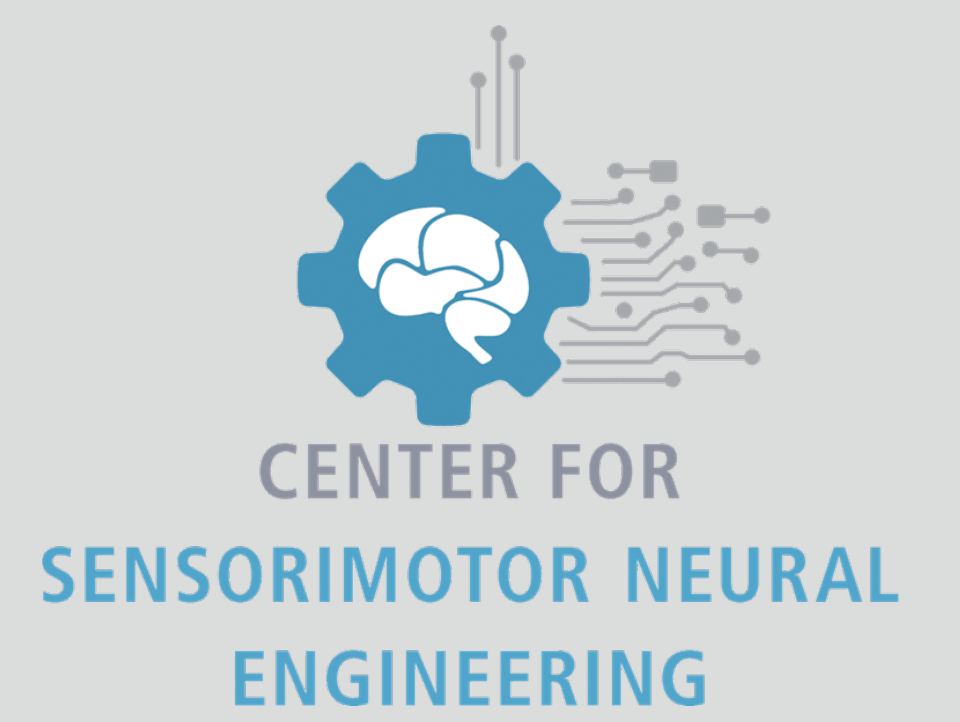




# Interactive Web App for Multispectral Neural Connectivity

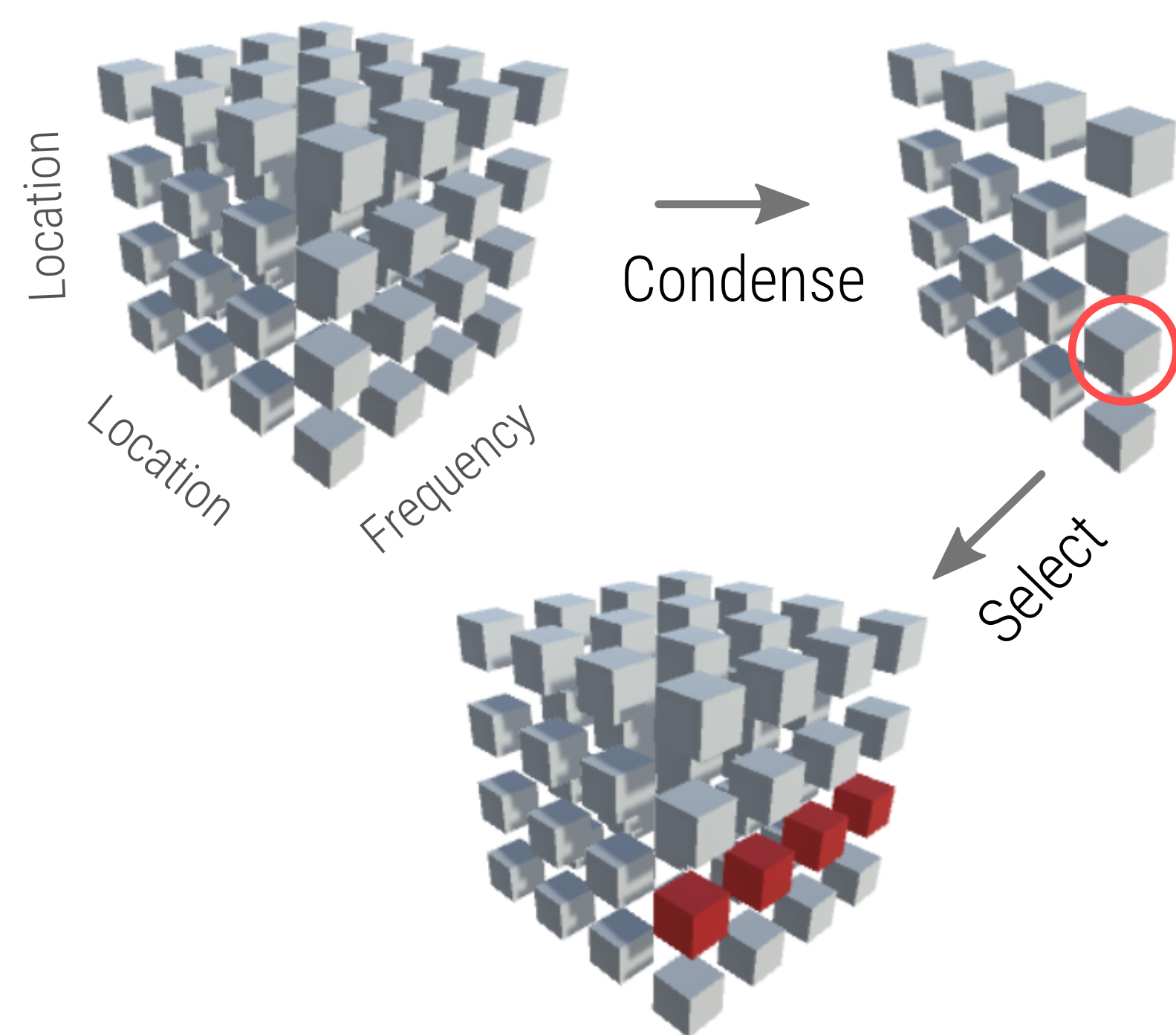
David Caldwell<sup>1,2,\*</sup>, Jing (James) Wu<sup>1,2,\*</sup>, Nick Foti<sup>3</sup>, Emily Fox<sup>4</sup> \* Authors contributed equally

