Rat whiskers versus human fingertips: touch and touch alike

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(PhysOrg.com) -- Rats use their whiskers much like humans use their fingertips to feel objects, but despite these great differences they both process those sensations in the same part of the brain and in the same way, a new study has found.

The finding may shed new light on how many animals use their vital sense of touch to make sense of the world around them, suggests the study, published in the Proceedings of the National Academy of Sciences.

"As nocturnal animals, rats use their whiskers much like the blind use walking sticks: to navigate their surroundings, localise objects and judge their size, shape and roughness," says one of the authors of the study Dr Ehsan Arabzadeh, of the UNSW School of Psychology's Neural Coding

Laboratory.

When an object makes contact with the whiskers, their corresponding movement triggers nerves in the hair follicle to send signals to the part of the brain that registers touch sensations, the somatosensory cortex. A whole section of that structure - known as the barrel cortex - is devoted to dealing with sensations from the whiskers.

As the rat twitches its whiskers back and forth across the object, it generates a representation of the object within the barrel cortex. Rats depend on their whiskers even more than their eyes to "see" the world around them, much as bats use sound.

The study tested the responses of neurons in rat barrel cortex to tiny pulses of vibration to their whiskers, first using a series of regular pulses of the same intensity, then by irregular vibrations of slightly varying intensity. In both cases, however, the number of pulses and the average degree of stimulation was the same overall.

The irregular vibrations excited the neurons more than the regular ones, suggesting that such "noisy" signals might be interpreted as being stronger in intensity. The researchers predicted that human brains might respond similarly.

They then tested student volunteers under similar conditions by exposing them to weak vibrations, felt through the tip of one index finger resting on a fine steel rod.

Although the introduced irregularity was extremely small and undetectable to the human subjects, they reported that the variable, irregular vibrations felt stronger than the regular unvarying ones.

"For rats, the processing of touch through the whiskers is a highly

efficient system and the whiskers have been shown by other researchers to be exquisitely sensitive," says Dr Arabzadeh. "They can be trained to detect incredibly tiny bumps and dents on the surface of a smooth object, at resolutions that are comparable to what we can manage with our sensitive fingertips."

"Our results with two such different species suggest that many other animals may perceive unpredictable sensory stimuli as being stronger than predictable ones. It's one more piece in the puzzle of how our brains use sensory information to comprehend the physical world."

More information: www.pnas.org/

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