A Comparison of Radial and Rotational Plaid Speed Judgments

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Introduction: The Medial Superior Temporal (MST) region of the primate visual system responds to both radial and rotational motion (Duffy & Wurtz, 1991). These two motion types differ by 90 degrees in local motion vectors. Prior work suggests that when stimuli contain the combination of radial and rotational motion, participants can accurately estimate the individual vectors - revealing a local component decomposition (Barraza & Grzywacz, 2005). Despite this local component decomposition, random-dot radial motion studies have demonstrated distinct sensitivities (Xiao, Barborica & Ferrera, 2006) and developmental time-lines (Shirai, Kanazawa & Yamaguchi, 2006) for radial expansion versus radial contraction. No corresponding directional dependence occurs for dot-defined rotational motion. Here, we investigated whether plaid stimuli, like the previously reported dot stimuli, generate directionally dependent radial motion performance and directionally independent rotational motion performance.

Method: Twenty-one Denison University undergraduates viewed displays containing two plaid stimuli, presented simultaneously to the left and right of a central fixation marker. On radial motion trials, one plaid either expanded or contracted at two octaves per second; the other did so 35 percent more slowly. On rotational motion trials, one plaid rotated either clockwise or anticlockwise at two revolutions per second; the other did so 20 percent more slowly. Participants reported which side contained faster motion.

Results: Mean performance for radial expansion significantly exceeded that for radial contraction (t(20)=2.263, p=0.035, r-squared = 0.204), but the effect size was modest (78.5% versus 73.9% correct) and non-significant according to a sign test (p=0.115). Clockwise and anticlockwise motion generated statistically indistinguishable performance levels (t(20)=0.860, p=0.40, r-squared = 0.036).

Conclusion: The small effect size generated by plaid with opposite radial directions seems surprising given the directionally dependent results in earlier studies that investigated radial judgments for dot patterns. This raises the possibility that distinct neural events may govern plaid-defined versus dot-defined radial judgments.

Word Count: 300