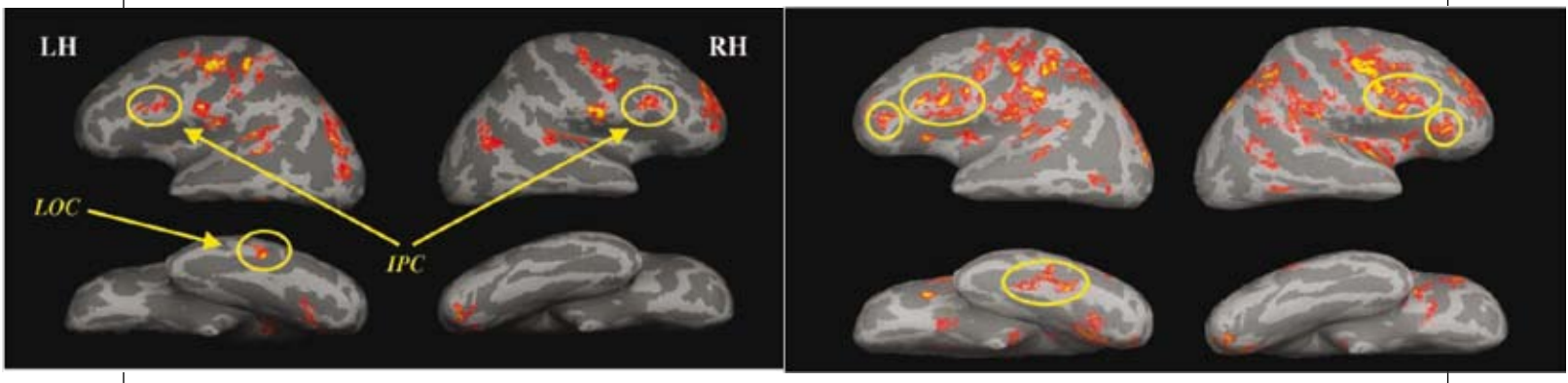
# Mirrors vs. Teapots
# How Our Brains Perceive the World

*Dr. Nurit Gronau of the Department of Psychology at the Open University is focusing her research on trying to understand how the brain perceives objects within a particular context. She is reluctant to define herself as "a pioneer" but no doubt her research is helping to sharpen our understanding of how the brain interprets the visual world.*




Dr. Nurit Gronau, of the Open University's Department of Psychology, is part of a growing group of young psychologists who are using brain imaging technologies to gain a greater understanding of how our brains perceive objects and their interrelationships.

In a fascinating new study, "Integrated Contextual Representation for Objects' Identities and Their Locations" recently published by the *Journal of Cognitive Neuroscience*, Dr. Gronau, along with her colleagues Maital Neta and Moshe Bar, show the strong interrelationship between our perception of objects and their contextual setting.

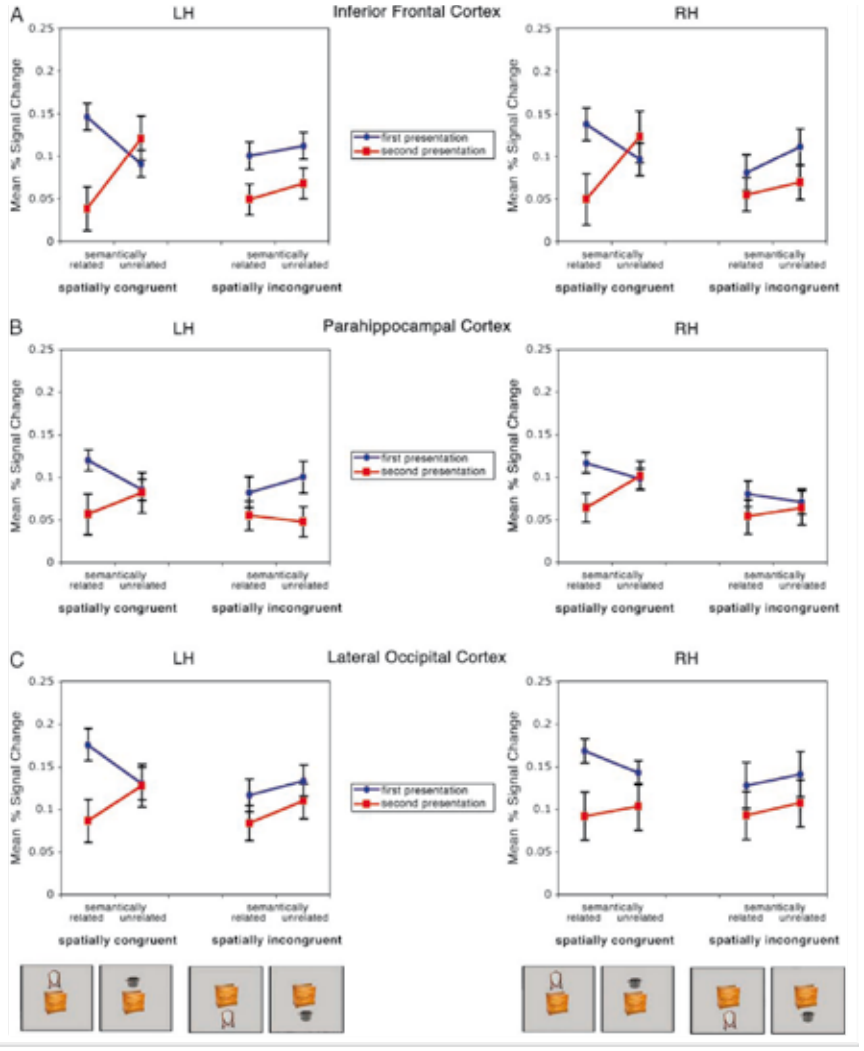
Why is this important? As Dr. Gronau explains, "First, most scenes we look at are complex, and our visual skills need to cope with this complexity. Second, to better help people who lack (for one reason or another) visual perception skills, we have to understand how perception under healthy circumstances works."

