

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

### **3. What Can Multisensory Processing Tell Us about Multisensory Awareness?**

Casey O’Callaghan emphasized that claims about multisensory processing don’t translate directly into claims about multisensory awareness. For example, even if the perceptual processing in distinct sense modalities exhibits a high degree of cross-modal coordination and interaction, it may still be that the subject’s perceptual awareness is merely a collection of modality-specific, albeit highly coordinated, experiences. Further, implicit measures of multisensory processing sometimes conflict with measures of multisensory awareness. In a study by Mitroff, Scholl, and Wynn (2005), subjects were shown an ambiguous stimulus of two objects travelling diagonally from opposite corners of a display and which can be perceived either to bounce or to stream through each other when they meet at the centre of the display (the “bouncing/streaming display”). They investigated whether implicit and explicit measures of the resulting percept agreed or disagreed. They found that their implicit measure (provided by measuring object-specific preview benefits) was strongly correlated with the bouncing percept, while their explicit measure (provided by subjects’ conscious reports) was strongly correlated with the streaming percept.<sup>1</sup> Similar dissociations between implicit and explicit measures have been found for intermodal illusions as well (see Zmigrod and Hommel 2011). Thus claims about perceptual processing don’t translate uncontroversially into claims about perceptual awareness.

Even once we recognize the above points, there remains the possibility that the concepts used at one level of description can affect and inform our understanding of phenomena at another level. Consider the concept of feature binding. As psychologists use

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<sup>1</sup> An object-specific preview benefit occurs when information on an object (e.g., a letter) is recognized more quickly because it reappears on the same object than on a different object.

the term, “feature binding” refers to the sub-personal mechanism that binds distinct feature representations into the representation of an individual with multiple attributes or parts. Feature binding is “intermodal” when the feature representations being bound belong to distinct sense modalities, as when an auditory feature is bound with a visual feature. In his talk, O’Callaghan also used “feature binding” to characterize a type of perceptual awareness: the awareness of multiple properties as being jointly instantiated by a single object or event. This can be illustrated in terms of a phenomenological contrast between, on the one hand, being aware of a thing’s being F and a thing’s being G and, on the other hand, being aware of a thing’s being both F and G, where only the latter is an instance of feature binding awareness. Moreover, O’Callaghan defended the existence of *intermodal* feature binding awareness—the awareness of features from more than one sense modality as jointly belonging to the same object or event. Although O’Callaghan’s case for the existence of intermodal feature binding awareness drew primarily on phenomenological considerations, it also involved an appeal to empirical evidence about intermodal feature binding processing.

In his commentary, Kevin Connolly proposed an account of what O’Callaghan had been calling “feature binding awareness” as resulting not from a feature binding mechanism but from an associative mechanism called “unitization”. Unitization consists in the integration of distinct parts of complex stimulus into a single functional unit as a result of perceptual learning, and Connolly argued that this process can occur both intramodally and intermodally. He prefaced his discussion of unitization by suggesting that our conception of multisensory awareness may be shaped by the view that one takes of the underlying mechanisms—e.g., whether we regard it as resulting from a binding mechanism or an associative mechanism. Partly to mark its associative basis, Connolly referred to the resulting intermodal awareness as “associative awareness” instead of “intermodal feature binding awareness”.

Two main questions arise in light of Connolly's commentary. First, one can ask whether feature binding and unitization really are competing sub-personal accounts of multisensory integration. In particular, it may turn out that the process of unitization is one type of feature binding. If that is right, then the process of unitization may be one way of generating the sort of states of multisensory awareness whose existence O'Callaghan is concerned to defend, and so there may not be a substantive disagreement between Connolly and O'Callaghan. Supposing, however, that unitization and feature binding are genuinely distinct types of perceptual processing, then a second question arises concerning the implications that each type of processing might have for our understanding of multisensory awareness. Given empirical evidence for both feature binding and unitization, this may give us initial reason to posit and investigate two distinct types of multisensory awareness: feature binding awareness and unitization awareness. There may be a sort of unitization awareness that, like O'Callaghan's feature binding awareness, is something over and above mere awareness of associated unisensory properties--we may be able to experience them *as* operating together as a functional unit. Further investigation is thus needed to determine whether each type of perceptual process underlies a distinctive type of multisensory experience.

**References:**

Mitroff, S. R., Scholl, J., and Wynn, K. (2005). "The relationship between object files and conscious perception," *Cognition* 96: 67-93.

Zmigrod, S. and Hommel, B. (2011). "The relationship between feature binding and consciousness: Evidence from asynchronous multi-modal stimuli," *Consciousness and Cognition* 20(3): 586-593.