RealClear Science

Human Touch Sensitivity Extends to Nanoscale

By Ross Pomeroy
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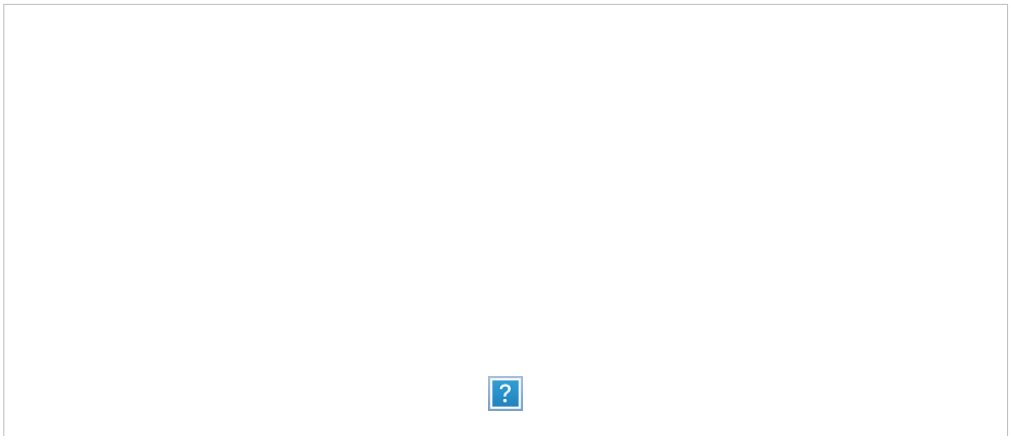
When it comes to senses, you might think that humans got the short end of the evolutionary stick. We can't smell food eighteen miles distant, like the grizzly bear. We can't hear sound frequencies up to 300,000Hz, like the greater wax moth. Nor can we spot a scampering rabbit from several miles away, like the bald eagle.

But don't resign yourself to jealous melancholy just yet. Swedish researchers have just announced that our sense of touch is a far cry from deficient. In fact, humans are capable of discerning deformations down to thirteen nanometers! Take that, giant squid. We don't need or want your billions of photoreceptors!

To glean the result, the researchers sat down twenty blindfolded subjects and had them -- using only their index finger -- touch and compare all possible paired combinations of 18 fabricated surfaces. Subjects were instructed to compare the surfaces on a percentage scale: 100% meant the surfaces were exactly similar, while 0% meant they were totally dissimilar. The surfaces were very basic. Sixteen were created with varying amplitudes (height variances) between seven nanometers and 4.5 micrometers and wavelengths (distances between peaks) from 270 nanometers to 90 micrometers, and two were engineered to be completely flat (see examples below).



The subjects were capable of distinguishing amplitudes down to 13 nanometers, and wavelengths down to 760 nanometers versus the blank surfaces.

"This shows unambiguously that the human finger, with its coarse fingerprint structure in the sub-millimeter range, is capable of dynamically detecting surface structures many orders of magnitude smaller," the researchers say.

Human fingers have miniscule mechanoreceptors embedded in the skin; some focus on detecting surface deformations while others are sensitive to vibration. The current research indicates that these cellular workhorses are much more attuned than previously thought.

The study was published in the September 12th release of Nature's *Scientific Reports*.

Source: Skedung, L. et al. Feeling Small: Exploring the Tactile Perception Limits. Sci. Rep. 3, 2617; DOI:10.1038/srep02617 (2013)

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