

Visualization as analyses

Readings for today

- Cairo, A. (2012). *The Functional Art: An introduction to information graphics and visualization*. New Riders. Chapters 1 & 3.
- Yanai, I., & Lercher, M. (2020). A hypothesis is a liability. *Genome Biology*, 21, 1

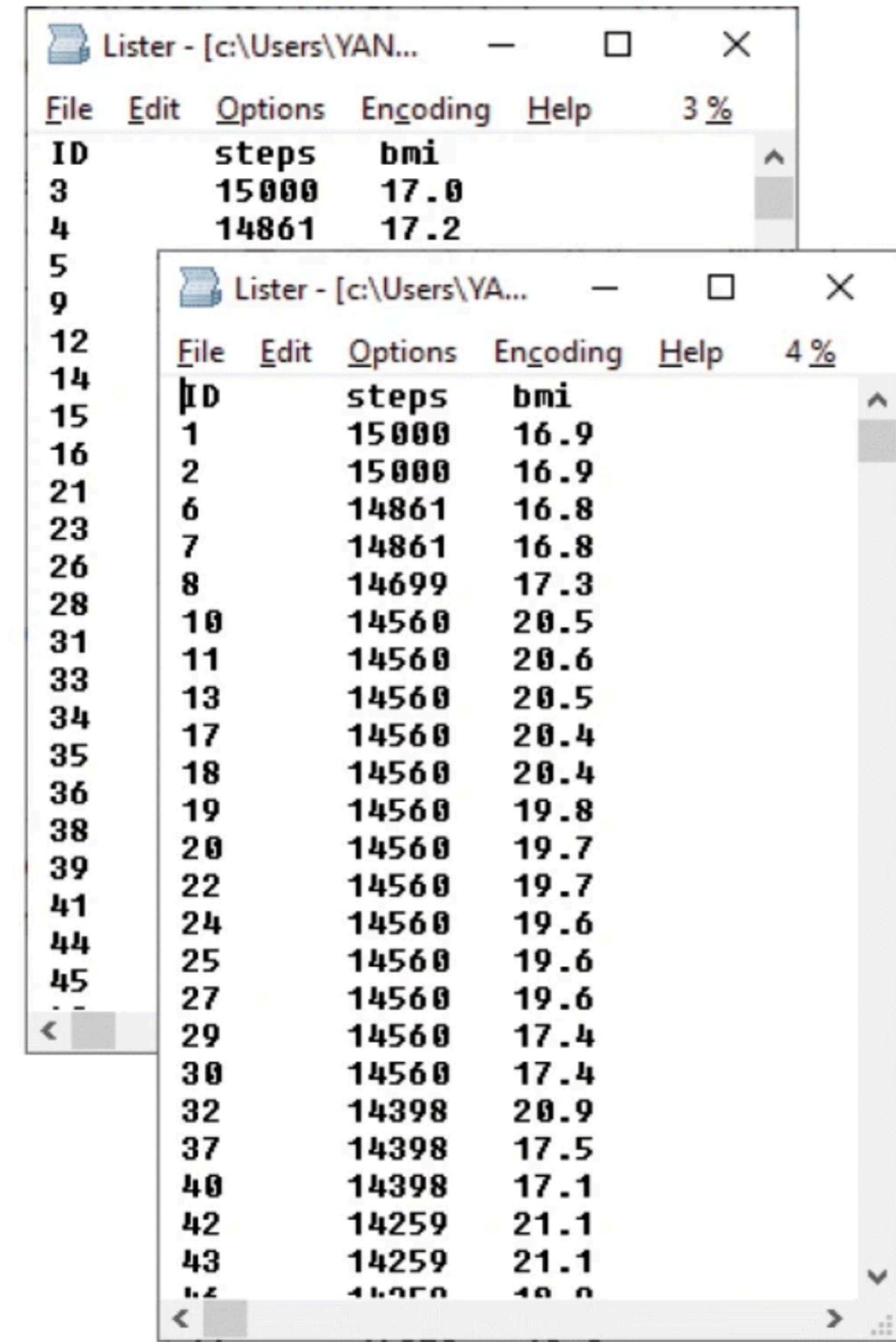
Topics

1. Goals of visualization
2. Balancing a paradox

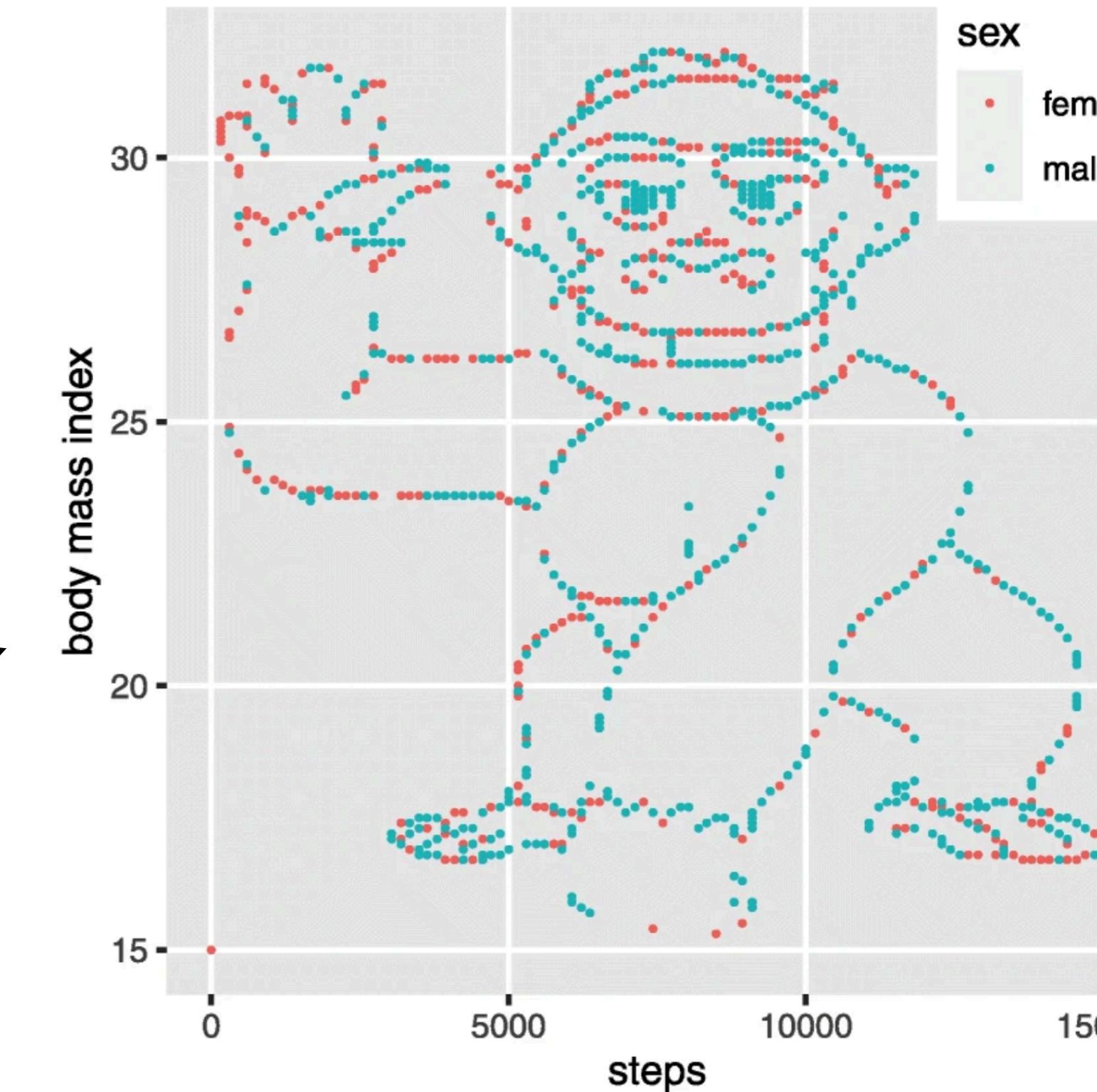
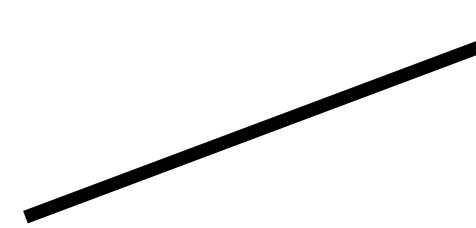
Goals of visualization

