This is an excerpt from a report on the workshop on multisensory integration at the University of Toronto, on May 9th and 10th, 2014, written by Kevin Connolly, Aaron Henry, Zoe Jenkin, and Andrew MacGregor, and available at:
http://networksensoryresearch.utoronto.ca/Events_%26_Discussion.html

2. Do Multisensory Percepts Involve Emergent Features?

At the workshop, Matt Fulkerson, Barry Smith and Casey O'Callaghan all raised the possibility of genuinely emergent features in multimodal awareness, distinctively multisensory percepts that are not reducible to the respective senses' contributions. It was clear from discussion that the notion of emergence here was a strong one, and would not be satisfied by some of the forms of multisensory integration that were proposed. It would not be sufficient for multisensory emergence that, for example, the contributions of multiple senses are represented as coinstantiated (whether through feature-binding and/or association - see question 3 below), or that the inputs of one sense affect how we represent with another, as in the ventriloquist illusion or McGurk effect.

The awareness of emergent features would instead involve the representation of novel feature types not accessible to any one of the contributing senses alone. In asking whether there might be such emergent features, the workshop speakers were questioning whether the content and character of multisensory experience must be reducible to the contributions of the respective senses, or whether the interaction between them might generate some novel, irreducibly multisensory content.

Several speakers cited flavor as an example: here, the percept appears to be something unitary and not reducible to a mere conjunction of the respective contributions of taste and smell. Smith suggested that other examples might include the perception of balance and self-motion where, as described by Jennifer Campos, vision, proprioception, and the vestibular system work in concert. Whether we should allow that there is any genuinely emergent percept here will depend on whether we can identify a novel feature type that cannot be

accessed by any of the relevant senses alone. It is not obvious what that would be in this case: for example, one might think that, in its contribution to self-motion perception, proprioception gives us awareness of something--body position--that is in principle accessible to vision, even if less efficiently or accurately. (Smith also offered speech perception as possibly involving emergence, although any emergence here arises substantially out of diverse features accessible to a *single* mode, i.e. the various auditory objects one might think are accessible in speech perception--sounds, a voice, words, words with meaning, etc.)

Even if we take flavor as the least controversial instance of a novel and emergent feature type, there remains a question about how we might go about demonstrating that it is genuinely emergent. The claim for emergence is based, at least in part, on intuitions about the phenomenal character of flavor experiences and the phenomenal character of taste, smell and touch experiences, each taken in isolation. The intuition is that the mere co-instantiation of the latter is not sufficient for the former. But this relies heavily on our capacity to imaginatively reconstruct, for example, what it's like to experience menthol from what it's like separately to taste bitterness, smell mint and feel coolness on the tongue (see question 1). The reliability of our imagination in this respect is easily questioned.

The challenge here is compounded by the frequent difficulty of subjectively distinguishing the relative contributions of the various senses, sometimes because we are so accustomed to experiencing them together. As Matt Fulkerson pointed out, some senses are especially hard to disentangle phenomenologically (as with taste and smell, or touch and kinesthesis), while some ostensibly unitary senses (vision for example) might actually involve the interaction among several sub-systems that respond to different features of the world.

We might therefore look instead for some empirical evidence, perhaps some measurable differences in subjects' behaviors or powers of discrimination when presented with, say, a

flavorful object to various combinations of the relevant senses. In this vein, relying on data from an array of studies on how information from the sensory modalities is fed into higher-level conceptual systems, Auvray and Spence (2008) argue that flavor should be considered a separate perceptual system due to its unique functional interaction with cognition. However, empirical evidence for functional unity of the system still leaves open whether the experiential properties themselves are emergent, or remain specific to the olfactory and gustatory modalities.

References:

Auvray, M., & Spence, C. (2008). "The multisensory perception of flavour." *Consciousness & Cognition*, 17, 1016-1031.