What about depicting quantities of objects that do not have typical colors? Do people have color intuitions? General Question: Do specific color-concept mappings influence interpretations of visual representations?

Do so, are visual representations easier to interpret when color coding matches color intuitions?

Approach: information visualization as a problem of analogy

Analogies are good when alignment between domains is structurally consistent

Structurally Consistent Structurally Inconsistent

Maybe visualizations are clear when perceptual-concept mappings are structurally consistent.

Problem: which color-concept mappings are structurally consistent?

Straightforward for categories with typical colors (e.g., fruit) (Bullough, 1907).

What about depicting quantities of objects that do not have typical colors?

Assessing Color Intuitions

Task: Interpret a colormap with no legend (no correct answer).

Are you more likely to spot animals on planet Spart early or late in the day?

“Early” and “late” regions clearly differ in lightness (left/right balanced).

1 trial per participant (Amazon Mechanical Turk).

Each saw a different version of the visualization.

Will responses differ from chance? And if so, how?

If they do, then there are color intuitions for color quantity mappings.

Do people share color intuitions for how colors map onto quantities?

Hypotheses: Larger quantities represented by...

1. Higher-contrast region because they are figural.

2. Darker region because darker colors are heavier.

3. Lighter region because lighter colors are more active.

Color intuition: Dark-is-More (DiM) Bias

No higher-contrast bias because contrast was always high enough.

Experiment 1: Dark-is-More (DiM) Bias

Color Scale

Blue Scale

Red Scale

White Background

Black Background

Hypotheses: Larger quantities represented by...

1. Higher-contrast region because they are figural.

2. Darker region because darker colors are heavier.

3. Lighter region because lighter colors are more active.

Experiment 2: DiM Bias and Higher Contrast Bias

Color Scale

Blue Scale

Red Scale

White Background

Black Background

Color intuition: DiM Bias + Higher Contrast Bias

Does the DiM bias persist for extremely low-contrast backgrounds?

What types of color-quantity mapping are most frequently used in journal articles?


Collected all figures with colormaps (n = 83)

Only on low-high scales (no neutral point) (n = 48)

Coded scales as light-more map dark-more map rainbow map

Discussion and Conclusions

People share color intuitions for colormap data visualizations.

Strong Dark-is-More (DiM) bias Weak higher-contrast bias

Sample of journal figures contained more light-more mapping, violating the DiM bias.

Should all visualizations use DiM mapping?

Depends on answers to several questions...

(1) Does the DiM bias affect interpretations of data when legends specify “true” mapping?

(2) Will it persist for concepts associated with lighter colors (e.g., snow, activation)?

(3) Do experts accustomed to looking at light-more maps demonstrate the DiM bias?

References and Acknowledgments

References

Adapted from Lin et al., 2013.

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