story of Forbes Magazine, "In Search of the Buy Button" [September 2003]. The article describes researchers charting brain activity in response to product messages, looking for the triggers that make people decide to buy. Grafman is among those quoted in the piece.

"Here, you're actually able to see different brain areas being activated," Grafman said. "By the nature of the colors you use or the kind of scene you show, or the way objects are shaped, you may be more or less likely to activate a certain pattern in the brain that is going to get the kind of approach you want people to take." In other words, if you want impulse buying for your product, activate one sector of the prefrontal cortex; if you want a contemplative buyer for a big-ticket item, activate another.

Though this research seems ostensibly distant from improving health outcomes in the real world, Grafman believes it is merely the first fiber of insight in a tight weave of neurological understanding. “First, we are trying to learn how the frontal lobe of the brain works – that’s basic. Secondly, we also know that the prefrontal cortex is susceptible to not functioning as well as a result of aging and disease and some forms of brain damage. Our research will enable us to make predictions about what kinds of problems people in these circumstances will have so their families can adjust. Hopefully we will have some direct impact on day-to-day life.”

He has demonstrated, for example, that repetitive stimulation of the left prefrontal cortex significantly reduces response times in analogic reasoning – finding similarities between stimuli, scenes or events – without affecting accuracy, indicating that the left prefrontal cortex is important to drawing analogies. “Although our study involved only normal subjects and not subjects with brain injury,” he wrote in Neurology (February, 2001), “the facilitation of response time in analogic reasoning … raises a question of future therapeutic effect of this technique in neurorehabilitation.”

For even more direct real-world implications down the road, Grafman points to his driving simulator, a computerized car complete with steering wheel, brakes, and accelerator. “We’ve been trying to see how patients who have focal lesions to the prefrontal cortex and dementia perform on the driving simulator. We need to point out to people in the community that it’s not just Alzheimer’s patients or older people who have problems driving; there are also brain injuries or disorders that can affect driving ability.

“Many transportation departments, state, national, and abroad, are extremely interested in trying to determine the root cause of accidents,” he said. “One of the causes happens to be that if somebody has had neurological injury, they might be more likely to violate certain norms or rules and unable to benefit as much from error feedback.”

Grafman’s other major research interest is the brain’s plasticity – how certain areas of the brain can reorganize their neural networks to accept a different learning function to compensate for injury to another part of the brain. “We’re trying to understand the basic rules that guide cognitive plasticity,” Grafman explained. “We know there are maps in the cortex that reflect the domains of what’s being learned. If we learn about that in normal people and also learn about recovery of function in people who have had local brain injuries, then we might be able to influence how therapies are guided and introduced to people who have had brain injuries.”

He is trying to understand both the variability of the brain’s plasticity and its cost, “because plasticity isn’t free.” According to Grafman’s research, when a recovering patient improves functioning because an uninjured part of the brain has taken on the work of an injured part, “it may be that given the limited real estate, the limited amount of cortical space we have; it may cost you in another function.” All are areas ripe for translational research. Not that Grafman hasn’t already had firsthand success translating his work. During the 1980s, he served five years at the Walter Reed Army Medical Center in Washington, DC, as neuropsychology chief of the Vietnam Head Injury Study, research that prompted changes in both helmet design and how soldiers with head injuries are evaluated and treated. He is still with that project, which is about to bring the soldiers back to look at the long-term effects.

Veterans provide a rich pool for such research, because there is a great deal of baseline, pre-injury data on them. Vietnam veterans’ aggression studies, for example, identify areas of the brain important for inhibiting abnormal aggression. “If doctors know that a patient had a prefrontal lobe injury, and this patient wasn’t aggressive before but is now, examiners may conclude that the aggression may be due to the injury.”

“The nature of what I’m studying,” Grafman said, “lends itself to some application. In the end, I want to help patients. This has been a driving factor in my own career. In my own experience right out of graduate school, being the psychologist on the Vietnam Head Injury Study, I was dissatisfied with the clinical instruments, the tests available to me. I didn’t think they captured the richness of the problems people were having.”

In Grafman’s experience, developing research and laboratory testing is interesting, but what makes the work necessary and worthwhile are the people it affects. “Every time I sit down with the family of a patient,” he said, “if I can take the results of our work and tell them this is how we think it relates to them, if you can do that one patient at a time, you are translating your research into real world results, perhaps not in a general way but person by person, helping patients.

“To this day,” he continued, “the goal is to bring [application] back to the real world. I don’t know whether I’ll succeed or not, but I’m trying, that’s for sure.”