Key Note

# Chapter 10: Visual and auditory localisation

## Key note 10C: Can touch alter the visual perception of depth?

The aim of this note is to describe the interaction between two different sensory modalities (touch and vision) in the perception of orientation in depth. Without experiments, it is not obvious that one can influence the other – they might be completely independent.

In everyday life we often receive information about the orientation of surfaces from touching them, as when we polish a car or stroke a cat. One possibility is that vision is completely dominant in this situation, and that our perception of the surface is not affected by feedback from the joints and muscles of the hand about surface orientation. Alternatively, it may be that our visual perception is influenced by hand movements (haptic feedback about orientation). Participants of Ernst et al. (2000) viewed vertical surfaces similar to that in Figure 10.9 in the book, except that the pattern elements were squares, and the surface orientation was defined by binocular disparity, as well as by texture gradient. However, the cues were put into conflict, so that one cue specified a surface in the fronto-parallel plane, and the other a surface which was tilted so that either the left or right edge was nearer to the observer. In these circumstances, observers typically perceive a surface whose tilt is somewhere between that specified by the two cues.

The observer’s hand was placed on a force-feedback device, which, as the hand moved, created the impression that it was moving across a surface in a particular orientation. In some conditions, the orientation of this virtual plane was the same as that defined by disparity, in the others, that defined by the texture gradient. The experimenters found that, after haptic training (but in the absence of haptic stimulation), the visual appearance of the surface had changed towards that of the cue whose orientation was that of the virtual haptic surface. So if, for example, texture specified a surface 0 degrees from frontoparallel, and disparity one 30 degrees from frontoparallel, an observer before training might perceive the surface to lie at 15 degrees from frontoparallel. After haptic training to texture-specified orientation, the surface might now appear at 5 degrees from frontoparallel, and after training to disparity-specified orientation, the surface might appear at 25 degrees from frontoparallel. Thus haptic feedback does not merely follow the orientation specified by vision, but can actively change the visual representation.

Ernst MO, Banks MS, Buelthoff HH (2000) Touch can change visual slant perception. *Nature Neuroscience* 3(1): 69–73.