Kitada, R., Hashimoto, T., Kochiyama, T, Kito, T, Okada, T., Matsumura, M., **Lederman, S.J.,** & Sadato, N. (2005). ***Graded response in the human brain for tactile roughness estimation of gratings: An fMRI study.*** NeuroImage , 25 , 90-100.

Abstract
Human subjects can tactually estimate the magnitude of surface roughness. Although many psychophysical and neurophysiological experiments have elucidated the peripheral neural mechanisms that underlie tactile roughness estimation, the associated cortical mechanisms are not well understood. To identify the brain regions responsible for the tactile estimation of surface roughness, we used functional magnetic resonance imaging (fMRI). We utilized a combination of categorical (subtraction) and parametric factorial approaches wherein roughness was varied during both the task and its control. Fourteen human subjects performed a tactile roughnessestimation task and received the identical tactile stimulation without estimation (noestimation task). The bilateral parietal operculum (PO), insula and right lateral prefrontal cortex showed roughness-related activation. The bilateral PO and insula showed activation during the noestimation task, and hence might represent the sensory-based processing during roughness estimation. By contrast, the right prefrontal cortex is more related to the cognitive processing, as there was activation during the estimation task compared with the no-estimation task, but little activation was observed during the no-estimation task in comparison with rest. The lateral prefrontal area might play an important cognitive role in tactile estimation of surface roughness, whereas the PO and insula might be involved in the sensory processing that is important for estimating surface roughness.

Newman, S.D., Klatzky, R.L., **Lederman, S.J.** & Just, M.A. (2004). ***Imagining material versus geometric properties of objects: an fMRI study.*** Cognitive Brain Research, 23(2-3), 235-246.

Abstract
Two experiments are reported that used fMRI to compare the brain activation during the imagery of material and geometric object features. In the first experiment, participants were to mentally evaluate objects along either a material dimension (roughness, hardness and temperature; e.g., Which is harder, a potato or a mushroom?) or a geometric dimension (size and shape; e.g., Which is larger, a pumpkin or a cucumber?). In the second experiment, when given the name of an object and either a material (roughness and hardness) or geometric (size and shape) property participants rated the object on a scale from 1 to 4. Both experiments were designed to examine the underlying neural substrate that supports the processing of material object properties with respect to geometric properties. Considering the relative amount of activation across the two types of object properties, we found that (1) the interrogation of geometric features differentially evokes visual imagery which involves the region in and around the intraparietal sulcus, (2) the interrogation of material features differentially evokes the processing of semantic object representations which involves the inferior extrastriate region, and (3) the lateral occipital cortex (LOC) responds to shape processing regardless of whether the feature being queried is a material or geometric feature.

See also **"Haptic Face Processing"**