Priming and Anchoring Effects in Visualization

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Thanks André!



What are **priming** and **anchoring** effects?



https://crew.co/blog/the-priming-effect-why-youre-less-in-control-of-your-actions-than-you-think/

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Priming effects ...

influenced by a preceding perceptual stimulus.

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...describe phenomena in which human responses are



Anchoring effects ...

provides a frame of reference.

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... describe phenomena in which a previous stimulus



Anchoring



https://commons.wikimedia.org/wiki/File:Portrait Gandhi.jpg

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* he died at the age of 78.



Are priming and/or anchoring effects at play in Visualization?

Example



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Why is it important?

- Current models assume perception to be more or less constant
- Some work on individual differences [Kay and Heer 2016, Toker et al. 2013]
- We: temporal effects



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Contribution

- A series of 5 studies on priming/anchoring in visualization ...
- ... using class separability in scatterplots as an example.

Today: Brief overview & main results

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(Pilot) Study 1

- Q: Any priming/anchoring effects visible in real data?
- **Data:** from previous work [SedImair et al., EuroVis 12, InfoVis 13, EuroVis 15]
- **Task:** rate separability on a scale 1-5
- MTurk Study
 - 180 participants

* 200 overall, 180 after removing speeders, etc.

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Study 1: Setup (in a nutshell) Hypothesis: **Priming** on unclear targets.





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Cat-eye plot

Study 1: Example result





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Study 1: Summary results

Maybe priming effect was at play



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• **BUT:** Too many uncontrolled variables to say definitely



(Pilot) Study 2

- Goal: Identify well-controlled stimuli
- How: Created 200 sample scatterplots
 - only distance between classes is varied
- MTurk Study
 - 43 participants*
 - task: separability on scale 1-5

* 47 overall

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Study 2: Result —> Three suitable stimuli

2 primes / anchors participants agreed

(a) clearly nonseparable or

(b) separable



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1 unclear target large variance across participants



Study 3



MTurk Study: 196 participants*

* 251 overall

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Ωт

- Visible effect in 2nd trial
- **BUT:** No effect in 1st trial
- Reason
 - training anchors -
 - after **masking** small priming effect

Study 4 = Study 3 without Training

MTurk Study: 243 participants*

* 351 overall

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No bias from training tasks

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clearly separable

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4

က -

 \sim

clearly non-separable

Clear anchoring effect for first target

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clearly non-separable

Also anchored by first target

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2/3 of a tick mark difference for the very same target

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clearly non-separable

Study 4: Summary results

- Anchoring effect!
- **First anchor** in small studies is very influential.
- What not: within-subject priming effects*

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* within-subject: does even the very same person judge scatterplots differently based on what they have seen before?

Study 5

- Goal: understand subtle, within-subject priming effects
- Long term usage study
 - data: 200 randomly generated scatterplots w/ centroid distance = [0;4] Stdev
 - **task:** separability judgments: 1-5 scale up to 1000 judgments per participant
 - Online study with 64 participants / 28,544 judgments*

* 31,105 overall

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x 1000

Analysis

- Regression model predict current stimulus based on: (1) the **current** centroid distance
 - (2) the separability of the **previous** stimulus.
- Hypotheses
 - H1: Mainly depends on centroid distance
 - H2: Small priming effect, i.e., it depends also on previous stimulus

p-dist

c-dist

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Results — Simplified Linear Regression rating = $0.6 + 1.0 \times c$ -dist + $0.1 \times p$ -dist

• rating = [1;5]

Press on your keyboard 1-5 to rate the separability!

clearly not separable	not separable	don't know	separable	clearly separable
1	2	3	4	5

• c-dist, p-dist = [0;4]

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Results — Simplified Linear Regression $rating = 0.6 + 1.0 \times c$ -dist + $0.1 \times p$ -dist

• Intercept

- Influence of the current distance [0;4] is high
- Small influence of previous distance [0;4]

Study 5: Summary results

- We do see within-subject priming effects in long-term usage
- They account for ~7% of the next judgment

Conclusions

Summary

- priming & anchoring effects in VIS
- 5 studies
 - from application-driven
 - to well-controlled
- first evidence for anchoring & priming in VIS

Future work

- ... just a beginning
- How to use in vis design?
 - counteract?

tasks

idioms

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