Neural representation of materials in visual cortex

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Material information is processed mainly along the ventral visual pathway of the cerebral cortex. Neuroimaging studies have shown that transformation of signals takes place along the hierarchy of this pathway where early areas represent low-level image statistics and higher ventral area represents cross-modal impression of the materials. By comparing neural representation of materials before and after the visuo-haptic experience in the monkey using fMRI, we found that visuo-haptic experience shapes cross-modal representation in the higher ventral cortex. Then, how is material information processed and distinguished in the ventral visual pathway? Processing of natural texture likely plays a key role because different classes of materials (e.g. wood, leather, fur) have specific surface textures. Analysis of neural selectivity to texture images show that higher order image statistics related to parametric description of natural textures are gradually extracted in the intermediate stages of the ventral visual pathway. Together, we can think that materials are visually represented by a combination of texture features in the intermediate stage of the ventral visual pathway, and that association with haptic information is made at the higher stage to form cross-modal impression of materials.

Reference:

Komatsu H, Goda N, "Neural mechanisms of material perception: quest on Shitsukan," Neuroscience 392:329-347, 2018.

Goda N, Yokoi I, Tachibana A, Minamimoto T, Komatsu H, "Crossmodal association of visual and haptic material properties of objects in the monkey ventral visual cortex," Curr Biol 26:928–934, 2016.

Okazawa G, Tajima S, Komatsu H, "Gradual development of visual texture-selective properties between macaque areas V2 and V4," Cereb Cortex 27:4867–4880, 2017.

Biography:

Hidehiko Komatsu received his PhD in Engineering from Osaka University in 1982. In 1982, he joined the Faculty of Medicine in Hirosaki University as an assistant professor. After working from 1985 - 1988 in National Eye Institute in U.S.A. as a visiting associate, he joined the Electrotechnical Laboratory as a senior researcher. In 1995, he joined National Institute for Physiological Sciences as a professor. From 2017, he is the director and professor of Brain Science Institute of Tamagawa University. His primary research interests are the neural mechanisms of visual perception and cognition.

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