Dept of <sup>1</sup>Bioengineering <sup>2</sup>Center for Sensorimotor Neural Engineering <sup>3</sup>I-LABS <sup>4</sup>Statistics University of Washington

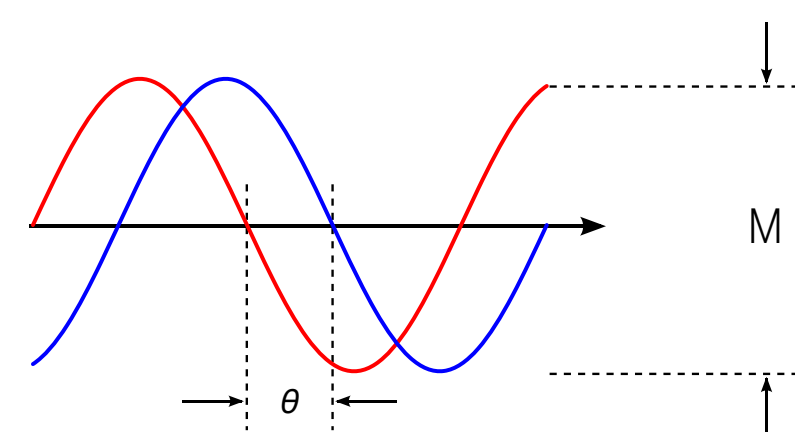


## Problem

Neural connectivity exploration requires a user-friendly method of exploring high-dimensional data with simultaneous displays of multiple matrix slicing.

