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 plaids 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