Key Note

# Chapter 5: Seeing pattern and motion

## Key note 5B: Direct and indirect tilt illusions

Although the mostly commonly studied effect of one stimulus on another is an apparent increase in their difference, in some situations this difference can be reduced. This note discusses one such effect of orientation, and the circumstances in which it arises.

The shift in perceived orientation demonstrated in Figure 5.7 in the book, in which the orientation of the central grating is shifted away from that of the surrounding grating is sometimes called the direct or contrast effect, and occurs when the orientation difference between the two gratings is less than about 50 degrees. When the orientation difference is larger than 50 degrees, the perceived orientation of the central grating shifts towards that of the surround – the indirect or assimilation effect. Wenderoth and Johnstone (1988) found that stimulus manipulations which had a large influence on the direct effect had little influence on the indirect effect, and vice versa. Thus the introduction of a gap between centre and surround, and variations in the thickness of the annulus in which the surround was displayed changed the magnitude of the direct but not the indirect effect. Conversely, adding a rectangular frame with vertical sides to the display almost abolished the indirect effect, but scarcely changed the direct effect. The authors suggested that the two effects were mediated by different visual mechanisms, the direct by inhibition between orientation-sensitive channels in V1, the indirect by extra-striate processes (perhaps in V2 or V4) less selective for the spatial properties of the stimuli. A previous suggestion that the indirect effect might reflect a release from inhibition within V1 (of the kind found by De Valois (1977) for spatial frequency, mentioned in the book) is not supported by the data of Wenderoth and Johnstone, since one would then expect the direct and indirect effect to be affected similarly by stimulus manipulations.

De Valois KK (1977) Spatial frequency adaptation can enhance contrast sensitivity. Vision Research 17: 1057–1065.Wenderoth P, Johnstone S (1988) The different mechanisms of the direct and indirect tilt illusion. *Vision Research* 28(2): 301–312.