3. Perceptual constancy. Although we believe that color is an inherent property of objects, in reality perceived color is based on our inferences about the illumination and surrounding colors. It is a second-order calculation based on the relative ratios of absorptions in different parts of the field. Color matching under different illuminations requires imagining what the standard would look like under the second illumination, not matching cone absorptions. In this target article, Erickson presents results illustrating that the description of tastants is similarly context dependent. Are such judgments possible with a population code or must they also be based on higher-level excitation ratios?

In sum, senses convey specific survival information, as well as respond to an evolving environment. But, as I have argued earlier, it is the particulars of the environment that determines the organization and distribution of the receptors and the subsequent transformations at later neural regions. The neutral excitation at the eye (a photograph) or ear is transformed into a set of parallel intensity contrasts at multiple resolutions that segment sensory experience into objects and properties regardless of scale (De Valois & De Valois 1988; Lewicki 2002). I would expect similar sorts of transformations for taste, and deriving those transformations is necessary to create an adequate theory of taste perception.

Basic tastes and unique hues

doi: 10.1017/S0140525X08003427

David R. Hilbert

Department of Philosophy, University of Illinois at Chicago, Chicago, IL 60607.
hilbert@uic.edu
http://www.uic.edu/~hilbert/

Abstract: The logic of the basic taste concept is discussed in relation to the physiology and psychophysics of color vision. An alternative version of the basic taste model, analogous to opponent-process theory is introduced. The logic of quality naming experiments is clarified.

Erickson mounts a vigorous attack on the concept of a basic taste in all its forms. My concern is not with the physiology of the taste receptors, but with a psychophysical conception of basic tastes. Color vision provides an interesting point of comparison that may help illuminate some of the issues, a comparison Erickson himself makes in several places. As is discussed at some length in the target article, the receptors that underlie color vision have broad and overlapping spectral tuning. Information about the spectral composition of the stimulus is not signaled by activity in any one of the three receptor types, but rather, is embodied in the pattern of activity across all three receptor types. Nothing follows from these facts about the receptors, however, as to the central encoding of spectral information and the structure of color experience. The same set of receptors could drive a system that encoded spectral information more centrally in terms of relative amounts of three basic hues or by a representation that treats each spectral mixture as unique and singular. In fact, the receptor outputs are recombined starting in the retina to form three new channels that encode spectral information in terms of sums and differences of the receptor outputs. Similarly, the structure of taste experience is not fixed by the number of receptor types or by their tuning. Even if the taste receptors themselves are narrowly tuned, it would not follow that the central representation is in terms of neurons with similar narrow sensitivity, nor that taste experience consists in combinations of a small number of specific tastes. Although these points are not incompatible with the target article, its attack on the basic taste concept in all its forms is carried through so ruthlessly that the impression is left that there are strong connections between the different basic taste concepts.

There is another more substantive way in which the comparison with color may be helpful. Although it is true that each color experience is singular in the way mentioned in the target article, it is not true that color experience is unstructured. The prevailing theoretical perspective in color science, opponent process theory, conceives of color experiences as encoding color in terms of two opponent hue channels, yellow-blue and red-green, and a non-opponent achromatic channel (Kaiser & Boynton 1996, pp. 250–59). Thus, the experience of orange combines yellowness from one chromatic channel and redness from the other, plus some amount of whiteness from the achromatic channel. It is not that orange is experienced as being some kind of mixture of a pure red and a pure yellow, but rather that there is a hue attribute, yellowness, that is shared by a large number of hues, including orange, and a different hue attribute, redness, which is also possessed by many hues including orange. In one sense, there are basic colors, in that color is represented using a very small number of basic attributes. In another sense, there are no basic colors because nothing is seen as having more than one determinate color. There is some ambiguity in the taste literature, including the target article, as to which sense of basicness is at stake.

Finally, I will comment on the experimental illustration found in section 7 of the target article. The first condition involved using basic taste names to account for the taste of a stimulus. The remaining conditions involved accounting for the taste of the stimulus in terms of sets of tastants, both basic and non-basic, depending on the condition. There is no reason to think the two types of tasks are comparable, so the tastant conditions cannot serve as controls for the naming condition. Erickson interprets the failure to reach 100% in the naming condition as significant, but this feature of the data is uninterpretable given the lack of controls. Similar experiments done using names for the four opponent hues have provided useful support for the opponent process theory, but only by looking at how subject performance changes as the set of available hue names is varied (Sternheim & Boynton 1966). It is also worth noting that nothing regarding the basic taste concept follows from the fact that English contains taste words other than the names of the putative basic tastes, contrary to the suggestion in section 7.7.3. Even if it is true that every taste is experienced as some mixture of the four basic tastes, it wouldn't follow that there would be no use for words specific to those mixtures. It is not even a direct consequence of the basic taste model that the names of the basic tastes are more commonly used than the names of mixtures. The only relevant claim is that it should be possible to describe any taste completely using only the basic taste words, not that there is no other way to describe tastes.

Neither the comparison with color nor the difficulties with the experimental illustration provide positive evidence in favor of any basic taste concept. If it is to be rejected, however, it needs, as Erickson argues, to be clarified, and the rejection should be on the basis of data that are properly controlled and genuinely in conflict with predictions of the model.

Taste quality coding in vertebrate receptor molecules and cells

doi: 10.1017/S0140525X08003439

Linda M. Kennedy and Kristina M. Gonzalez

Neuroscience Laboratory, Lasry Center for the Biosciences, Clark University, Worcester, MA 01610.
lkennedy@clarku.edu
kgonzalez@clarku.edu