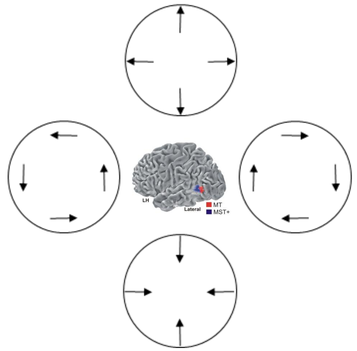
Double Dissociation in Radial & Rotational Motion-Defined Temporal Order Judgments

Leslie Welch[1], Nestor Matthews[2], Elena Festa[1], Kendra Schafer[2]

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

Poster # 26.456

Introduction

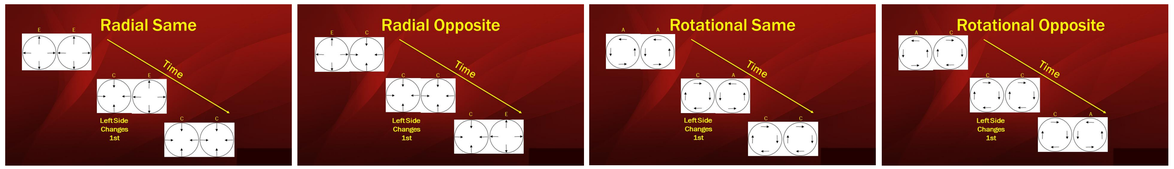


- **Motion Physics** – The figure above shows that radial motion can be converted to rotational motion (and vice versa) by rotating local linear motion vectors 90 degrees.
- **Motion Physiology** – Radial and rotational motion register in the Medial Superior Temporal (MST) region of the primate visual system, according to prior neurophysiological research [1-7].

Research Question

- Do shared or distinct neural events limit how precisely we judge asynchronies defined by these two types of MST-mediated motion?

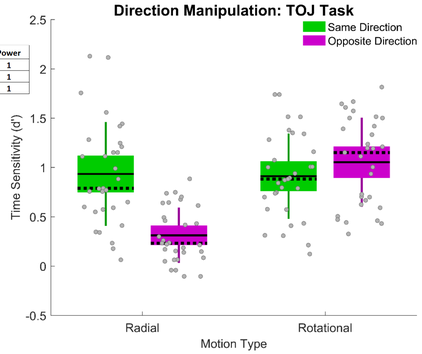
TOJ Task: Left or Right First? SJ Task: Same or Different Time?

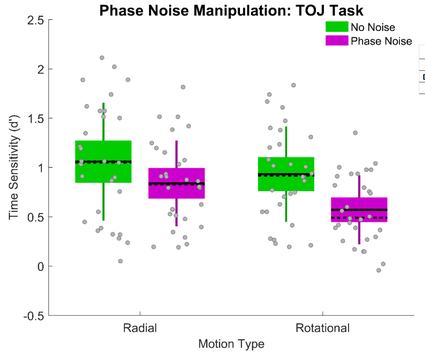


Results

Exp 1

Effect	F(1,30)	p	$_pEta^2$	Power
Motion	59.657	<0.001	0.665	1
Direction	36.177	<0.001	0.547	1
M x D	67.324	<0.001	0.692	1



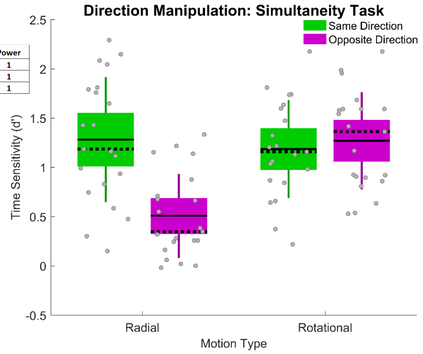


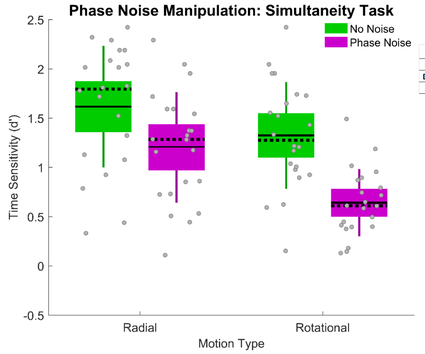
Exp 2

Effect	F(1,29)	p	$_pEta^2$	Power
Motion	10.615	0.003	0.268	0.883
Direction	46.865	<0.001	0.618	1
M x D	6.213	0.019	0.176	0.673

Exp 3

Effect	F(1,20)	p	$_pEta^2$	Power
Motion	56.035	<0.001	0.737	1
Direction	50.765	<0.001	0.717	1
M x D	56.179	<0.001	0.737	1





Exp 4

Effect	F(1,21)	p	$_pEta^2$	Power
Motion	42.251	<0.001	0.668	1
Direction	122.757	<0.001	0.854	1
M x D	9.769	0.005	0.318	0.846

Discussion

- Contrary to a shared-mechanism account, Exp 1 revealed distinct temporal order judgment (TOJ) patterns for radial and rotational motion. Reversing the initial directions *impaired* radial TOJs, but *improved* rotational TOJs.
- Contrary to a shared-mechanism account, Exp 2 revealed distinct temporal order judgment (TOJ) vulnerabilities for radial and rotational motion. Phase noise generated larger impairments on rotational TOJs than on radial TOJs.
- Exp 3 & 4 confirmed and extended Exp 1 & 2's TOJ results to simultaneity judgments (SJs).
- **Conclusion** – The findings suggest a double dissociation between the neural events that limit how precisely we judge asynchronies defined by these two types of MST-mediated motion.

References

1. Tanaka & Saito (1989) **PMID: 2769351**
2. Duffy & Wurtz (1991a) **PMID: 1875243**
3. Duffy & Wurtz (1991b) **PMID: 1875244**
4. Smith et al. (2006) **PMID: 16420463**
5. Gilmore et al. (2007) **PMID: 18093371**
6. Wall et al. (2008) **PMID: 18547254**
7. Strong et al. (2017) **PMID: 28365777**

Stimuli & data available on the Open Science Framework: https://osf.io/knvxj/

Poster: http://personal.denison.edu/~matthewsn/vss2018welchmatthewsfestaschafer