Transfer of tilt after-effects between second-order cues

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Abstract—Second-order cues are visual stimuli that are detectable by human observers, without eliciting a peak in Fourier energy that corresponds to their perceptual properties. The most commonly studied exemplars of second-order cues are those defined by modulation of local contrast (CM). It is widely accepted that such cues are initially detected separately from first-order, luminance modulated (LM), cues. However, after-effects have been shown to transfer between first- and second-order cues (LM and CM, respectively). This suggests the existence of a late link in the mechanisms that subserve their processing. To extend the investigation of the mechanisms for processing second-order cues we consider cues defined by modulations in local orientation (OM). Using a tilt-after-effect (TAE) paradigm, we found partial transfer of adaptation between LM and OM cues, confirming the presence of a link between first and second-order cues. Furthermore, we found a partial transfer of TAE between OM and CM cues. These results suggest that, at or before the site of adaptation, information from all visual cues is combined. However, as transfer of adaptation is below 100% in all cases, this is only a partial integration of information.

Keywords: After-effect; second-order; adaptation; orientation; contrast.

INTRODUCTION

Much recent research has focussed on visual cues other than luminance and colour. Often called second-order cues, these consist of a first-order carrier pattern whose local properties (such as contrast, orientation, spatial frequency, size, or flicker) are modulated to produce a percept that does not have an associated large-scale change in first-order properties (i.e. in mean luminance or colour). Figure 1a shows an example of a first order carrier pattern. Figure 1b shows the same pattern after having undergone contrast modulation (CM), while Fig. 1c shows the same pattern after orientation modulation (OM).

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Figure 1. Example stimuli. (a–c) Show the central region of our example stimuli expanded here to aid visualisation. Real stimuli had a raised cosine contrast envelope. (a) Unmodulated Gabor noise carrier, (b) contrast modulated carrier, (c) orientation modulated carrier, (d–f) show phase-randomised versions of (a–c) respectively — see Method Section.