

THE SENSES: A COMPREHENSIVE REFERENCE

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Volume 6 SOMATOSENSATION

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TREATMENT OF HEARING LOSS: VIRAL TRANSFECTION
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Introduction to Volume 6

When we read the word ‘touch’ we think of hands: an empty hand extended in friendship, a lover’s caress, a mother cuddling her infant child, the ‘high fives’ of teammates slapping each others’ hand celebrating victory in sporting events. Touch means contact between our body and another person, object, plant, or animal. Contact deforms the skin in ways that convey information to the brain about the identity of external entities; their size, shape, compliance, texture, and temperature. Because the hand is the most densely innervated part of the human body, it is not surprising that we use the hand more than any other body part to glean information beyond ourselves that allows us to interact with our surroundings in meaningful ways.

The sense of touch is unique in that it is not merely receptive, but it is crucial for guiding motor behavior. We interact with the environment to acquire tactile information, and use that knowledge to modify the world. Touch is essential for guiding the behavior of our hands. This dual sensory and motor role of touch has been beautifully depicted by the seventeenth century Spanish artist Jusepe de Ribera (1591–1652) in a canvas entitled ‘*The Sense of Touch*’ (Figure 1). Here we see a blind man holding a sculpted head in his left hand as he palpates the face with his right hand. The surface contours and features of the head that are sensed by receptors in the hand are transformed by the brain into a mental image of the object. However, this object is not found in this form in nature, but was actually created by the hand of the sculptor, guided by touch. The painting itself is,

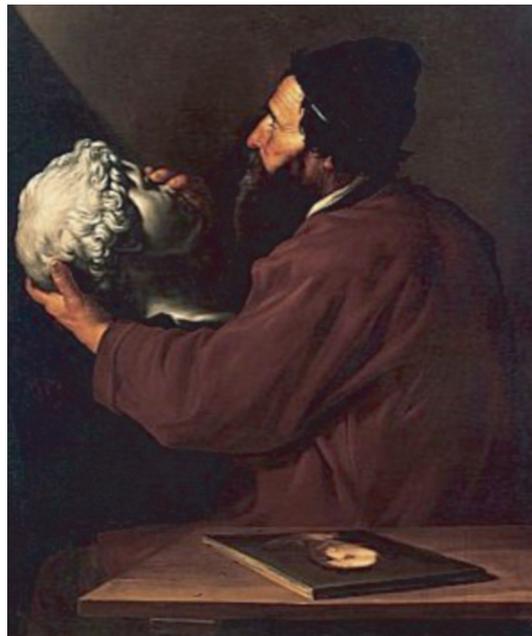


Figure 1 The Sense of Touch, c. 1615–16 by Jusepe de Ribera. Reproduced with permission from The Norton Simon Foundation © 2002.

of course, another work of the hand in which direct vision of the world, or the world of the artist's imagination, is transformed by the actions of the hand into an image on canvas delineated by skilled hand movements.

In this volume we have attempted to summarize current knowledge about the sense of touch. The various chapters have been selected to provide insight into the neurobiological mechanisms that underlie tactile sensations. We begin with an examination of the psychophysics of touch, the ability of humans to perceive the world through deformation of the skin by external stimuli. We then describe the various sensory receptors in the skin that transduce mechanical and thermal events into a pattern of nerve impulses that convey discrete bits of tactile information to the central nervous system. We explore how the information is integrated and transformed in the brain to give rise to conscious sensations of touch. In higher centers of the cerebral cortex, the sensory signals are further transformed by cognitive mechanisms such as attention, experience, and prediction, as well as by motor behaviors as we interact with the world in meaningful and useful manners. These subjective actions allow us to feel what we are particularly interested in, and to shape the information in ways that are useful for accomplishing the desired goals.

Most of the chapters in this volume deal with the sensory capabilities of the hand of humans and monkeys. However, we have also included chapters on touch in other parts of the body, and in other species, to highlight those properties of touch unique to primate hands, and those generalizable to touch as a sensory modality. We hope that this volume will provide a valuable resource to students encountering this subject for the first time, as well as to the expert audience who have contributed so much to our understanding of the sense of touch.

Jon H. Kaas

Dedication

During the course of one year, the somatosensory community lost three major colleagues: Kenneth Johnson, Stanley Bolanowski, and Tim Pons. All three had been invited to contribute to this Volume, but sadly they passed away before this was possible. References to their work abound in various chapters, but do not substitute for their unique achievements and voices. We all miss them dearly, and would like to dedicate this Volume to their memory.

Esther P. Gardner and Jon H. Kaas

