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“Light reflected from objects in the environment projects onto the retinal surface, resulting in intricate and dynamic patterns of brightness and color. Human observers interpret these images, nearly instantaneously and generally without awareness, to yield unequivocal and behaviorally informative percepts. Our goal has been to understand the neuronal structures and events that underlie visual perceptual experience, and its contributions to knowledge, behavior, and consciousness.”

We live in a dynamic environment. Optimal encoding of sensory information requires that sensory systems be continuously tuned to the prevailing environment, much like fine-tuning our cars for the current driving conditions. Yet while it is important that sensory information be represented with high fidelity, the brain has only limited resources available. Albright and his team are interested in how neural systems reconcile these conflicting demands in the primate visual system.

Using their working hypothesis that sensory systems resolve the dilemma by way of compromise, the scientists examined the effects of sensory resource reallocation—a phenomenon commonly known as sensory adaptation—on the perception of visual motion. The initial theoretical work led to predictions about the patterns of perceptual and neuronal change expected in a system that reallocates its resources to dynamically optimize perception in a changing environment. Behavioral studies put these predictions to the test by revealing the perceptual changes induced by adaptation. Physiological studies uncover the neuronal mechanisms of sensory reallocation.

The results reveal that sensory systems enhance the neuronal representation of those aspects of the environment that are frequently encountered and/or are significant for successful behavior. The enhancement comes at the cost of reduced sensitivity to those stimuli that are less commonly encountered. Specifically, the observed perceptual recalibration is mediated by changes in motion-selective neurons in the visual cortex. Some of the neurons change their sensitivity to particular stimuli, and others shift their sensitivity to other stimuli. These findings indicate that the neuronal mechanisms of perception can only be understood by studying how sensitivity is dynamically distributed across neurons tuned to the entire range of visible stimuli.

Taken together, the observations of Albright and his colleagues reveal that sensory processing is markedly adaptable. This adaptability enables us to optimize perception and behavior in a world that presents us with varying sensory demands, caused by changes in the environment, behavioral goals, and age-related decline in sensory function.

For more information, please visit
www.salk.edu/faculty/albright.html

Left to right:

First row: Jae Jin Ryu, Ricardo Gil da Costa, Christian Wehrhahn, Thomas Albright, Jorge Aldana, Sergei Gepshtein, Venkata Posina, Gene Stoner

Second row: Hulusi Kafaligonul, Ray Fung, Margaret Mitchell, Dinh Diep, Marco Lopes, Lu Lesmes