Data to perception

Data table:



ID	steps	bmi
3	15000	17.0
4	14861	17.2
5		
9		
12		
14		
15		
16		
21		
23		
26		
28		
31		
33		
34		
35		
36		
38		
39		
41		
44		
45		



	Gorilla <u>not</u> discovered	Gorilla discovered
Hypothesis-focused	14	5
Hypothesis-free	5	9

Visualization reveals structure in the data.

Graphical excellence

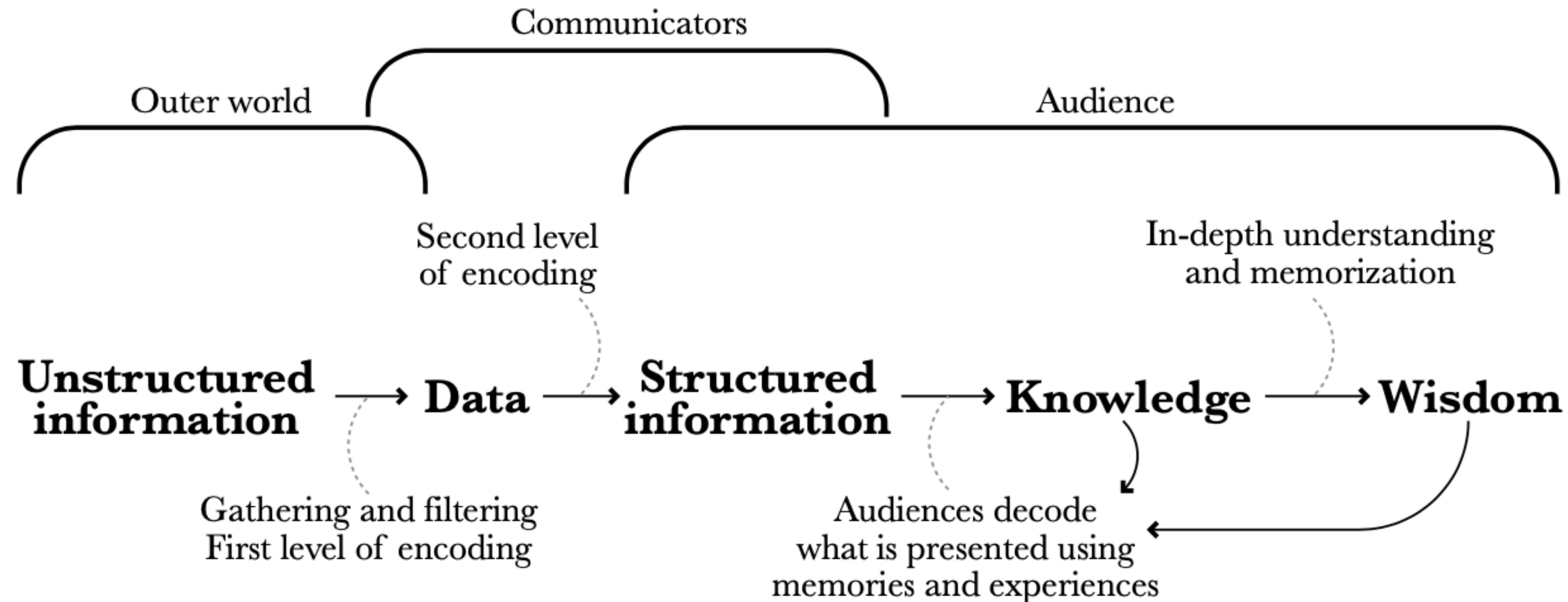
Goal: The efficient communication of complex quantitative ideas

9 Properties of Graphical Excellence:

1. Show the data
2. Substance > method
3. Avoids distortion
4. Many numbers in a small space.
5. Coherent large data sets
6. Encourage visual comparisons
7. Many levels of detail
8. Clear purpose
9. Integrated with statistics.

