# 'Extended Sensorium' Appendices

by Jason Ross

*The Feb. 4 issue of **EIR** featured a report by Lyndon LaRouche's "Basement" research team: "The Extended Sensorium," which covered a number of paradoxes regarding the division of the so-called "five senses," and discussed some other senses possessed by various animals. Here, we publish two follow-up articles on the ironies of the senses of touch and smell. The sensation of touch stands out as being a very mixed sense: temperatures, pressures, itches, and vibrations are all handled by distinct receptors, and can be said to truly be different sensory modes. The mind combines these sensations, along with other senses like sight, to piece together an understanding of the world, making touch a microcosm of the human thinking process in general. Smell presents its own unique features. It can truly be said to be the "first" sense developed by life, and has a very deep connection to emotions and memories in human beings.*

## A Touching Subject

> *The weight of this sad time we must obey,*
> *Speak what we feel, not what we ought to say.*[1]

The possibility of differentiating our senses comes from our ability to determine the means by which they are aroused. The game of peek-a-boo teaches babies that although their eyes may be covered, the world they see does not disappear. The connection between one aspect of understanding one's surroundings, and the eyes, is developed: Vision is not reality.

The different perception of an object when it is placed in the mouth shows the mouth to be a location of particular sensibility. Objects not in the mouth do not have the same richness of perception as when they are in contact with the tongue. This can be a fun game for a baby, separating an object's taste from its other qualities, and learning that their fingers cannot taste.

A childhood cold teaches the differences and connections between taste and smell: Foods taste different, although the tongue itself is unimpaired. Similarly, playing with the ears teaches of their function. Touch functions only when one's body is in contact with an object. Thus, the body, the world beyond, and our means of learning about it, become consciously differentiated.

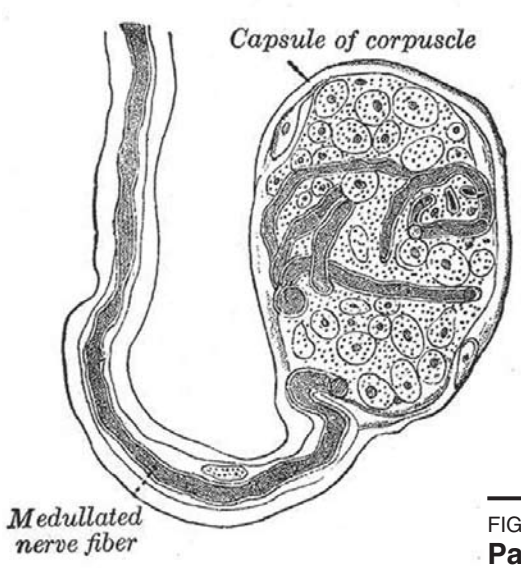
Although the sensory organs can be differentiated, the perceptual distinctions between the senses may be blurred.[2] The strong connection between smell and taste is possibly the clearest example. The McGurk effect reveals a connection between hearing and vision, and experiments with artificial colors and tastes indicate that even vision has a huge impact on our sense of taste.[3]

1. William Shakespeare, *King Lear*

2. See Oyang Teng, "Synesthesia: Beyond The Five Senses," *EIR*, Feb. 4, 2011, p. 6 (http://www.larouchepac.com/node/17200).

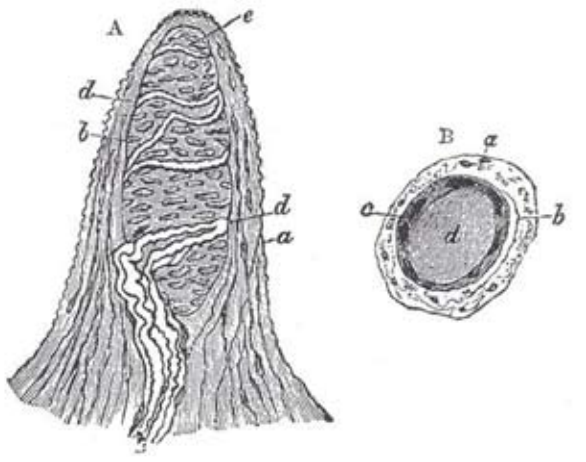
3. The McGurk Effect is seen in the creation of a film in which the video is a person enunciating *fa* while the audio is the same person saying *ba*. Amazingly (and somewhat inforiatingly), even when he knows the trick, an auditor cannot help hearing *fa*. Taste-tests with food colorings and flavors demonstrate that when tastes are combined with unexpected colors, they are misperceived. For example, a yellow glass of sweet fluid that is