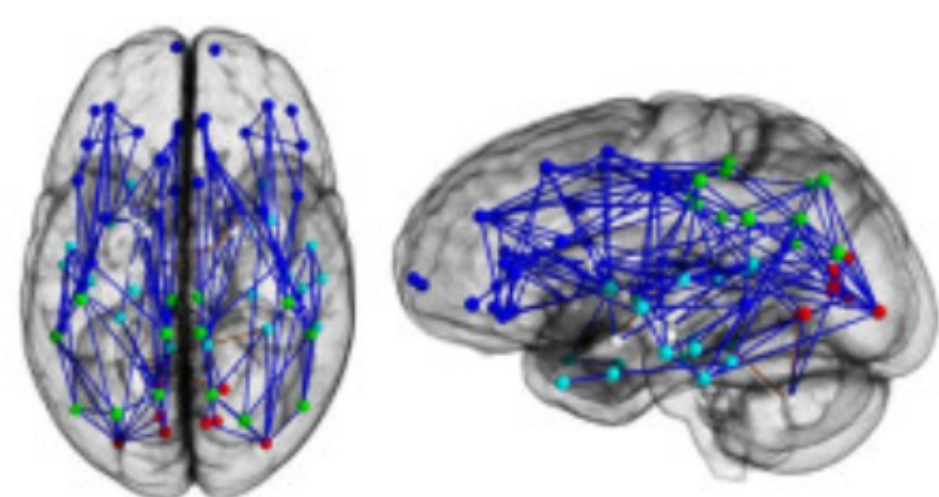


Multiple metrics for pairwise connection make connection displays time-consuming to navigate.



Wikipedia User:Peppergrawer, CC-BY-SA 3.0

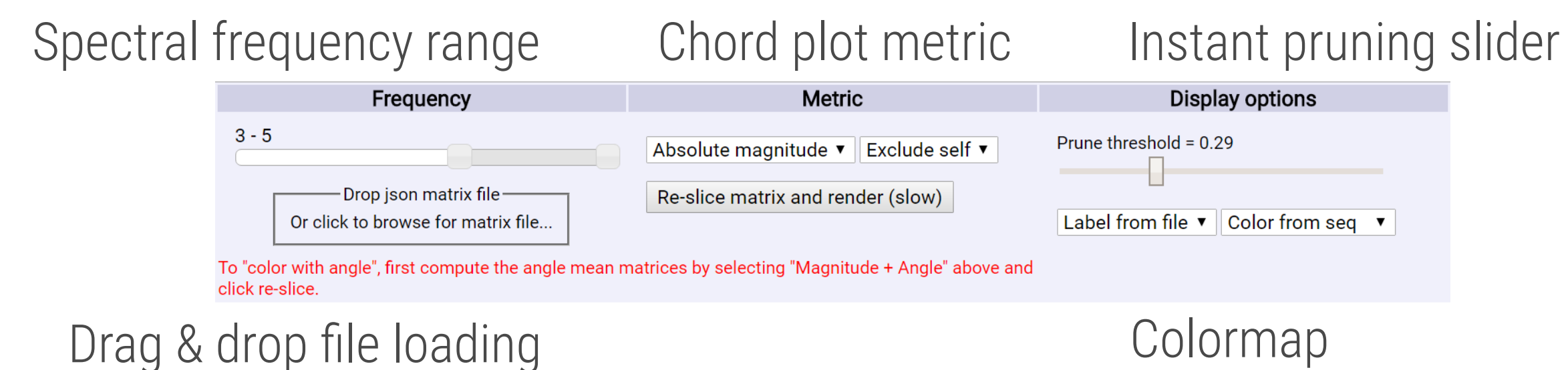
"Gold standard" visualization techniques in neuroscience literature highly insufficient for direct interpretation without supplemental data.