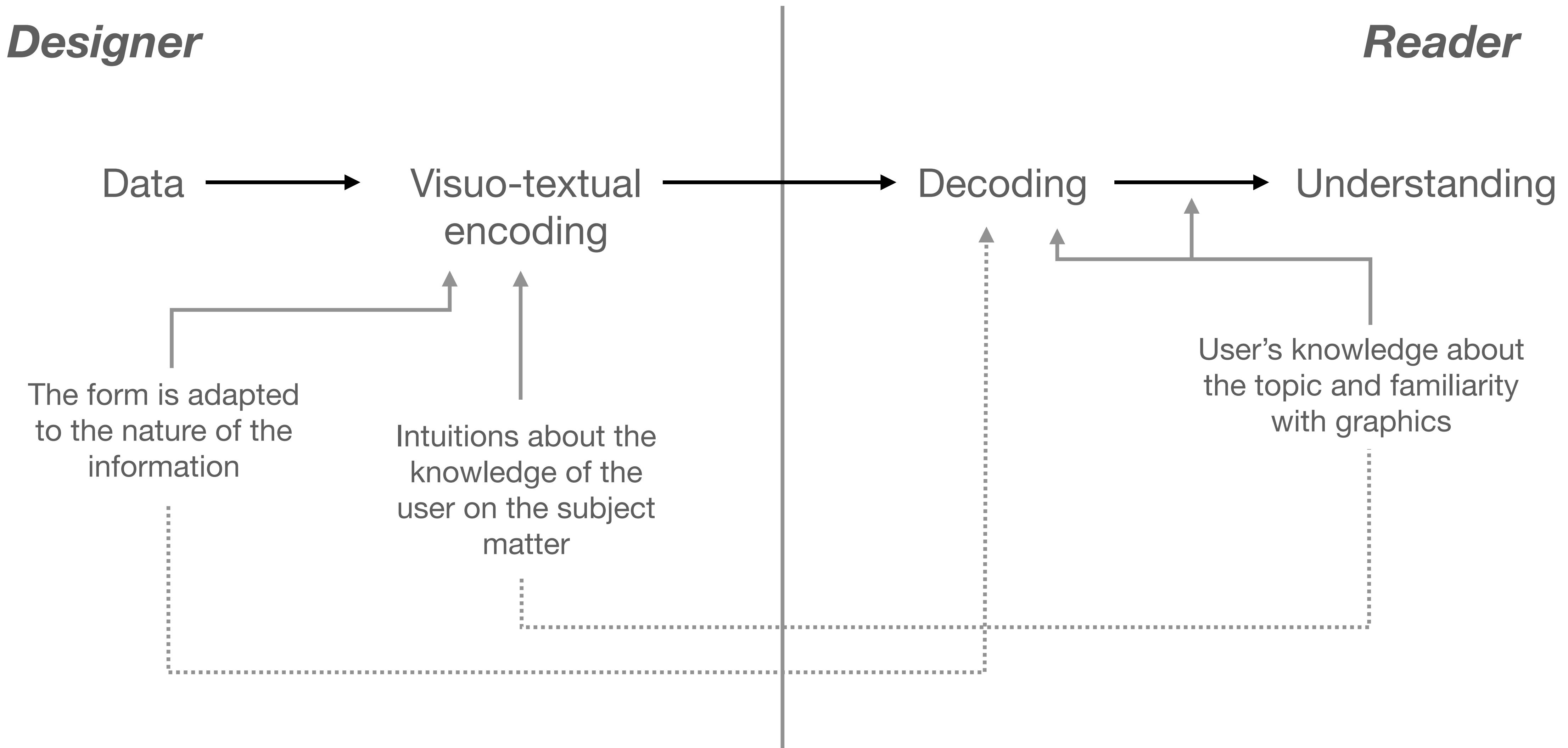
“Graphics should reveal data in a meaningful & intuitive way.” - Edward Tufte

