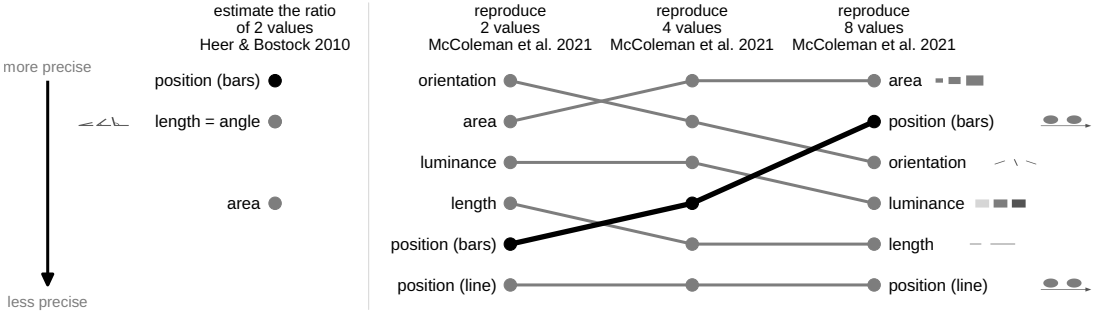
Channel order depends on what the reader has to do

Four ways to rank visual channels, and the tasks still to be measured.

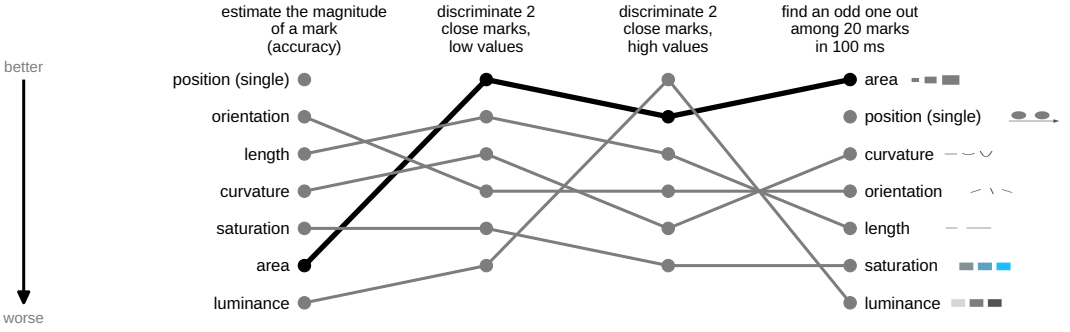
A Precision: two studies, two measures

On the left, Heer & Bostock 2010 rank channels by the error made when estimating the ratio of two values. On the right, McColeman et al. 2021 rank the consistency of responses when readers reproduce 2, 4, then 8 values. From most precise at the top to least precise at the bottom; each line follows one channel, the black line follows position (bars).



B Same readers, four tasks: the rank follows the task (Lee et al. 2026)

Lee et al. show isolated marks, with no axes or chart, to the same 105 readers for all four tasks (150 for discrimination). Each column has its own measure: the error when estimating a magnitude, the smallest perceived difference when discriminating two marks, the share of odd ones found when searching. From best at the top to worst at the bottom; the black line follows area.



C Bias: reproducing 2, 4 or 8 values (McColeman et al. 2021, fig. 8)

Here the rank gives the systematic gap between the reproduced value and the true one, from least biased (1) to most biased (6). In bold, position (bars).

least biased	2 values	4 values	8 values
1	orientation	length	length
2	length	**position (bars)**	**position (bars)**
3	**position (bars)**	orientation	luminance
4	luminance	luminance	position (line)
5	area	area	area
6	position (line)	position (line)	orientation
most biased			

D Single value or set of values

These studies compare charts with one another without ranking channels: for each task, the middle column says what wins.

task	what wins	source
compare two isolated values	position (bars ≈ points) > length (misaligned bars)	Yuan et al. 2018
compare the means of two pairs	no clear advantage left: bars ≈ misaligned bars	Yuan et al. 2018
compare the means of two groups of 6	no difference between these three charts	Yuan et al. 2018
find the month of the maximum, the minimum or the largest range	position > color	Albers et al. 2014
find the month with the highest mean	color > line; leading: the charts that aggregate by month	Albers et al. 2014; Correll et al. 2012

E Tasks to test

Tasks missing from the panels above, which other studies invite us to measure channel by channel.

– estimate a part of a whole: the pie chart matches bars and beats divided bars (Simkin & Hastie 1987);
– judge a change or a trend: better read with lines and bars (Hollands & Spence 1992);
– estimate a correlation: nine charts rank only in a partial order (Harrison et al. 2014; Kay & Heer 2015);
– find an odd one out among heterogeneous marks, without knowing in advance which channel sets it apart (Wolfe & Horowitz 2017);
– summary tasks, which the Cleveland & McGill ranking predicts less well than local tasks (Carswell 1992), including the four ensemble tasks of Szafir et al. 2016.

A Heer & Bostock 2010: angle = pie-chart slices, tied with length (fig. 4, overlapping intervals); area = circles and rectangles.

A McColeman et al. 2021: "angle" = arrows of a wind map (here orientation), luminance = heat map, length = misaligned bars; probabilistic ranks, two neighbors are sometimes nearly tied; the number of values weighs an order of magnitude more than the choice of channel. Their measure closest to Heer & Bostock's, the error of a single response (fig. 8), puts bars 2nd, 1st and 1st.

B Lee et al. 2026 (IEEE VIS 2026, 105 readers): a single mark on a blank canvas, no axes; orientation = tilt of a segment, tied with position for estimation; compared with another mark, position falls between length and curvature (aligned), between saturation and area (unaligned); corrected for its nonlinearity by a power law (exponent 0.424), area rises to 3rd rank.

B Discrimination: position not tested; orientation from 0 to 90°, ranks read off fig. 4 at both ends of the range. Search: hue (not shown) would be 2nd; the only tested gap, area > length ($p = 0.006$). Neighboring ranks are sometimes very close.

D Kim & Heer 2018 (scatterplots): for summary tasks (maximum, means), size does better than position; color is among the best for comparing means, with no clear advantage over position; colored scatterplots degrade as the number of categories grows.

D Saket et al. 2019 (5 to 34 points): no chart wins everywhere; bars for grouping, lines for correlation, scatterplots for outliers; no line chart to read a precise value.

Bertini et al. 2020 (position paper): the classic ranks come from a single task, the ratio of two values; for other tasks, evidence is scarce.

Davis et al. 2024 (109 readers, Cleveland & McGill task): fewer than 40% share the canonical order of charts (bars, then pie), about 22% the full order (bars, pie, stacked bars, bubbles): the average ranking holds for the group, not for each reader.