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Dermo-optical perception: the non-synaesthetic "palpability of colors"

A comment on Larner (2006)

Running head: Dermo-optical perception

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Abstract

We comment on Larner's (2006) recent description of the 17th century case of a blind man who could differentiate the color of objects by touch. This ability is generally known as "dermo-optical perception" and is due to the cutaneous temperature sense rather than to synaesthetic processing. Although devoid of references to the phenomenon of dermo-optical perception, Larner's communication is highly valuable because it raises several issues relevant to present-day neurosciences. These comprise functional reorganization after sensory loss, handedness effects and differences between single fingers in the sensitivity to thermal changes.

(90 words)

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Larner (2006) discusses Robert Boyle's 17th century account of a man, blinded by smallpox around age two, who appeared to be able to perceive the color of objects by mere manual palpation. We would like to guide the readers of the *Journal of the History of the Neurosciences* to the literature that already exists on "dermo-optical perception" or human subjects' ability to "see" colors with the skin. A brief review of this literature will make clear why we hesitate to consider it a special form of synaesthesia.

As one of the critics of the purported ability to "see" with the hands has noted, "claims of eyeless vision turn up with about the same regularity as tales of sea serpents" (Gardner, 1966, p. 656). In fact, 20th century scientific interest in "finger sight" or, more technically, "aphotic digital color sensing" (Youtz, 1964; Buckhout, 1965) was preceded by case reports scattered over many countries and over a period of well over one hundred years - most with a definite touch of sensationalism (Kaiser, 1983, for an overview). Initially dubbed "paroptic vision" (Romains, 1920), the phenomenon was quickly taken up by parapsychologically oriented writers, who hoped to have finally found reliable and replicable evidence for extrasensory perception, and be it mediated by the fingertips (e.g. Duplessis, 1983). Methodologically, the bulk of this work was incredibly poor, but at least some investigations (e.g., Nash, 1971; Zavala et al., 1967) ruled out that all dermo-optical perception could simply be dismissed as "a peek down the nose" (Gardner, 1966).

For years the topic of rather emotional debates, dermo-optical perception was finally freed from paranormal connotations by the American psychologist Walter Makous. His empirical research (Makous, 1966a) showed that the phenomenon relies on subjects' sensitivity to thermal exchanges between the skin and colored objects, even in complete

darkness. As objects of different color (lightness and hue) differ in their heat-reflecting properties, blind as well as normally sighted individuals can learn to differentiate between them. Makous demonstrated that under conditions ruling out cheating and experimenter effects, and which precluded subjects' reliance on alternative discriminative cues, radiant exchange between the hands and an object placed in immediate vicinity by far exceeds threshold values for cutaneous temperature discrimination. He even published a hands-on [*sic*] experiment to test one's ability in cutaneous color sensitivity (Makous, 1966b). We may cite the most pertinent passage in full:

> "Anyone can, in an hour or two, prove to himself his ability to discriminate via his cutaneous senses between radiant exchanges with objects of differing emissivities. After applying flat black paint to half of a square plate (about 15 cm on a side and 0.3 cm or more thick) of polished metal, he can discriminate the painted (highly emissive) side from the unpainted (poorly emissive) side merely by holding his hand half an inch from the surface and attending to thermal sensations. He can take any precautionary measures he deems necessary, but after two or three practice trials he will be able to perform the discrimination correctly on about 90 percent of the trials." (Makous, 1966b, p.1109)

Thus, although the term "dermo-optic" may seduce one to assume that we deal with a form of synaesthesia (Larner, 2006), no crossmodal processing is involved in dermo-optical perception. Discrimination between, say, red and blue with the cutaneous thermal sense does not usually induce the phenomenal awareness of *seeing* red or blue. This is in contrast to the case of a blind synaesthete, who became explicitly aware of seeing colored dots on tactile exploration of Braille characters (Steven and Blakemore, 2004). It is doubtful, therefore, to conceive of dermo-optical perception as a synaesthetic phenomenon. Nevertheless, Larner's (2006) communication appears

valuable beyond its historical merits. It raises several issues that would seem to justify a revival of research interests into dermo-optical perception, especially from a neuroscience point of view. First, its occurrence in a blind person makes the phenomenon attractive for the study of functional reorganization after sensory loss. In the blind, occipital areas are involved in the tactile reading of Braille (Cohen et al., 1997), and deaf individuals reportedly activate auditory cortex while lipreading from silent faces (Calvert et al., 1997). As evident from the report of another 17th century born subject blinded by smallpox at a very young age (Brewer, 1966), not all who lost their sight will be successful in their attempts to discriminate colors by touch. However, it would be interesting to know whether the blind can develop the ability more easily than the normally sighted, even if the hope for practical applications of dermo-optical perception in cases of visual impairment had to be disappointed from very early on (Kaiser, 1983). Another issue is handedness. To our knowledge, the report cited by Larner (2006) is one of the rare instances with a discussion of potential sensitivity differences between the hands. While the subject mentioned by Larner (2006) felt his right thumb clearly more sensitive than his left, later observations, though from a fringe-science perspective, suggested a left-hand superiority in right-handed subjects (Jaegers, 1973/1999). Both accounts have their theoretical justification, the former stressing more peripheral, skill-related factors, the latter focusing on central, right hemisphere mediated mechanisms of unconscious perception. Finally, the notes about sensitivity differences between single fingers (Larner, 2006, p. 247) shows that observations from centuries ago may contain more information than many present-day accounts, which typically undervalue sophisticated introspective report. Here, Larner (2006) suggests that the enhanced “color-sensitivity” of the thumb may be a consequence of the thumb’s larger cortical representation area (compared to that of the index finger). Considering the nature of dermo-optical perception (i.e. cutaneous thermal sensitivity), we think it is more parsimonious to assume that, compared to the index finger, the thumb simply represents the larger receptor surface. This assumption seems especially appropriate in view of the fact that functional imaging at high magnetic fields has revealed that (contrary to textbook information) the somatosensory representation areas of thumb and index finger are of comparable size (Maldjian et al., 1999).

In summary, we would like to suggest that the phenomenon described by Larner (2006) is not synaesthetic in nature, but that the case he discussed is possibly the first account of dermo-optical perception. We agree with Larner that the neurobiological basis of

dermo-optical perception constitutes a great challenge for contemporary neuroscience.

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