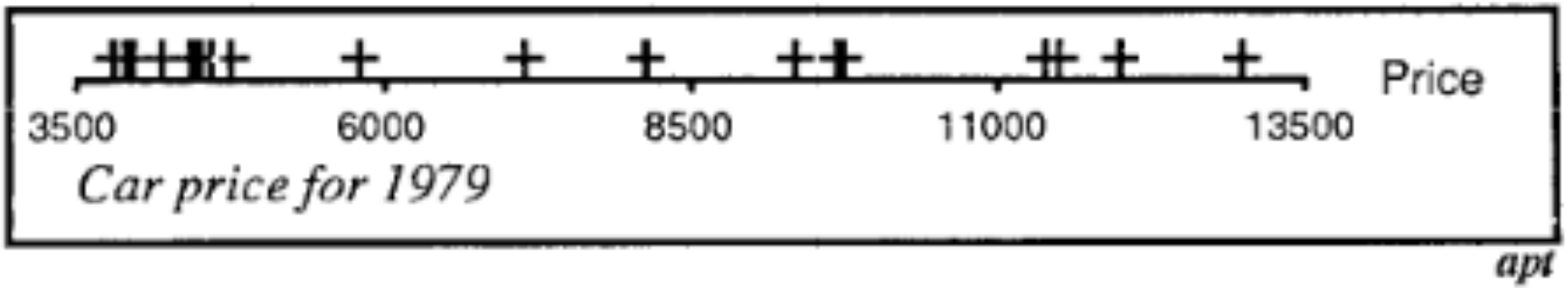
Encoding Data Effectively

Expressiveness:

Encodes all the facts in the set,

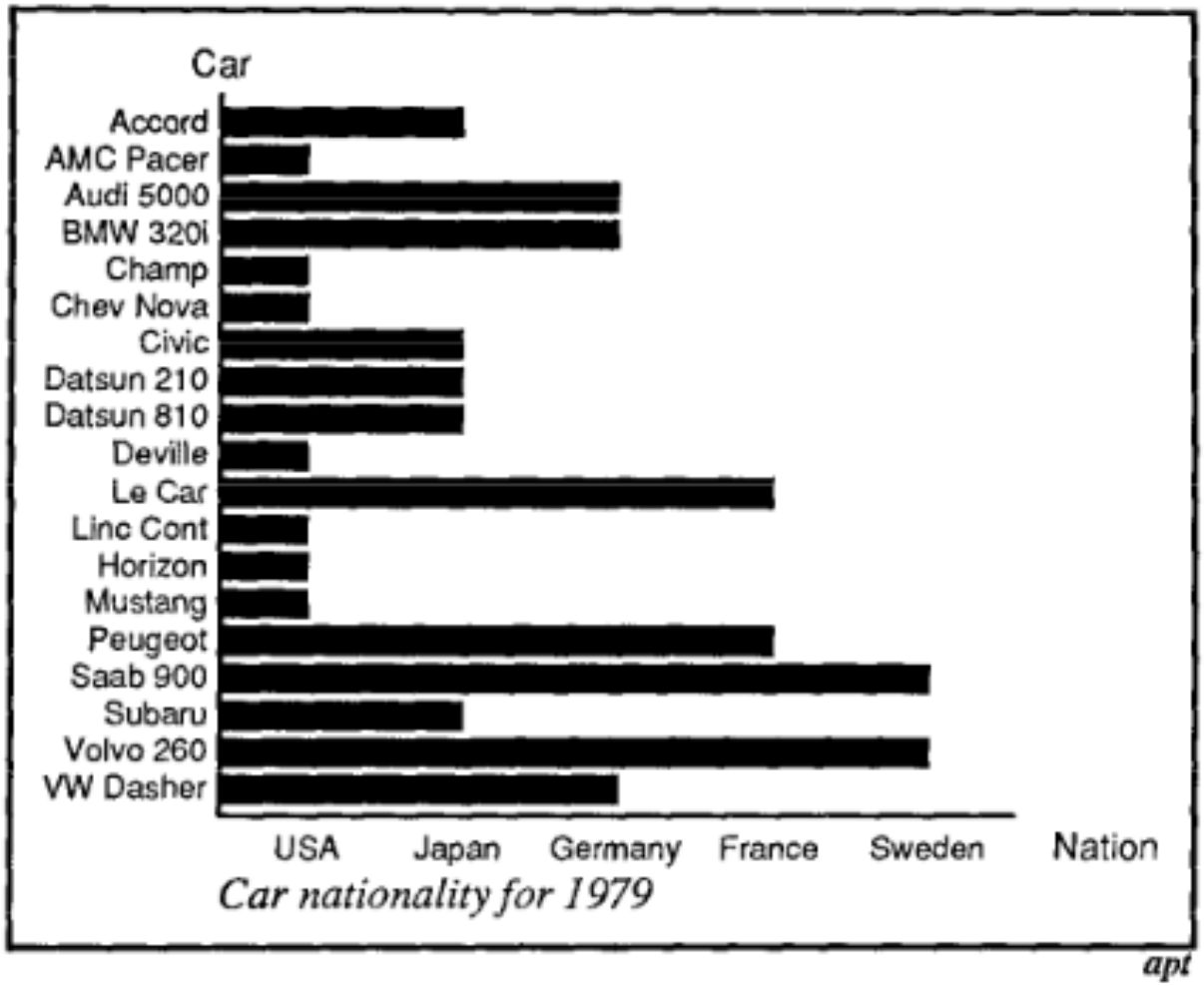
and encodes only the facts in the set of data.