FIGURE 1
**Krause's Corpuscle**



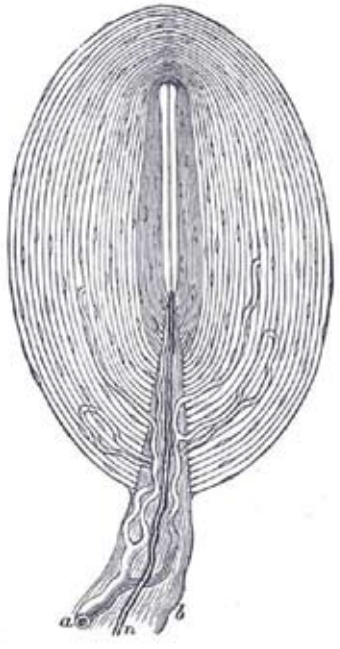

Gray's Anatomy

FIGURE 2
**Meissner's Corpuscle**




Gray's Anatomy

FIGURE 3
**Pacinian Corpuscle**



Gray's Anatomy

Synesthetes[4] have more pervasive connections between sensory functions, often involving color and letters. For them, the shape and color-aspects of vision are not separable, as they are in other people, and some shapes are connected with characteristic colors. Although we have knowledge of the different sensory organs, their connection in the mind, developed through habituation, can be difficult to then separate.

## Touch

Although touch is considered a single sense, it is itself a blurred combination of a variety of entirely different receptor modalities. Just as our single sense of vision actually makes use of four different light-receptor cells, our sense of touch involves no less than eleven different receptors![5] Compare the perceptual categories—viewed objects may be described as red, globular, smooth, or large—descriptions which, to some degree, represent the differentiated aspects of visual construction: shape and color, for example. The language of touch includes such descriptions as rough, smooth, sharp, hot, cold, vibrating, heavy, which more directly reflect the varied nature of touch: There are more distinct categories of perception.

Totally different receptors inform us of maintained pressure as opposed to initiated or released pressure. The pressure receptors in the lips and tongue (Krause corpuscles) differ from those in the fingertips (**Figure 1**). Low-frequency vibrations have two receptors dedicated to them, located deeper within the limbs and body. The Meissner corpuscle (**Figure 2**) is found only in hairless skin, and is most sensitive to very low frequencies (20-40Hz). The Pacinian corpuscle (**Figure 3**) is found throughout the skin, and responds to higher frequencies (150-300Hz). Pain and damage (and itching!) have their own receptors, whose nerve impulses travel an order of magnitude slower than the others, along non-myeleinated nerve cells.[6]

Heat receptors are active at temperatures above 86°F, and cold receptors are activated below 95°F. Al-

strawberry-flavored may be perceived as tasting like lemonade!

4. Teng, op. cit.

5. Known receptors include: hair follicles, Ruffini endings, Krause's corpuscle, Pacinian corpuscles, Meissner's corpuscle, free nerve endings, Merkel cells, proprioceptors, heat receptors, cold receptors, and the otoliths.

6. This is why, if you stub your toe, you feel the event first, and then the pain follows a measurable (short) time afterwards.

though their distribution varies over the body, cold-receptors are more numerous. These senses can be fooled with the familiar warm-water experiment: The subject starts with one hand in cold water and the other in hot water, and then places them both in the same container of warm water. A difference-based perception arises—the formerly hot hand feels the water as colder than the hand that was previously in cold water. At very high or low temperatures, these receptors are inactive, and pain is the only indication of extreme temperatures. A person born without pain receptors may be able to feel normal warmth, but be oblivious that his hand is burning. Anesthetics can serve to separate the different sensations: One can feel the pressure of a scalpel cutting the skin, but neither its sharpness nor the usually attendant pain.