From visualization to wisdom

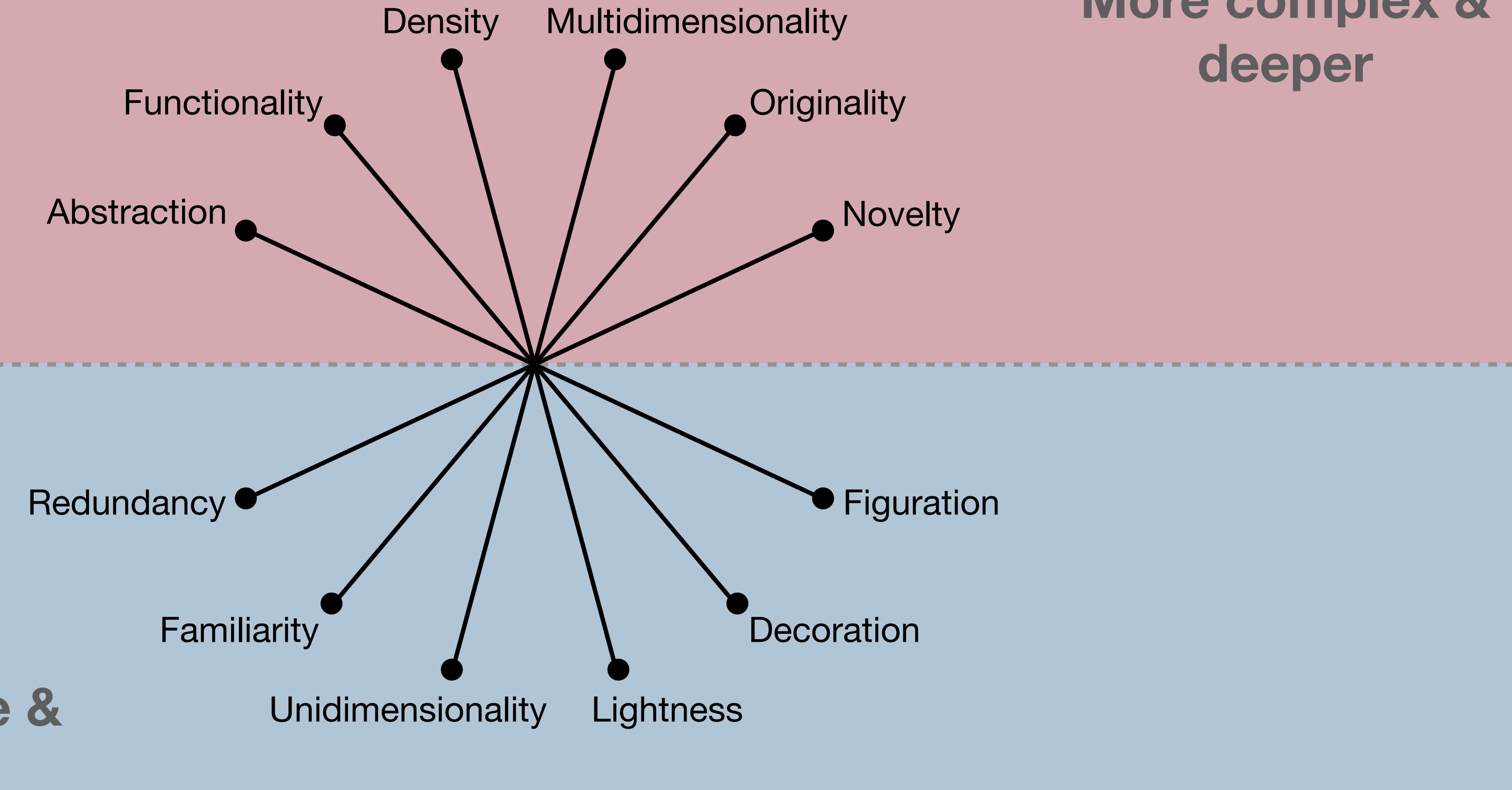


Balancing a paradox

Think carefully of the decoding process