[Mackinlay, 1987]



Unable to express the facts!

One to many cannot be adequately expressed using a single horizontal position.



Expresses more than the facts!

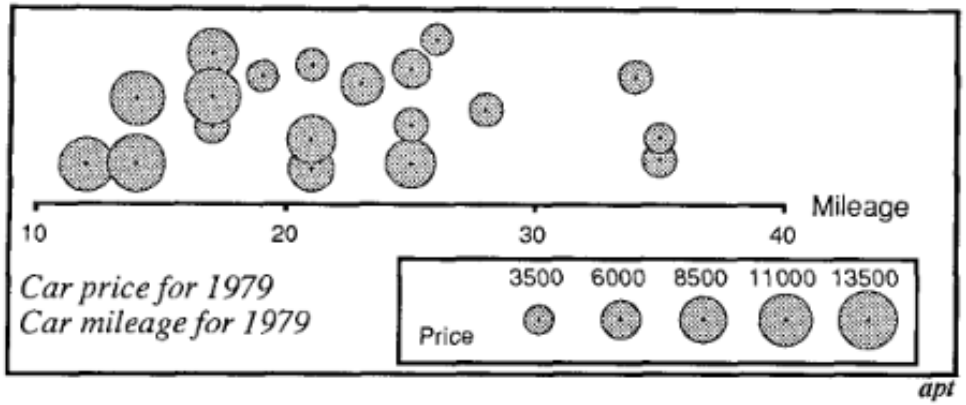
Bar length expresses a false position and rank.

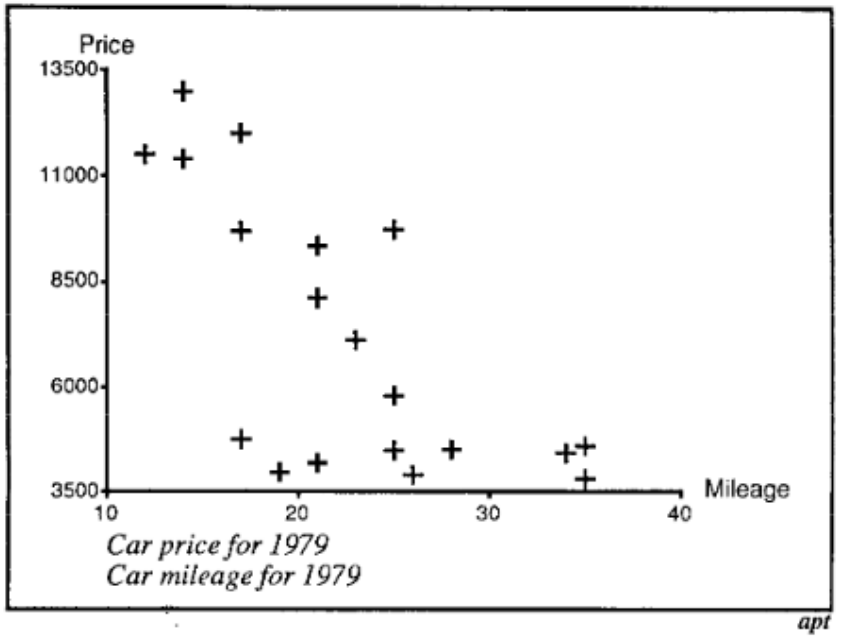
Effectiveness:

