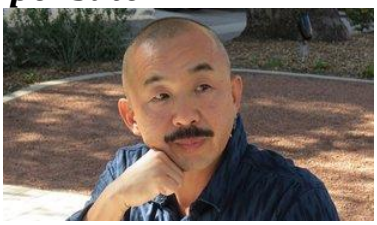
Plenary Talk 2

Vision is to see "Invisible"
- go *behind*, *beyond*, *across*, and *to compensate*



Baltimore Professor Shinsuke Shimojo

California Institute of Technology, USA
(Division of Biology & Biological Engineering; Computation & Neural Systems)

Abstract

Biological vision is not just to extract the "information explicitly represented" in images. As for the first case, it certainly interpolate *behind* occluders immediately and (seemingly) effortlessly, which had challenged machine vision especially during 80's - 90's (and partly still). Second, vision goes *beyond* what is explicitly visible in the image, which actually has two aspects; a) spatially in the literal sense, as exemplified in so-called illusory contours, and b) more in the sense of implicit inference, as witnessed in dynamic perception (with a lot of "postdictive" features), local constraint propagation, the Generic Viewpoint Principle, and 3D object perception. Third, vision is in a way not just mono-modal, rather it goes *across* various sensory modalities. It not only affects perception in other modalities, but it also is affect by them. It mostly follows Bayesian-like predictions and overall to be consistent with evidence-weighted integration based on S/N ratios, but some phenomenological aspects (including awareness and confidence) remain to be solved.

In fact, one may even say that the entire history of Vision Science, specifically Psychophysics and Neuroscience, can be summarized along the line (of seeing "Invisible"). In this talk, I will present a variety of examples to offer some insights to the future, in the image processing community. Additional examples will include X' (extreme) peripheral vision, multisensory interactions/integration being consistent with the "Brain Compensation" hypothesis, and sensory-motor aspects (such as "vection" and postural reflex).

To conclude, vision can surely be considered a kind of inference, but it is a very special kind which is implicit, effortless, self-organized, and even unavoidable.

Biography

Shinsuke Shimojo is an experimental psychologist/cognitive neuroscientist, with long-standing interests in visual psychophysics and their applications to visual illusions, cross-modal plasticity, human emotion, preferences, and decision-making. He received his B.A. and M.A. degrees from the University of Tokyo (1978, 1980), and his Ph.D. from the Massachusetts Institute of Technology (1985). He is currently Gertrude Baltimore Professor in Experimental Psychology in the division of Biology/Computation and Neural Systems at the California Institute of Technology. His laboratory at Caltech has been applying quantitative psychophysical techniques to understand human implicit perception and social behaviors, with applications of eye tracking, fMRI, EEG, TMS and tDCS, and other techniques. He has approximately 150 publications, including multiple papers in high-impact journals, such as Nature, Science, Nature Neuroscience, and Neuron. He is also known for his collaborations with artists, and a science column (ASAHI WEBRONZA).