Verma et al, PNAS 2013

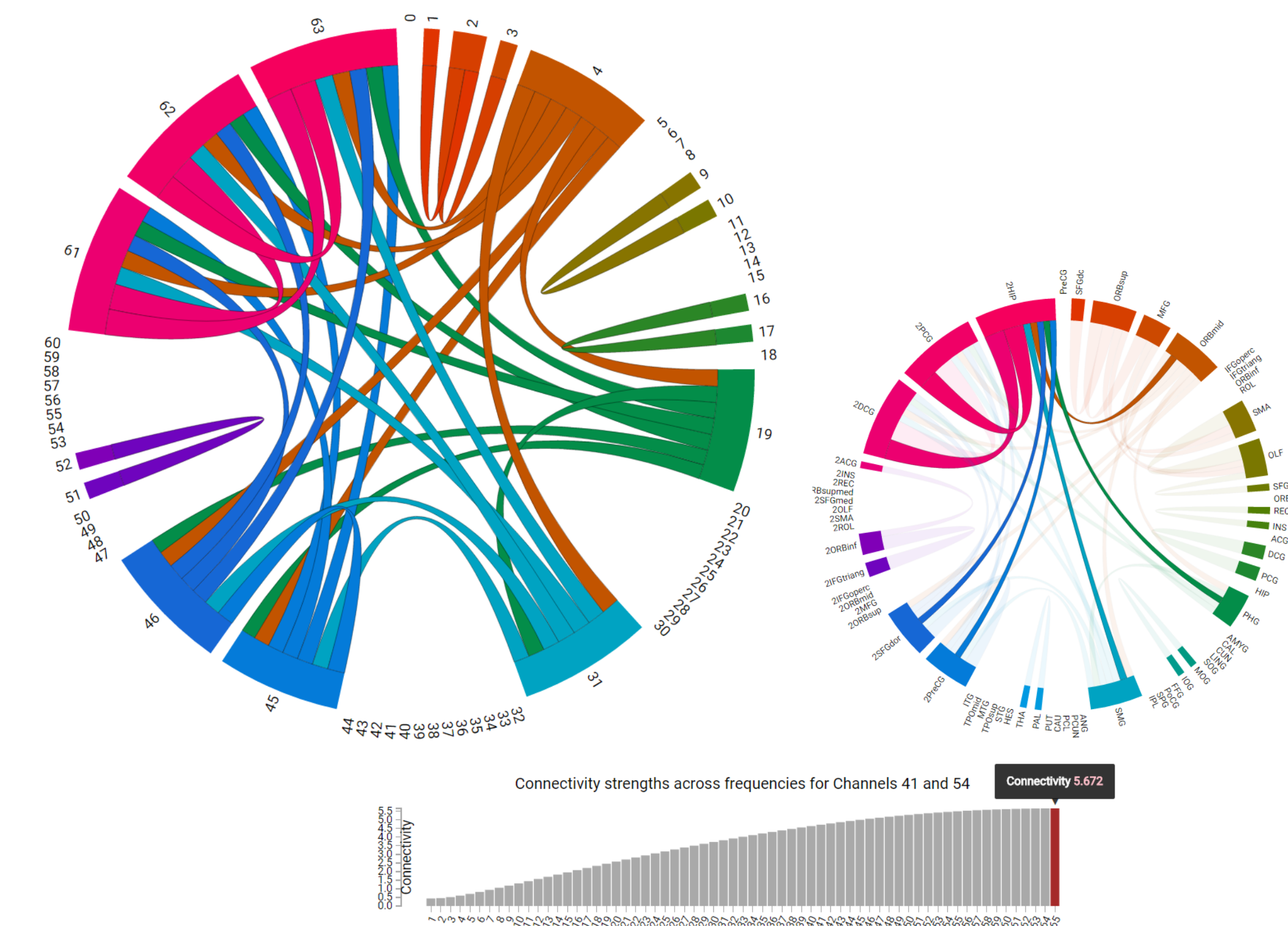
User interactivity with on-demand selection of multivariate attributes and in-browser computation and thresholding is the key for revealing underlying trends.