Encoding data in a visualization so that information is readily perceived by a human to perform a task.

[Mackinlay, 1987]

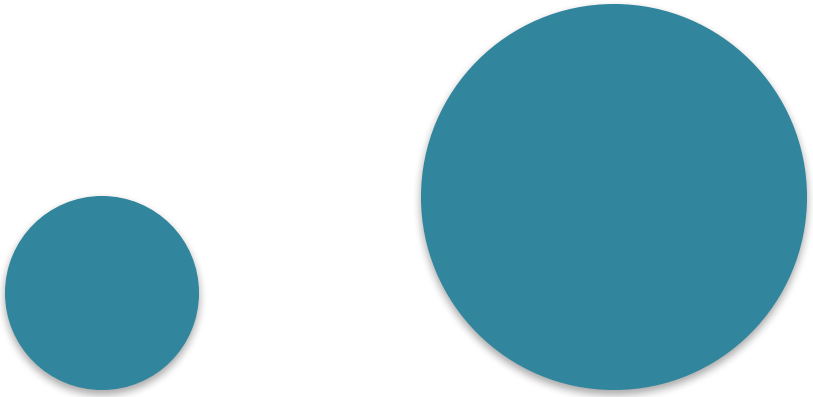
Which Is More Effective?





[Mackinlay, 1987]

How much bigger is the larger circle, by area?



How much bigger is the larger bar, by length?