The body even feels itself internally. A blindfolded test subject, allowing her arm to hang loosely, can tell the orientation of her arm when it is moved around her, even if quite gently. The knowledge does not come from pressure on the skin, since this experiment can be performed even with an anesthetic. Receptors inside the muscles, tendons, and joints allow the mind to make such determinations. This sense is called proprioception, meaning self-perception.

When the head is moved in different directions, structures within the inner ear respond, allowing us to maintain a sense of which way is up. Spinning in circles can confuse these structures, causing dizziness and disorientation. Proprioception lets us determine how heavy an object is: Both the pressure against the hand, and the effort needed to hold it become one sensation of weight.

In his book *The Man Who Mistook His Wife for a Hat*, neurologist Oliver Sacks relates the story of a woman who lost her sense of proprioception due to a viral infection in her spinal cord. Without the ability to know the orientation of her feet, legs, and body, she was unable to walk. After lengthy physical therapy, and learning to walk with a mirror, using her eyes to tell her what her proprioception used to, she was able to walk, although only with total concentration and great difficulty. Speech, too, was quite difficult, as she could no longer feel her vocal apparatus, and had to learn to use her hearing as the primary feedback mechanism. She also had difficulty understanding how firmly she held objects, since the tension of the muscles (proprioception) was no longer available to her.

*Therapeutic effects may be evoked by touch; for example, studies show that gentle touching and skin contact can be beneficial to the health and development of in premature babies, who are often confined to incubators, as seen in this photo.*

The case of amputees provides further insight into the sense of touch. Many of those who lose a limb continue to feel its presence, and, unfortunately, this perception may be one of great discomfort or pain. Without an actual limb to treat or sooth, the condition can be maddening, and analgesics are not always effective. One treatment involves using a mirror box to give the patient the visual impression of, once again, having both limbs. Therapy applied to the existent limb can provide relief for the phantom limb. Even simply moving the real hand can give a surrogate sense of proprioceptive motion for the phantom one, which can be helpful.

## Other Uses of Touch

Touch can be used as a form of mechanical communication. In technological situations, this is usually referred to as haptic feedback. One application is the development of prosthetic limbs. An artificial arm, for example, may use muscle motions in the chest to activate its motions, and may provide pressure and other feedback to the skin of the chest.[7] Additional applications have been tested for pilot feedback via a tactile harness, providing such information as altitude or bearing, and for the replacement of eyes for vision. Blind people have successfully used tongue-vision, a technology by which a camera transmits an image to the tongue via electrical impulses. The shape of the impulses on the tongue provides a replacement for the non-functioning optical system.[8]

Therapeutic effects may be evoked by touch. Premature babies, often confined to incubators, receive little emotional touch, but studies show that gentle touching and skin contact can be beneficial for their health and development. Touch and hearing are two senses from among those they will develop later that are available to the embryo in the womb. Simple non-intimate physical contact with another human being has significant effects on mood and well-being. Tests show that simple touch, such as "accidentally" brushing a subject's hand in an encounter, lead to greater enjoyment of the situation, even if the subject did not particularly note the event. A server who gently touches the patrons' shoulders in an informal dining environment can typically expect slightly larger tips. A massage therapist can report that part of the beneficial effects of massage are not the effect of pressure on muscles and tissues: It is the simple fact that it is human touch. For this reason, mechanical massage devices do not provide the same benefits.

Hardly a single sense, touch operates as a microcosm of our sensory apparatus as a whole: Different types of biological receptors are used by the mind to piece together an overall conception of the surrounding world. Discovery of the ironies between the reports provided by different receptor modalities provides the opportunity for new insights into the processes that act upon the parts of our bodies that are particularly sensitive to them, and thus, we learn more of the world that lies beyond our senses.

The human mind need not express knowledge as correlated patterns of stimulation of sensory tissues: Our reflection upon the cause of these stimulations finds answers in the intentions that we use to compose the way we act on the world around us. Statistical modeling is akin to studying patterns of activity in sensory organs, rather than the actual world revealed by true science. Although the universe is not sensible, it does make sense.

7. Aria Pearson ``Woman with bionic arm regains sense of touch,'' *New Scientist*, February 2007.

8. As an interesting display of plasticity, the portion of the brain primarily involved in processing visual information is active in blind people when reading in Braille.