## Affinity: connectivity rapid exploration tool



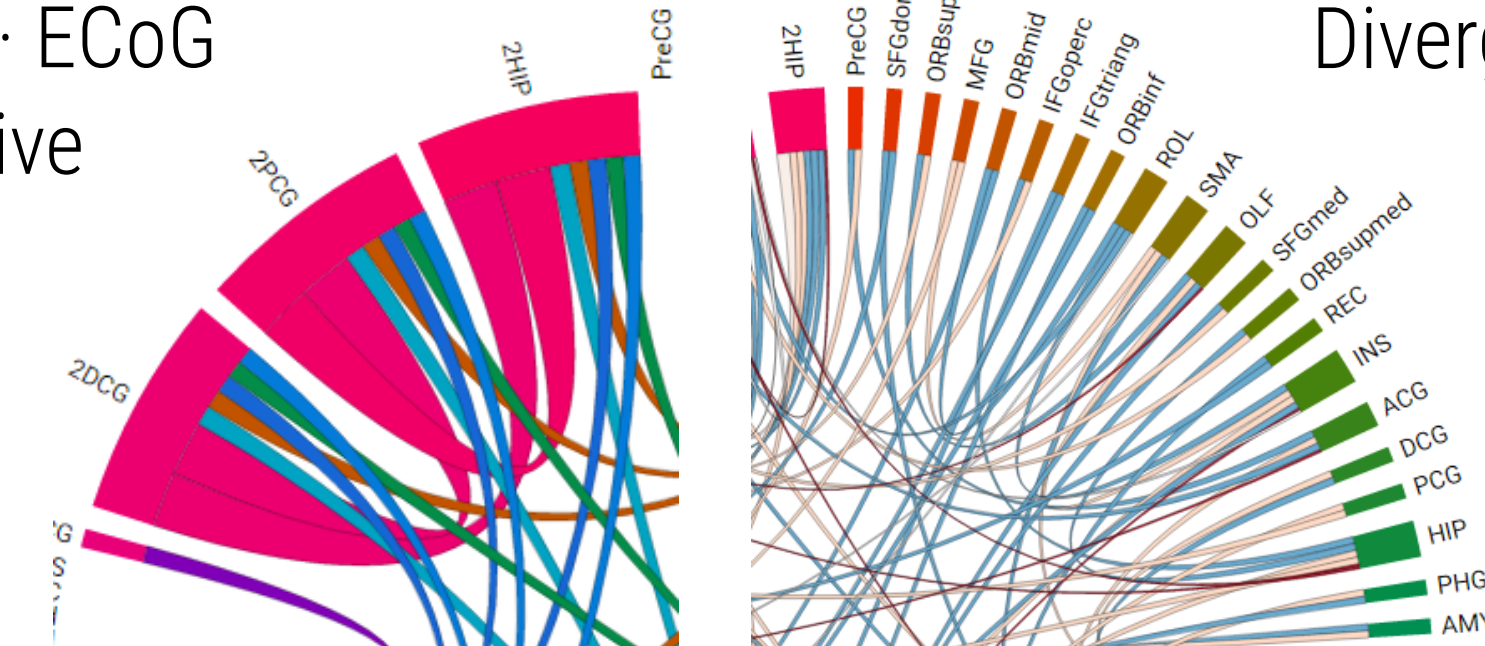
Drag & drop file loading

Colormap



Connectivity magnitude for EEG · sEEG · ECoG  
Spatial qualitative coloring shows inter- and intra-connectivity

Phase angle for EEG · MEG  
Divergent color scale shows  $-\pi \dots +\pi$  phase angles



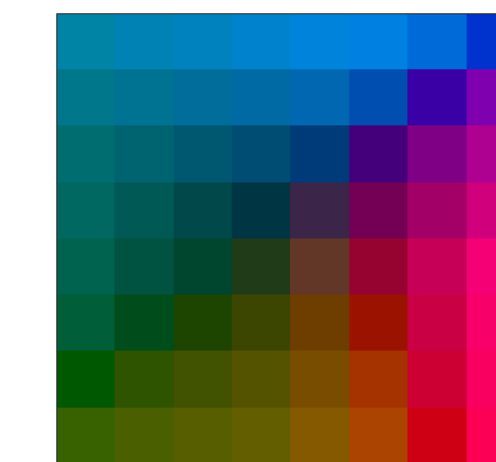
## Future Work

Rapid switching between chord diagram and anatomical brain in WebGL  
Python numpy processing in-browser for larger matrices (>1 million elements) in flask  
Additional dimension: temporal variability plotting

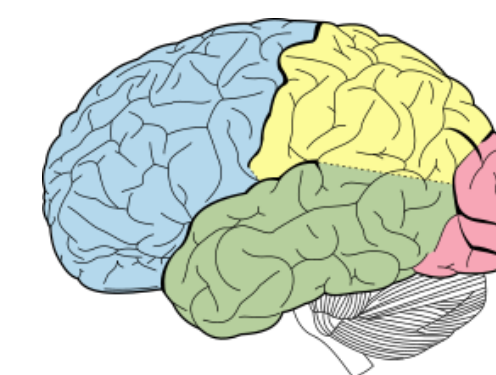
## References

bost.ocks.org: d3.layout.chord  
d3 bar charts  
FileDrop.js: iframe+HTML5 sample  
AmeliaBR: chord disambiguation key  
<https://jsfiddle.net/KjrGF/12/>  
Verma et al. PNAS 2013: Literature example of connectivity  
ColorBrewer divergent scale: [colorbrewer2.org](http://colorbrewer2.org)  
Pascal Getreuer: MATLAB L\*a\*b and L\*c\*h coordinate transformations