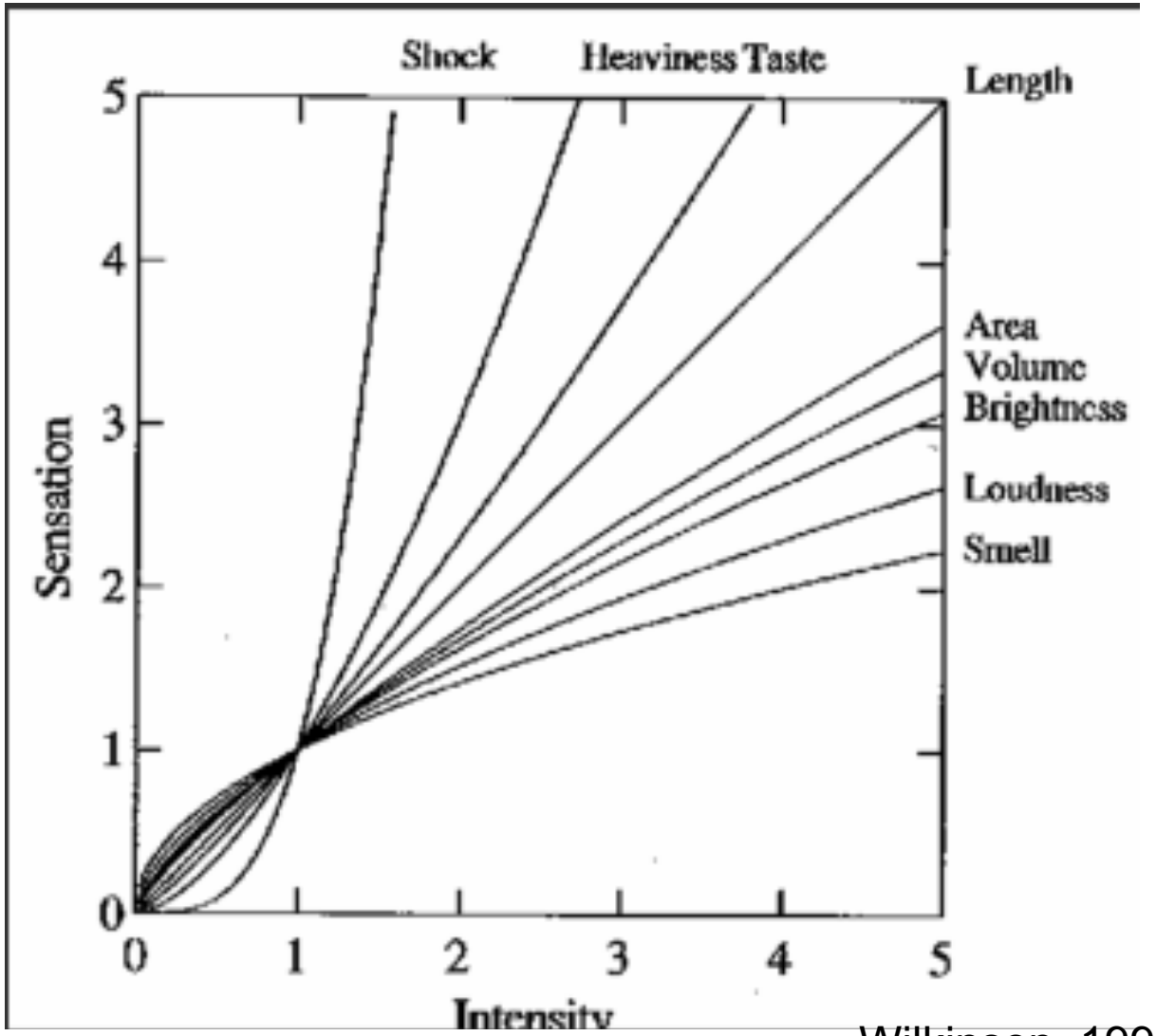
Stevens's Power Law

$$\psi(I) = kI^a$$

Perceived intensity is proportional to actual intensity to some power.

The exponent varies with the type of stimulus.

