**Depth from Motion Alters Radial & Rotational Motion-Defined**

**Temporal Order Judgments**

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**Introduction:** This study addressed a recently discovered dissociation between temporal order judgments (TOJs) of radial and rotational motion stimuli ([Matthews, Welch & Festa, 2018](https://doi.org/10.1523/ENEURO.0241-18.2018)). Specifically, radial TOJ thresholds exhibited 3-fold differences depending on whether stimuli initially radiated in the same versus opposite directions. By contrast, rotational TOJ thresholds exhibited no dependence on same versus opposite initial rotational directions. To understand this non-intuitive dissociation, we psychophysically tested diverging predictions from two hypotheses. (1) The Attentional Prior Entry (APE) hypothesis posits faster neural relays for radially looming stimuli than for radially receding stimuli because looming objects are potentially more threatening ([Franconeri & Simons, 2003](https://www.ncbi.nlm.nih.gov/pubmed/14674628)). APE predicts TOJ psychometric-function biases (PSE shifts) and reaction time advantages skewed toward initially looming stimuli. (2) The Depth Uncertainty (DU) hypothesis posits that our previous data showing poor performance for the opposite-radial condition was due to trial-by-trial uncertainty about the number of depth planes to monitor. Rotational and same-radial conditions depicted two plaids at the same depth while opposite-radial condition depicted two plaids moving apart in depth. DU predicts a reduction in opposite-radial TOJ thresholds after reducing depth-from-motion uncertainty by constraining all trials within a block to the opposite-radial condition.

**Method:** We bilaterally presented plaids that either radiated or rotated before changing direction. College students reported whether the direction changed first on the left or right. In Exp 1 (n=26), [one stimulus initially loomed while the other initially receded](https://youtu.be/vAgHFf7h_2M). In Exp 2 (n=22), [one stimulus initially loomed then receded, the other stimulus rotated](https://youtu.be/eqleU18Ycs8). In Exp 3 (n=28), [one stimulus initially receded then loomed, the other stimulus rotated](https://youtu.be/4m1hx_-C384).

**Results & Conclusion.** In total, across the three experiments 76 participants completed 21,280 TOJ trials for analysis. The data disconfirmed the APE predictions while supporting the DU predictions. Depth from motion can generate dissociations between radially and rotationally defined TOJs.

**Word Count: 300 (with the reference removed)**