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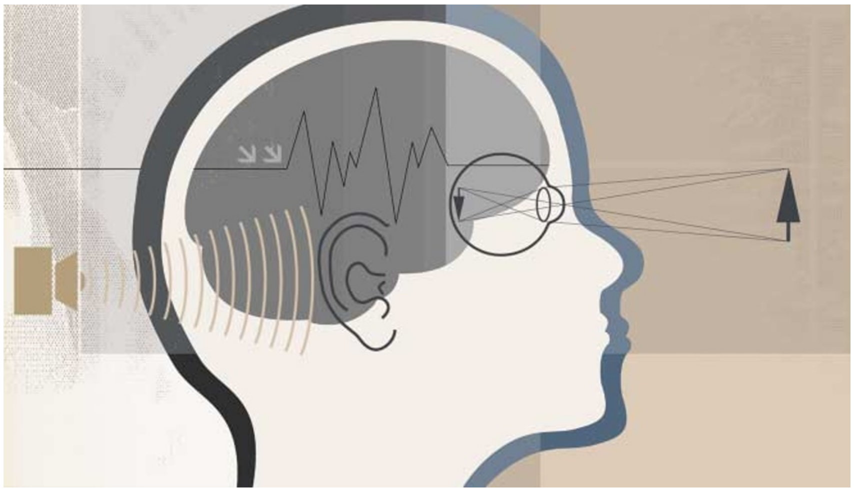
FUNCTIONAL NEUROIMAGING

Sight and sound collide



Although functional imaging and electrophysiology have given us a good idea of which brain areas are important for cross-modal binding — linking together information from different sensory modalities, such as sight and sound, that comes from the same stimulus — just how these brain areas bind sensory inputs together is unknown. A new study from Bushara and colleagues does not completely answer this question, but it does use a clever trick to give us some more clues.

One of the problems with studying binding is that it is hard to be sure that neural activity is associated specifically with the process of binding rather than arising passively as a result of the co-occurrence of two stimuli. Bushara *et al.* used a task that dissociates these two effects. They showed subjects a screen on which two bars are seen to move towards each other, then to cross and continue moving. Usually people perceive the two bars as crossing over each other, but on a small number of trials the two bars will appear to collide and then bounce back towards their points of origin. If a 'collision' sound is played at the point of overlap, the perception of a collision becomes more likely.

The authors reasoned that, for the sound to influence the visual perception of the two bars, the auditory and visual stimuli must be bound in the brain. But if the sound is played and the subject does not see the collision, the stimuli were probably not bound. By asking subjects to report their perception, Bushara and colleagues could compare these two types of trial, in which the presented stimuli were identical but the perception — and therefore the binding state — differed.

Functional magnetic resonance imaging (fMRI) showed that activity in 'multimodal' areas such as the superior colliculus and parietal cortex was higher when binding occurred and the subject saw a collision. More interestingly, activity in unimodal areas such as the occipital (visual) and temporal (auditory) cortex was lower during these trials than during trials in which binding did not occur. This finding was unexpected, as attention influences perception and increased attention to a stimulus would be expected to increase neural activity in sensory areas of cortex.

The authors propose that there is a reciprocal, competitive interaction between unimodal sensory areas and the multimodal areas that mediate binding. According to this view, the interaction between these areas, rather than a top–down, one-way influence of multimodal cortex on unimodal cortex, would lead to stimuli being perceived as bound or unbound. This kind of behavioural task should allow more insight into the processes that are involved in binding, particularly if it can be extended to nonhuman primates for electrophysiological studies.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPER Bushara, K. O. *et al.* Neural correlates of cross-modal binding. *Nature Neurosci*. 23 December 2002 (doi: 10.1038/nn993)

FURTHER READING Robertson, L. C. Binding, spatial attention and perceptual awareness. *Nature Rev. Neurosci.* **4**, 93–102 (2003)

WEB SITE
Hallett's lab:
http://intra.ninds.nih.gov/Lab.asp?Org_ID=72