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unfocussed spatial attention (Strasburger, Harvey, & Rentschler, 1991; Strasburger, 2005). None of these

test contrast was equal to the target contrast. In the blank trials, the 3-s topping-up adaptation was followed by a 1.5-s blank interval.

For each adapting stimulus, there were a total of 18×6 trials, 108 for each type of trial. The order of the three

$A_{Parallel}$) / ($A_{Orthogonal}$ + $A_{Parallel}$), where $A_{Orthogonal}$ is the mean amplitude of the responses to the orthogonal test stimulus and $A_{Parallel}$ is the mean amplitude of the responses to the parallel test stimulus. This index could range from −1 to 1 and was positive whenever the mean response to the orthogonal test stimulus was greater than the mean response to the parallel test stimulus. A large adaptation index of an ROI means a strong adaptation effect.

[illegible]

B[illegible]

Subjects' responses to the luminance change at the fixation point were both accurate and fast, indicating that they followed our instruction. Their reaction time (RT) and correct rate (CR) were categorized into several groups according to the type of adapting stimulus in the

Figure 3. fMRI results for the high-contrast adaptation condition. (A) Time courses of BOLD signals in V1 and V2/V3 evoked by orthogonal and parallel test stimuli for the unflanked and flanked conditions. (B) fMRI adaptation effects in V1 and V2/V3 for the unflanked and flanked conditions as measured by the peak signal difference between the orthogonal and parallel test stimuli (left panel) and adaptation index (right panel). Asterisks indicate a statistically significant difference between the fMRI adaptation effects in the unflanked and flanked conditions (*p < 0.05; **p < 0.01). Error bars denote 1 SEM calculated across subjects.

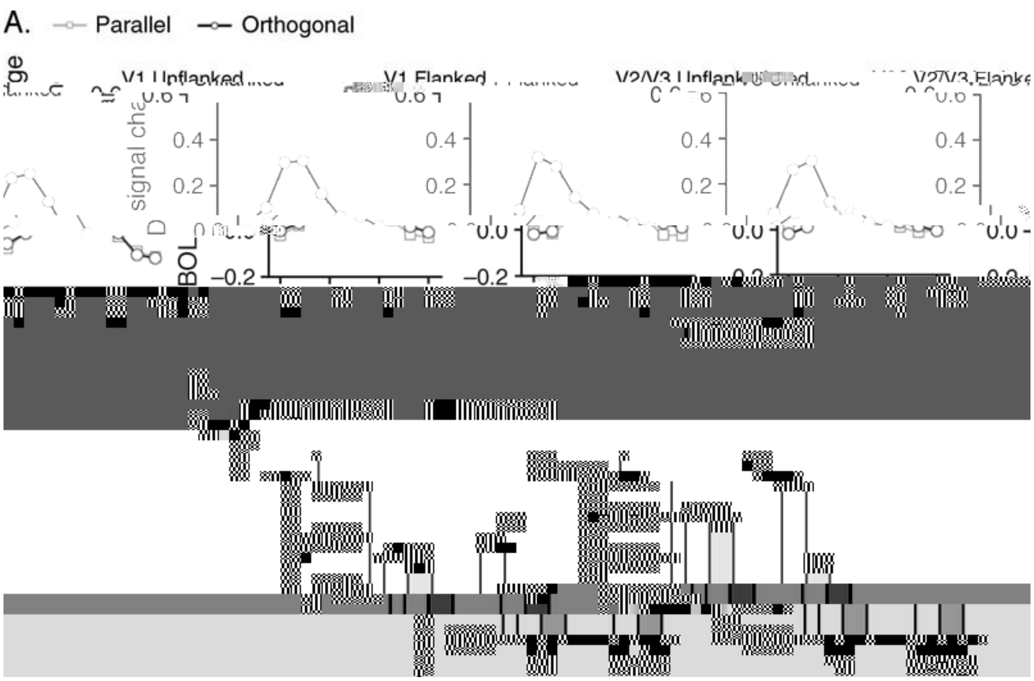

Figure 4. fMRI results for the low-contrast adaptation condition. (A) Time courses of BOLD signals in V1 and V2/V3 evoked by orthogonal and parallel test stimuli for the unflanked and flanked conditions. (B) fMRI adaptation effects in V1 and V2/V3 for the unflanked and flanked conditions as measured by the peak signal difference between the orthogonal and parallel test stimuli (left panel) and adaptation index (right panel). Asterisks indicate a statistically significant difference between the fMRI adaptation effects in the unflanked and flanked conditions (*p < 0.05; **p < 0.01). Error bars denote 1 SEM calculated across subjects.

difference: (4) = 4.214, < 0.05; high contrast/adaptation index: (4) = 5.661, < 0.01; low contrast/amplitude difference: (4) = 6.633, < 0.01; low contrast/adaptation index: (4) = 7.297, < 0.01).

The above statistical analyses suggested that the adaptation effect in V2/V3, but not in V1, could be affected by crowding. To further examine the interaction of visual area and crowding condition, we performed two-way repeated-measures ANOVAs (visual area [V1 vs. V2/V3] × crowding condition [unflanked vs. flanked]) for both the high- and low-contrast adaptation conditions. The interaction effects were significant for both conditions (high contrast/amplitude difference: F (1,5) = 10.418, < 0.05; high contrast/adaptation index: F (1,5) = 19.336, < 0.05; low contrast/amplitude difference: F (1,5) = 10.237, < 0.05; low contrast/adaptation index: F (1,5) = 16.192, < 0.05).

We also examined fMRI signals from the ROIs corresponding to the locations of the flankers. The signals were very weak and no adaptation effect was observed. This was not surprising because the test stimuli presented at the target location were not expected to activate these ROIs.

We show that when subjects' attention was controlled, orientation-specific TEAE was not affected by crowding regardless of the contrast level of the adapting stimulus. The adapting contrast levels (0.9 and 0.14) here were the same as those in Blake et al. (2006; personal communication). More important, we could replicate the findings in Blake et al. if subjects were not asked to do the fixation task and were allowed to deploy their attention freely. Data from two representative subjects are presented in Figure 5re thpts72-215pa phrephen7(ys)garicentesuegar4tw1779Then7(isin17790(entels)]regarct)heentelsentedien9e(ann174e)re use supra-threshold test stimuli in the psychophysical experiment? Blakemore, Muncey, and Ridley (1973) and Blakemore and Nachmias (1971) have shown that, after adaptation, both contrast threshold elevation with near-threshold test stimuli and loss of perceived contrast with supra-threshold test stimuli are tuned to the adapting orientation. However, the issue of whether contrast adaptation can reduce perceived contrast of test stimulus has been the subject of considerable debate (Barrett, McGraw, & Morrill, 2002; Ross & Speed, 1996; Snowden & Hammett, 1992