

The appearance and disappearance of visual forms defined by differential motion evokes distinctive EEG responses in school-age children

Rick O. Gilmore (rogilmore@psu.edu), Daved A. Fared, Michael G. Dexheimer, & Andrea R. Seisler
Neuroscience 2016 – Poster 4367

MOTIVATION

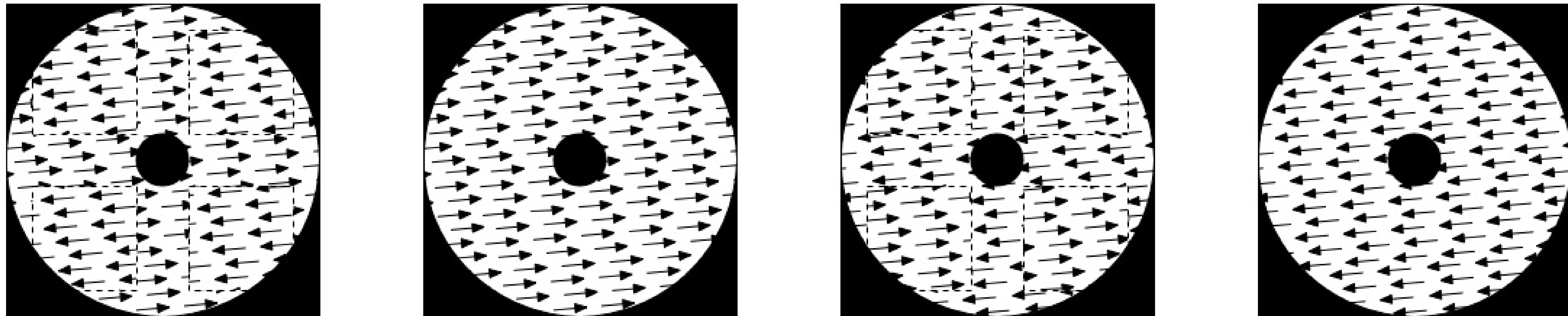
Differential motion patterns aid in the segmentation of visual figures from the background. Adults show evoked brain responses to time-varying motion-defined forms over posterior scalp regions [1],[2]; in these participants, EEG amplitudes scale with the magnitude of direction differences between the figure and background. Little is known about the development of brain responses to motion-defined forms in childhood [3]. In this study, we measured steady-state visual evoked potential (SSVEP) responses in school-age participants and compared the resulting patterns to previous results of adults.

METHOD

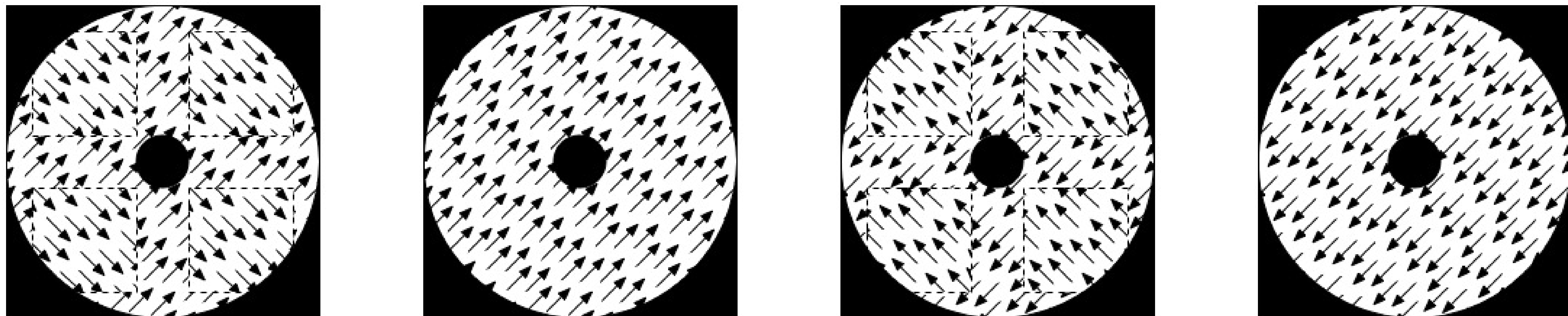
School-age observers ($n=37$; 4.3-9.0 years, $M=6.4$, 16 female) participated in this study. Participants passively viewed random dot kinematogram displays that depicted visual forms which differed in direction from uniform background motion by 5° , 45° , or 180° . Four 9×9 deg square-shaped figure regions emerged from and disappeared into the background at a rate of 1.2 Hz (F1). Figure and background regions were populated with white (39 cd/m^2) dots on a black ($.065 \text{ cd/m}^2$) background at a density of 10%; dot positions were updated at 36 Hz (F2). Each condition was presented at two speeds (1.2 and 6.0 deg/s). All patterns were displayed in an annular region 24° in outer and 4.8° inner diameter at the 60 cm viewing distance. EEG was collected at 432.43 Hz using a 128 channel EGI system and PowerDiva Video 3.4 software and submitted to a discrete Fourier transform. The complex domain (real and imaginary) components of each channel were analyzed using mixed-effects MANOVA, with direction difference and speed as fixed factors and participant as a random factor.