A struggle between competing goals



**More intelligible &
shallow**

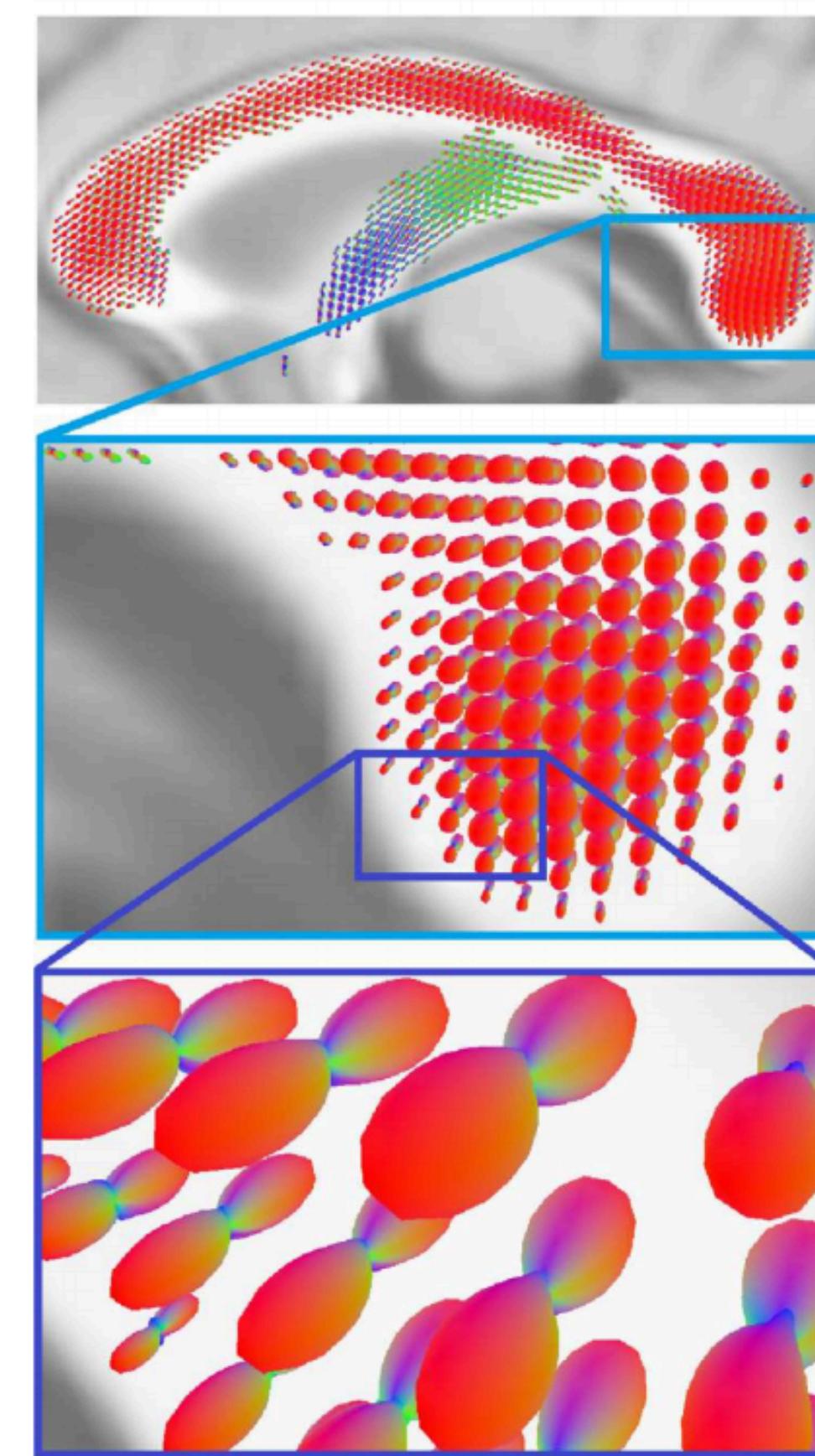
**More complex &
deeper**

Abstraction vs. Figuration