Stevens's Power Law



Wilkinson, 1999

Stevens's Power Law

Measurements of a	
Length	.9 to 1.1
Area	.6 to .9
Volume	.5 to .8

Estimating Circular Areas

Flannery's appearance compensation

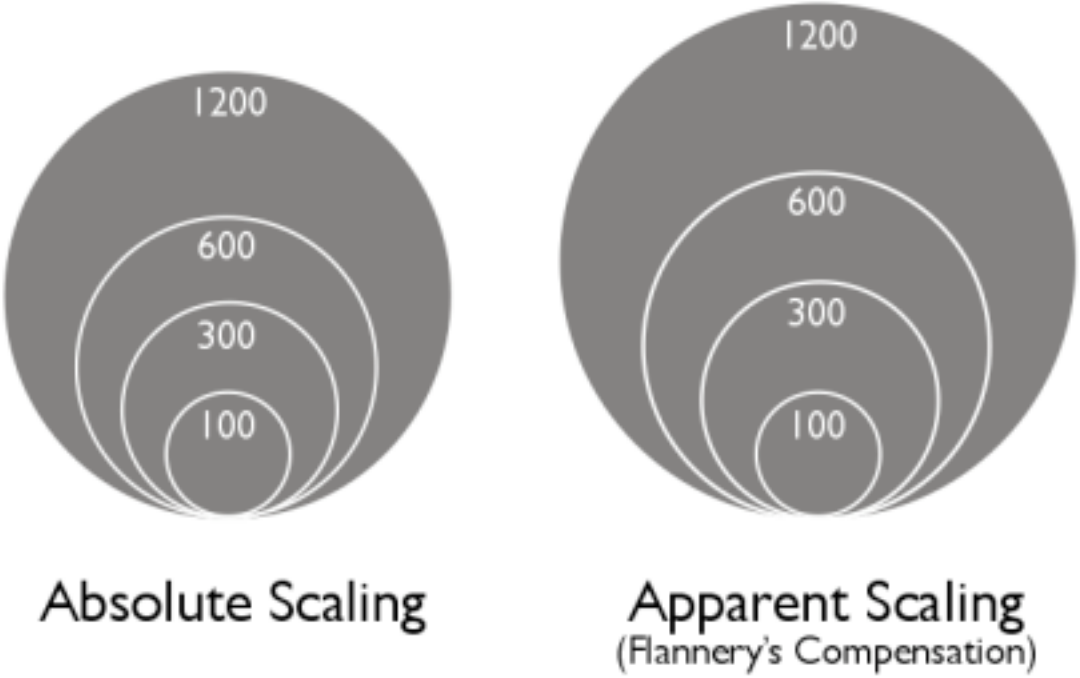


Diagram Source: http://makingmaps.net/2007/08/28/perceptual-scaling-of-map-symbols/

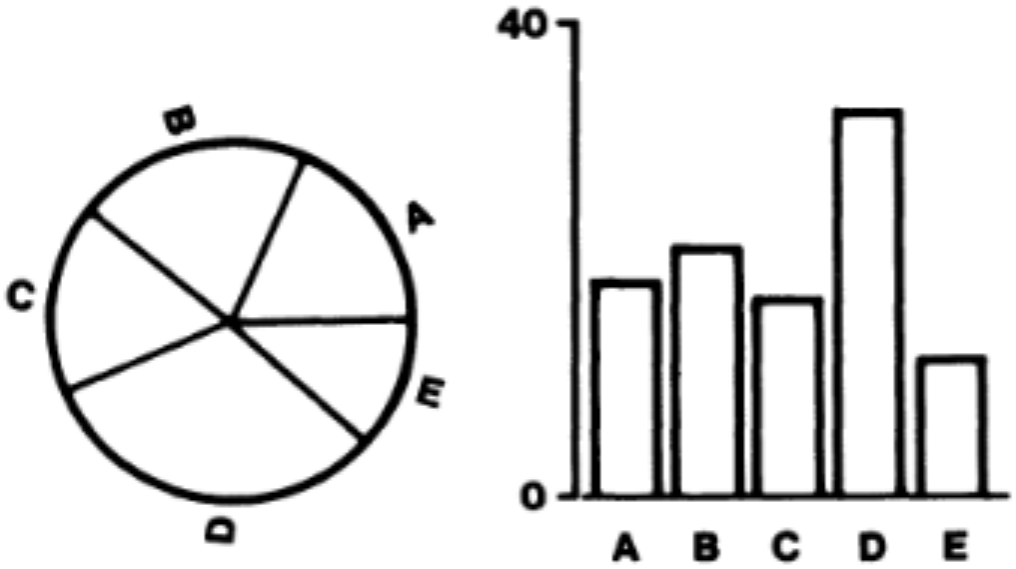


Figure 3. Graphs from position–angle experiment.

[Cleveland & McGill, 1987]