DISPLAYS

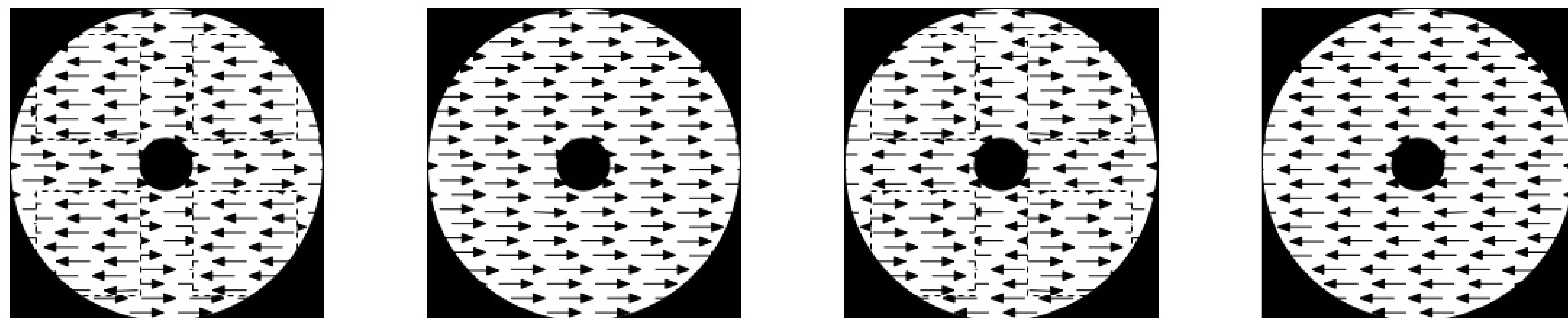
5 degree



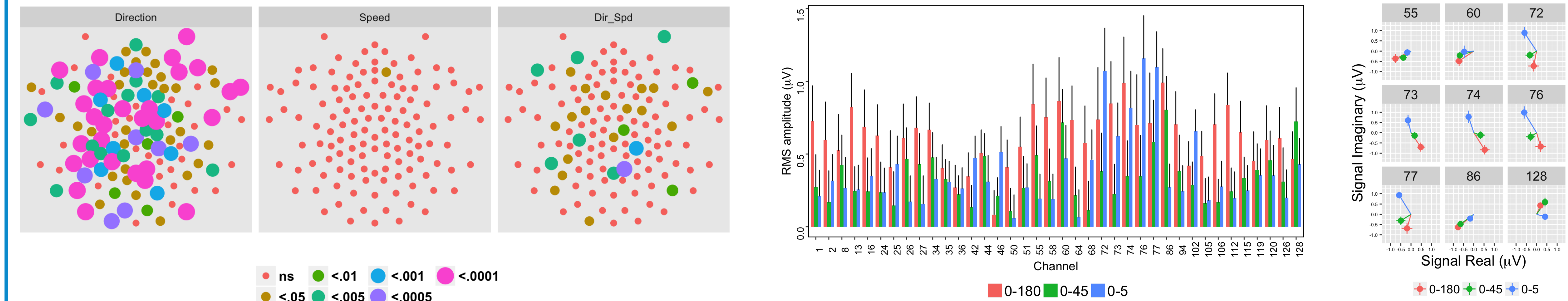
45 degree



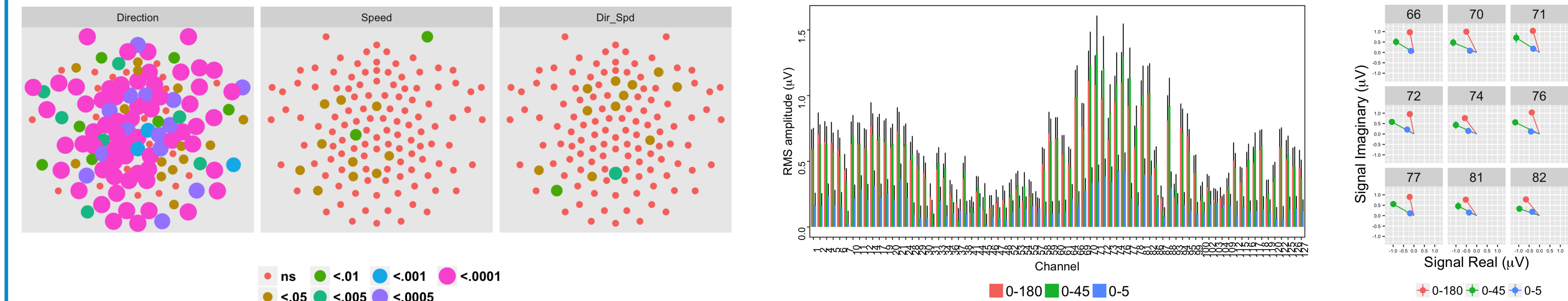
180 degree



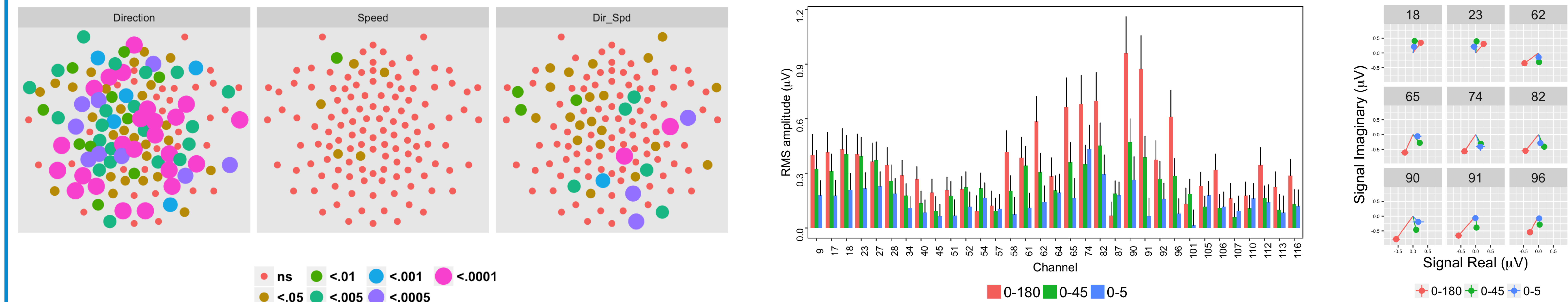
RESULTS - 1F1



RESULTS - 2F1



RESULTS - 3F1



DATA SHARING

Movies of the displays, metadata about the participants, and raw data files are available at: <http://databrary.org/volume/144>.

ACKNOWLEDGEMENTS

This material is based upon work supported by the National Science Foundation under Grant Number BCS-1147440. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

REFERENCES

- [1] J. D. Fesi, A. L. Thomas, and R. O. Gilmore, "Cortical responses to optic flow and motion contrast across patterns and speeds," *Vision Research*, vol. 100, pp. 56-71, Jul. 2014. [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S0042698914000765>
- [2] J. D. Fesi, M. P. Yannes, D. D. Brinckman, A. M. Norcia, J. M. Ales, and R. O. Gilmore, "Distinct cortical responses to 2d figures defined by motion contrast," *Vision Research*, vol. 51, no. 19, pp. 2110-2120, Oct. 2011. [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S0042698911002616>
- [3] R. O. Gilmore, A. L. Thomas, and J. Fesi, "Children's Brain Responses to Optic Flow Vary by Pattern Type and Motion Speed," *PLOS ONE*, vol. 11, no. 6, p. e0157911, Jun. 2016. [Online]. Available: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0157911>