

Open vs Closed Shapes: New Perceptual Categories?

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A viewer's ability to rapidly and accurately discern between two or more categorical variables in a chart or figure is contingent upon the distinctiveness of the encodings applied to each variable. Research in perception suggests that differences in shape, while by no means the dominant visual cue, yield meaningful differences in distinctiveness. We have proposed that open or closed shapes (that is, whether shapes are composed of line segments that are bounded across a region of space or not) represent a salient characteristic that influences perceptual awareness. Three experiments were performed to test the reliability of the open/closed dimension: the first two from the perspective of attentional allocation, and the third experiment in the context of multi-class scatterplot displays. In the first, a flanker paradigm was used to test whether perceptual load and open/closed feature dimension would modulate the effect of the flanker on target processing. Results showed an influence of both variables. The second experiment used a same/different reaction time task to replicate and extend those findings. Results from both show that responses are faster and more accurate when closed rather than open shapes are processed as targets, and there is more processing interference when two competing shapes come from the same rather than different open or closed feature dimensions. The third experiment employed three commonly used visual analytic tasks - perception of average value, numerosity, and linear relationships for both single and dual display of open and closed symbols. Our preliminary findings show that for numerosity and trend judgments, in particular, different symbols from the same open or closed feature category cause more perceptual interference when they are presented together in a plot than symbols from different categories. Moreover, the extent of the interference seems to vary when a participant is focused on processing open or closed symbols. We are seeking feedback and productive discussions on these results and our plans for future studies.

Our aim is to continue exploring the open/closed feature category, to investigate the interaction of encoding with metrics of clustering and overlap in scatterplots, and to work toward a set of guidelines for visual encoding strategies in scatterplot displays.