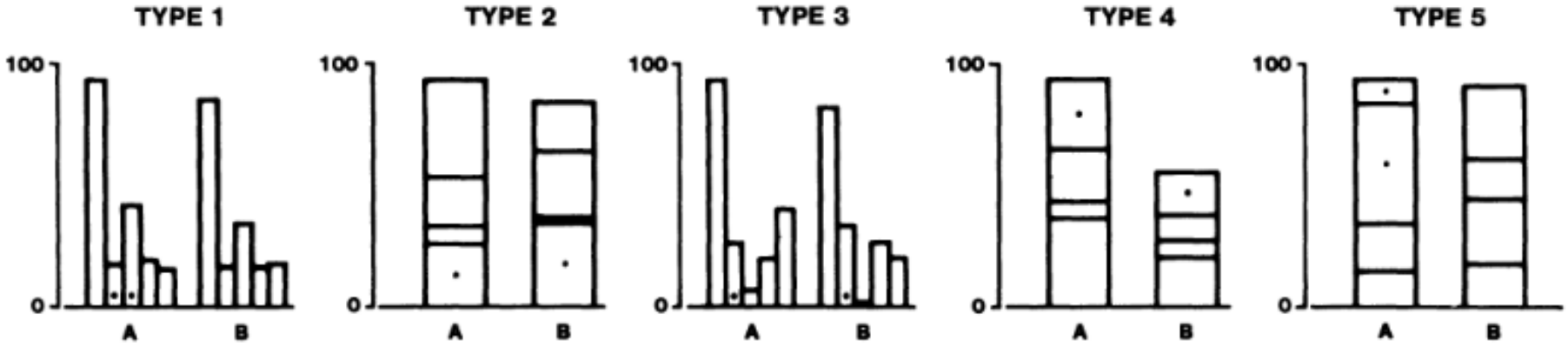


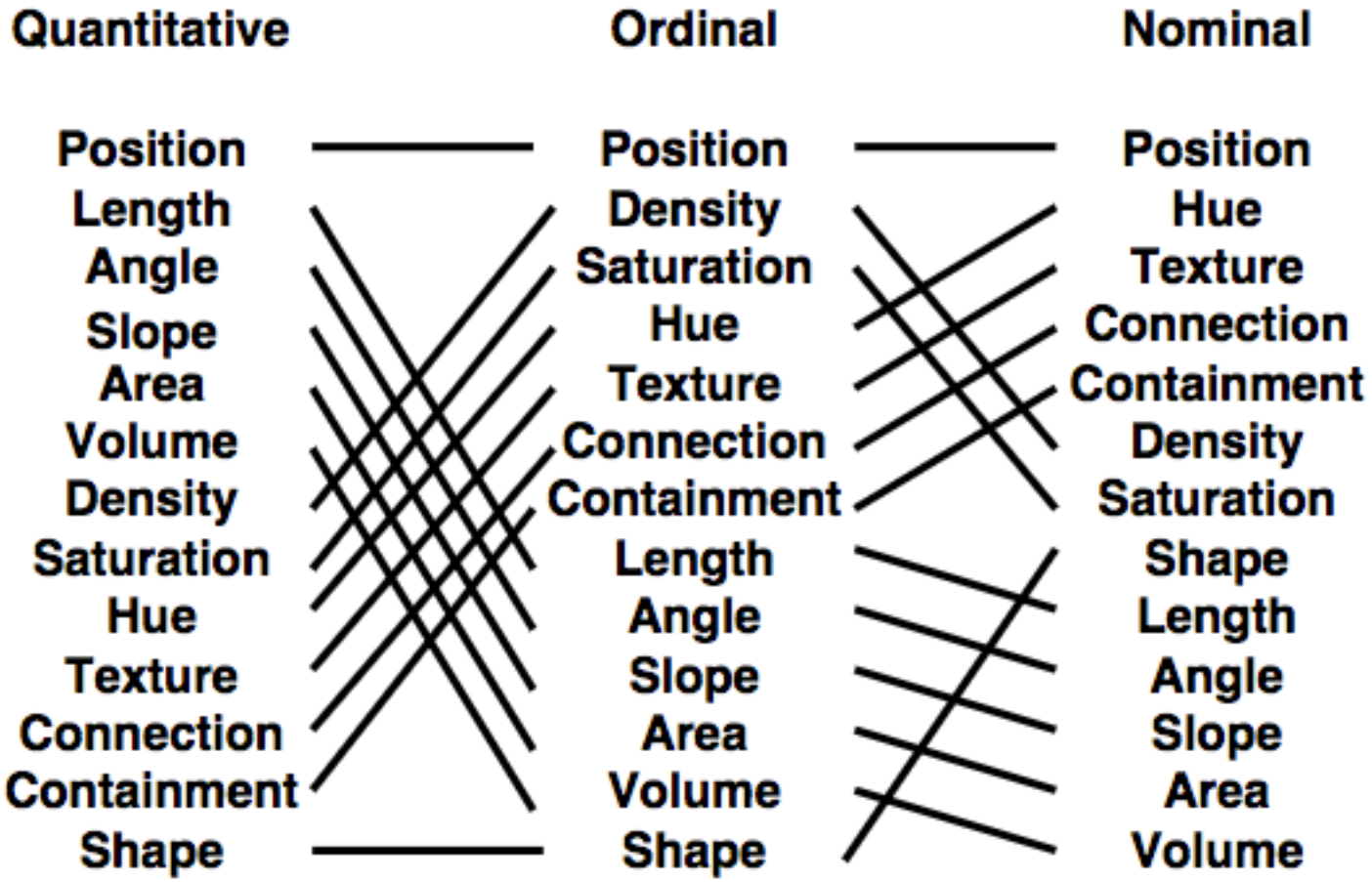
Figure 4. Graphs from position–length experiment.

