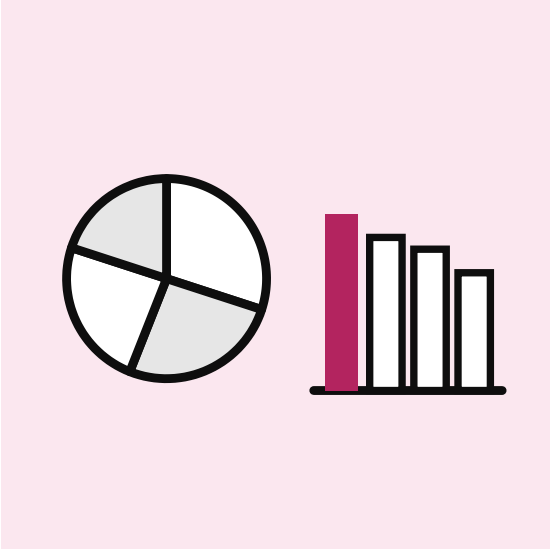
Theory

Accuracy of visual encodings

Ranks the ways of showing a value (position, length, angle, area, color) by how accurately people read and compare them.



In Spanish

Precisión de las codificaciones visuales

Origin

Cleveland and McGill (1984); replication by Heer and Bostock (2010)

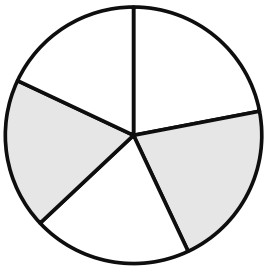
What problem it addresses

It explains why the same data are easy to compare in bars and hard in a pie chart. It gives design a criterion for deciding how to draw each value.

An example

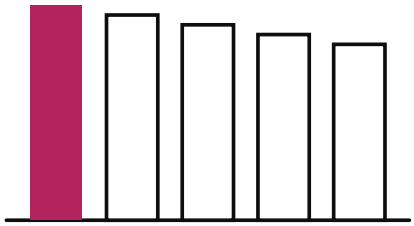
An illustrative example: five products with similar sales, shown in two ways.

Pie chart



You have to compare angles and areas. **Which one sells more? Hard to tell.**

Aligned bars



You compare heights along a shared axis. **The order is clear at a glance.**

The data are the same; what changes is the task you ask the eye to do.

Why it happens

1

Every chart asks for a visual task: judging a position, a length, an angle or an area;

2

not all of them are equally accurate, and position along a common axis is the one we read best;

3

if the key value goes into a hard task, it gets compared poorly even if the chart is correct.

Applications in design

Use it like this

Put what matters most in position along a common axis; leave color and area for secondary information.

Avoid

Asking for fine comparisons with angles, areas or shades of color.

Don't fall for it

If you need to read the labels to know which value is larger, the encoding isn't working.

1.96 times



What the research says

Comparing positions in bars was more accurate than comparing angles in a pie chart, in an experiment with 51 people (Cleveland and McGill, 1984).

●●● **Solid evidence.** An online replication confirmed that position wins, although angle did not come out worse than length, as the ranking predicted (Heer and Bostock, 2010).

Connections

Used in

- Data visualization

Related to

- Cognitive load
- Interaction of color

Authors and works

1984	**William S. Cleveland and Robert McGill**	Proposed the ranking of visual tasks and tested it with experiments comparing values.
2010	**Jeffrey Heer and Michael Bostock**	Repeated the experiments with online participants, confirmed the overall ranking and added rectangle areas.

Sources

Original sources

- Cleveland, W. S., & McGill, R. (1984). Graphical perception: Theory, experimentation, and application to the development of graphical methods. Journal of the American Statistical Association, 79(387), 531–554. View source (https://doi.org/10.1080/01621459.1984.10478080)
- Heer, J., & Bostock, M. (2010). Crowdsourcing graphical perception: Using Mechanical Turk to assess visualization design. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 203–212). ACM. View source (https://doi.org/10.1145/1753326.1753357)

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