Nurit and her team examined how people respond to multiple objects within particular settings. Much research in the brain imaging domain has been devoted to understanding visual perception of individual objects. However, in real world settings, objects do not appear in isolation. Rather, they are typically surrounded by other contextually-related objects (e.g., a computer screen lying next to a keyboard and a mouse, all three objects resting on a desk). "Thus, the contextual environment of an individual object may affect object recognition" Dr. Gronau explains "and our goal was to examine whether this effect is manifested in participants' brain activation."

## Context and Object

In language, words are linked via semantic associations such that a target word is recognized faster if it appears after a semantically associated prime word (for example, doctor-nurse, table-chair). Does this hold true in the world of visual perception?

The team's hypothesis was that this was so, with one additional 'proviso' – a spatial-contextual framework. The thinking was that pairs of objects would be recognized better if they were semantically related rather than unrelated (as in language), however, object recognition would additionally depend on the exact spatial relations between the objects. Thus, the brain would identify objects better if they were set within an environment that also conveys their typical spatial or functional interrelationship.




What the research uncovered was that our brain perceives better scenes which have strong semantic interrelationships and exist in logical spatial frameworks.

Group participants examined pairs of objects in four different settings:

1) mirror on dresser: semantically-related; congruent setting
2) mirror under dresser: semantically-related; incongruent setting
3) teapot on dresser: semantically unrelated; congruent setting
4) teapot under dresser: semantically unrelated; incongruent setting

The brain showed stronger activation for scene #1 than scene #3, but, when objects were positioned in incongruent settings (in the case of scene #2 and scene #4), the brain did not show any differences between the two settings. What the researchers concluded was that "the visual domain is dependent on the spatial component, thereby proving that there is a deep associative encoding of object pairs that forms contextually coherent percepts."

How can this new knowledge be applied?

## Helping Stroke Patients

Stroke patients will often suffer lesions to the brain. One type of lesion results in a common disabling syndrome called Hemineglect. Individuals with right-sided brain damage may fail to be aware of objects to their left, thereby demonstrating neglect of leftward items.

In neurologist Oliver Sacks' best-selling book, *"The Man Who Mistook His Wife for a Hat,"* Sacks' describes cases of patients suffering from a range of neurological disorders. One such case is Mrs. S. who, following a stroke, was diagnosed with Hemineglect Syndrome. Mrs. S. was able to masterfully make up the right side of her face, but not the left because her brain could not process that she had a left side. Will Nurit's research help us help people like Mrs. S.?

Perhaps. "My findings support the fact that there is an integration of semantic and spatial factors at a rather low perceptual level that has to do with visual object processing. My research was done with healthy people, but it could have applications for people who have problems with the mental representation of the visual world – such as those suffering from Hemineglect – or people lacking the ability to process several objects together."

Meanwhile, Dr. Gronau is continuing her research on visual perception and working on developing a new course in cognitive neuroscience for the University's Department of Psychology.