Perception of Average Value in Multiclass Scatterplots

Michael Gleicher, Michael Correll, Christine Nothelfer, Steven Franconeri
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Which color is higher on average?
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Which color is higher on average?
Summary

How well can a general audience do this task?

How do design choices affect performance?
Visual Aggregation
Why?
Why?
Why?
Why?
Why?
Anscombe's Quartet
Premises
Premises
Premises
How Well Can We Aggregate?
Perception of Aggregates
Perception of Aggregates
Methodologies
Methods

11 between-subjects experiments
9 within-subjects experiments
600 participants (17,520 trials)
Results
Results
Visual variables
Color is a stronger cue than shape

79% > 72%
Results
Irrelevant Cues
Distractor class
78% \approx 77%
Distractor class and irrelevant cue
Averaging is robust to visual complexity
Averaging is robust to visual complexity
Averaging is robust to visual complexity
Averaging is robust to visual complexity
Results
Redundant cues
\[ \approx \]
Ongoing Work
Ongoing Work
Ongoing Work
Ongoing Work
Conclusion
Acknowledgments

This work was supported in part by NSF awards CMMI-0941013, BCS-1056730, SBE-1041707, DRL-0918409, DRL-1247262, and IIS-1162037 and NIH award R01 AU974787.

Visit http://graphics.cs.wisc.edu/Vis/ScatterVis13/ for data tables, stimuli, and sample experiments.
Extra Slides
Eye Tracking

Means 16 pixels apart

Means 80 pixels apart
Shape is a weaker cue than color
Shape is a weaker cue than color

72.9% accuracy overall

79.4% accuracy overall
Shape is a weaker cue than color

75% accuracy at 26.1 pixels apart

75% accuracy at 19.7 pixels apart
Color vs. Shape
Redundancy
Δparameter

Δ=16 pixels

Δ=80 pixels
$\Delta = 16$ pixels

$\Delta = 80$ pixels
$\Delta$ parameter

$\Delta=12$ pixels

$\Delta=80$ pixels
Shape is a weaker cue than color

Accuracy

72.9%  
79.4%
Averaging is robust to visual complexity.
Averaging is robust to visual complexity

Accuracy

76.9%

80.1%
Averaging is robust to visual complexity
Averaging is robust to visual complexity

Accuracy

78.2% 76.9%
Averaging is robust to visual complexity

Accuracy

<table>
<thead>
<tr>
<th>76.9%</th>
<th>80.1%</th>
</tr>
</thead>
</table>

| 78.2% | 76.9% |

Accuracy ranges from 0 to 1.
Visual complexity still matters
Visual complexity still matters

Accuracy

79.5%  75.5%

*
Visual complexity still matters

Accuracy

76.9% ± 0.2
78.2% ± 0.4
79.5% ± 0.6
80.1% ± 0.8
76.9% ± 1.0
75.5% ± 1.0

*
Redundant encodings don’t help
Redundant encodings don’t (always) help

80.7% 79.7%

Accuracy
Redundant encodings don’t (always) help