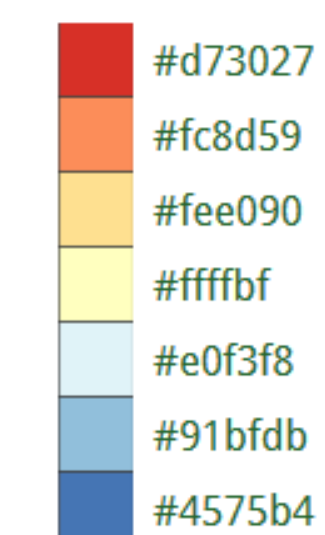
## Design Principles



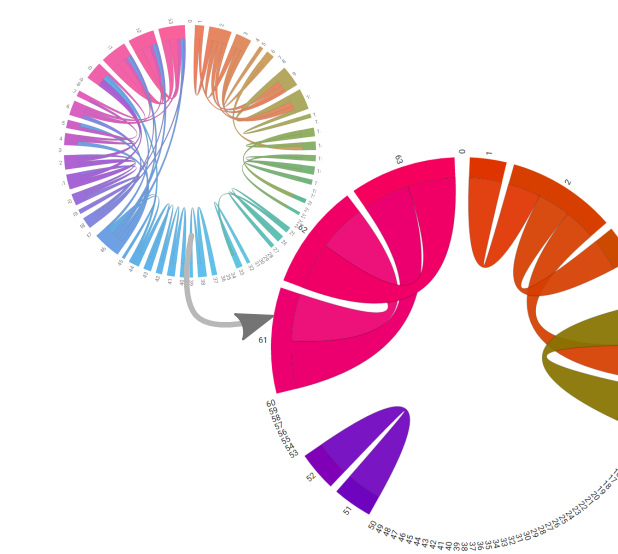
Equal luminance colormaps for nominal encoding of position



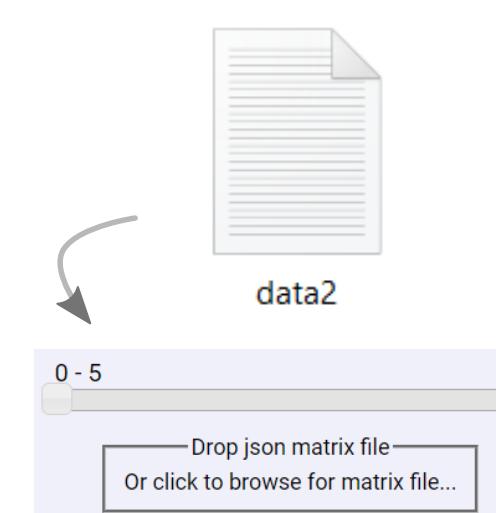
Feature not bug: take advantage of human visual quirk of perceptual color grouping



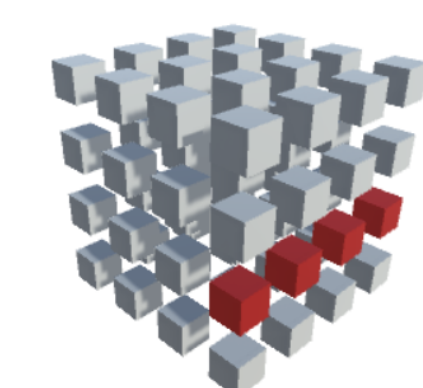
ColorBrewer diverging color scales for encoding quantitative data such as average phase angle



Responsive chord pruning slider for rapid examination of most salient features without occlusion



Drag-n-drop file loading and in-browser matrix slice selection with math.js and custom array .map() methods



Rapid slice selection across unplotted dimension on clicking chord