A Comparison of Radial and Rotational Plaid Speed Judgments

Nestor Matthews[1], Leslie Welch[2], Allison Murphy[1], Megan Puritz[1]

[1]Denison University - Department of Psychology; [2]Brown University - Cognitive, Linguistic & Psychological Sciences

Poster # 36.4035

Introduction

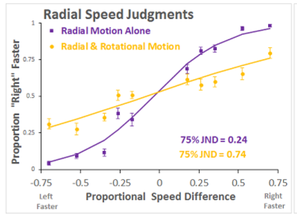
- The Medial Superior Temporal (MST) region of the primate visual system responds to both radial and rotational motion [1-3]. Despite this shared MST activity, prior studies reveal differences between radial and rotational judgments of random dot stimuli [4-9]. Here, we used *plaid stimuli* to investigate differences between radial and rotational speed judgments. After pilot data revealed little or no effect for opposite motion directions, we investigated whether combining radial and rotational motion differentially affects radial and rotational speed discrimination.

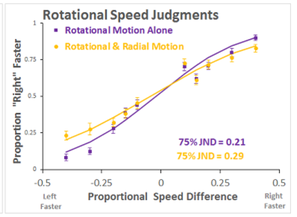
Method

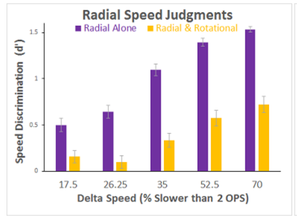
- **Participants:** 24 Denison University students.
- **Task:** Which side (L/R) contained faster radial motion (radial motion task), or faster rotational motion (rotational motion task)?
- **Stimuli:** On each trial, a pair of bilaterally presented plaids either rotated, radiated, or both. One plaid moved at the standard speed: 2 octaves per second or 2 revolutions per second, respectively, in radial and rotational trial-blocks. The other moved slower by various amounts.

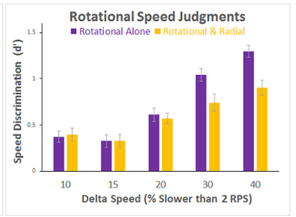
Results

Descriptive Statistics

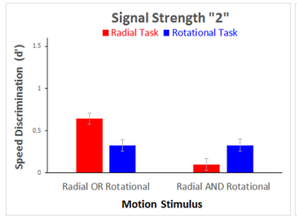




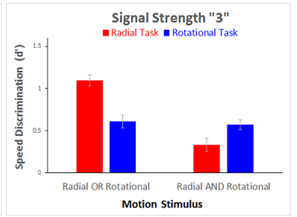




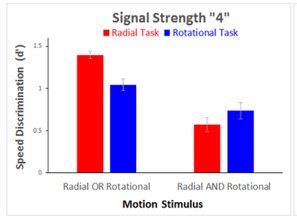
Interaction at a Given Signal Strength



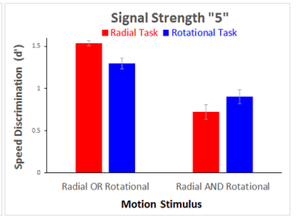
Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	17.203	<0.001	0.428	0.978
RT	9.777	0.005	0.298	0.849



Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	53.110	<0.001	0.698	~1
RT	3.805	0.063	0.142	0.464

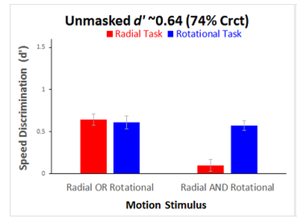


Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	21.370	<0.001	0.482	0.993
RT	12.625	0.002	0.354	0.925

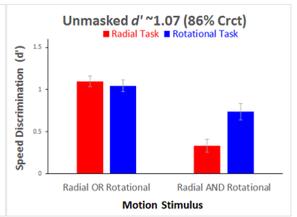


Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	13.249	0.001	0.366	0.936
RT	7.333	0.013	0.242	0.737

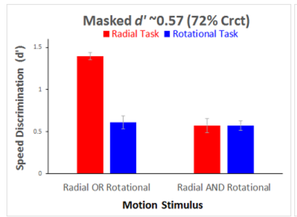
Interaction at a Given Performance Level (d')



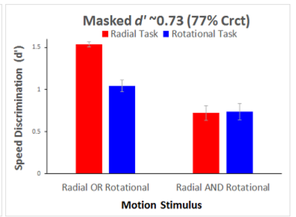
Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	29.077b	0.000	0.558	0.999
RT	6.868b	0.015	0.23	0.709



Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	14.097b	0.001	0.38	0.949
RT	2.974b	0.098	0.115	0.379



Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	48.944b	<0.001	0.68	~1
RT	36.200b	<0.001	0.611	~1



Task-by-Stimulus Interaction	F(1,23)	p	pEta^2	Power
d'	25.889b	<0.001	0.53	0.998
RT	11.311b	0.003	0.33	0.896

Discussion

- Combining radial and rotational motion impaired radial speed discrimination significantly more than rotational speed discrimination. This differential impairment occurred across signal strengths, and also after controlling for either "masked" and "unmasked" performance levels.
- The results from our plaid stimuli extend those from prior random-dot studies that also showed distinctions between these MST-mediated (radial versus rotational) motion judgments [4-9].
- Future experiments are needed to determine whether the present task effects reflect local speed differences, which can influence radial and rotational speed judgments [10-13].

References

1. Tanaka & Saito (1989). **PMID: 2769351**
2. Duffy & Wurtz (1991a). **PMID: 1875243**
3. Duffy & Wurtz (1991b). **PMID: 1875244**
4. Geesaman & Qian (1996). **PMID: 8944287**
5. Bex & Makous (1997). **PMID: 9425552**
6. Bex et al., (1998). **PMID: 9536513**
7. Geesaman & Qian (1998). **PMID: 9666990**
8. Shirai et al., (2006). **PMID: 17138275**
9. Xiao et al., (2006). **PMID: 16597350**
10. Werkhoven et al., (1993). **PMID: 8474842**
11. Barraza & Grzywacz (2002). **PMID: 12367744**
12. Barraza & Grzywacz (2003). **PMID: 12868642**
13. Barraza & Grzywacz (2005). **PMID: 16023697**

Poster: http://personal.denison.edu/~matthewsn/vss2016matthewsetal