[Cleveland & McGill, 1987]

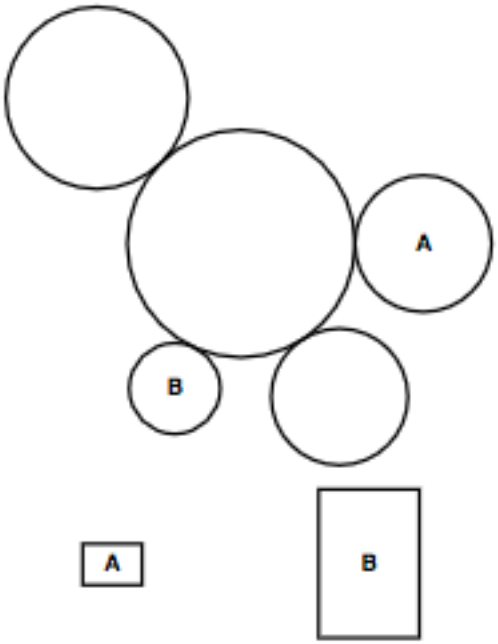
A Hierarchy of Accuracy

Decreasing quantitative accuracy

- Position
- Length
- Angle, slope
- Area
- Volume
- Color, density



[Mackinlay, 1987]



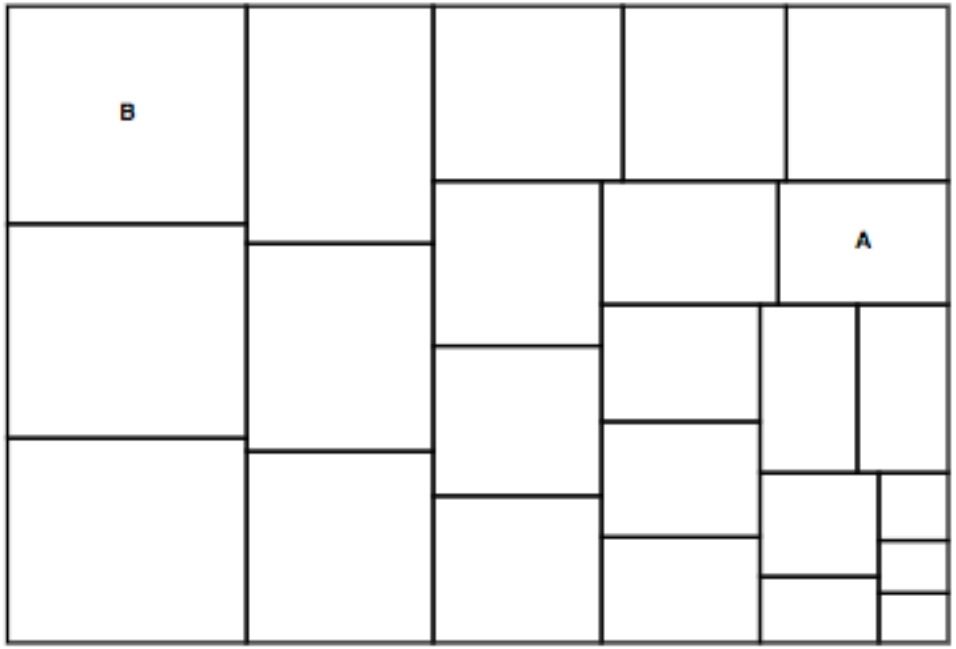
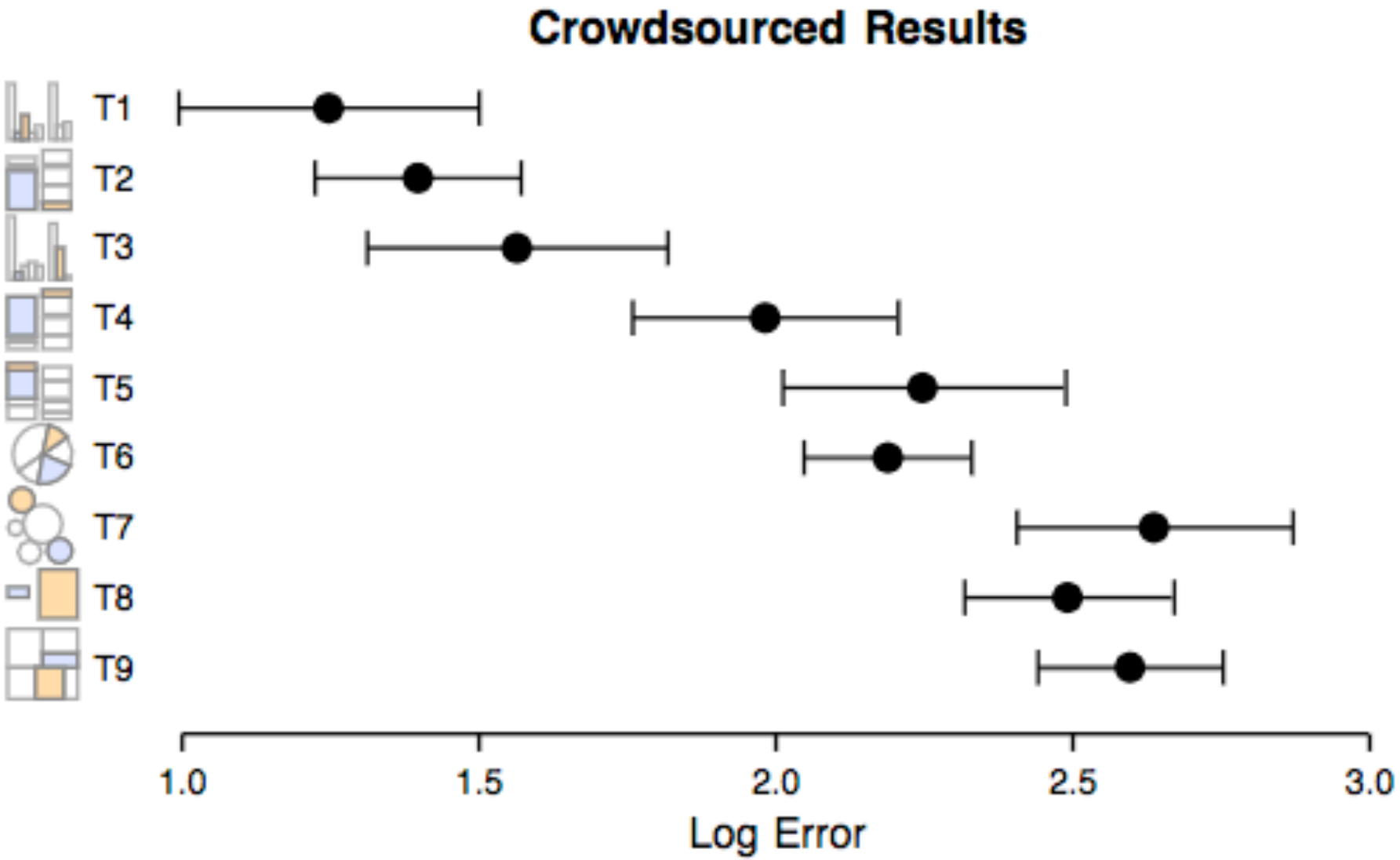


Diagram Source: Heer & Bostock, 2010



[Heer & Bostock, 2010]

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