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TACTILE DISCRIMINATION AND REPRESENTATIONS OF TEXTURE, SHAPE, AND SOFTNESS

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We present here some of the salient results on the tactual discriminabilities of human subjects obtained through psychophysical experiments, and the associated peripheral neural codes obtained through electrophysiological recordings from monkey single nerve fibers. Humans can detect the presence of a 2 microns high single dot on a smooth glass plate stroked on the skin, based on the responses of Meissner type rapidly adapting fibers (RAs). They can also detect a 0.06 microns high grating on the plate, owing to the response of Pacinian corpuscle fibers. Among all the possible representations of the shapes of objects, the surface curvature distribution seems to be the most relevant for tactile sensing. Slowly adapting fibers respond to both the change and rate of change of curvature of the skin surface at the most sensitive spot in their receptive fields, whereas RAs respond only to the rate of change of curvature. Human discriminability of compliance of objects depends on whether the object has a deformable or rigid surface. When the surface is deformable, the spatial pressure distribution within the contact region is dependent on object compliance, and hence information from cutaneous mechanoreceptors is sufficient for discrimination of subtle differences in compliance. When the surface is rigid, kinesthetic information is necessary for discrimination, and the discriminability is much poorer than that for objects with deformable surfaces.