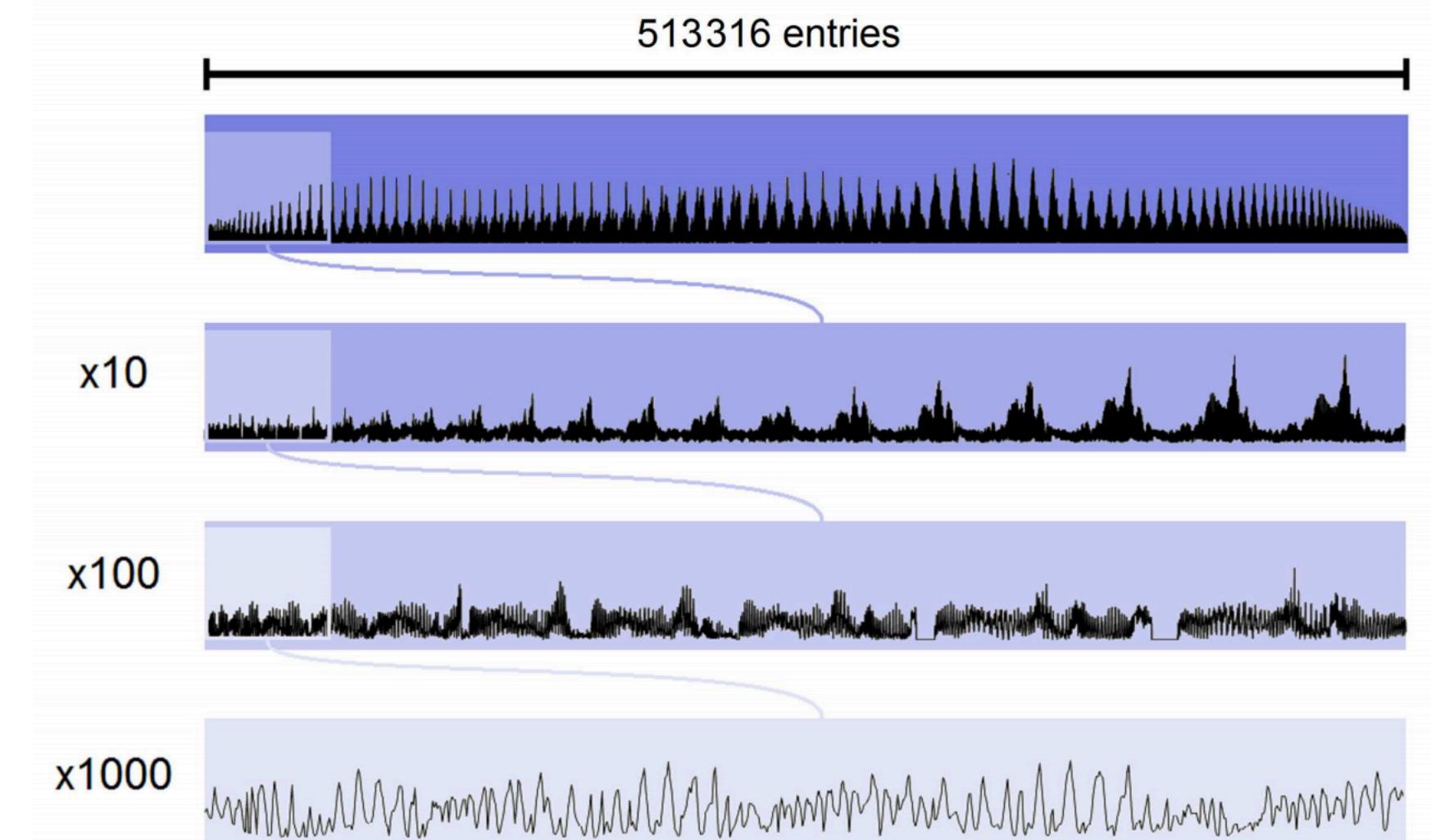
(Yeh et al. 2016)

The more distant the representation & its referent, the more abstract the visualization

Figurative



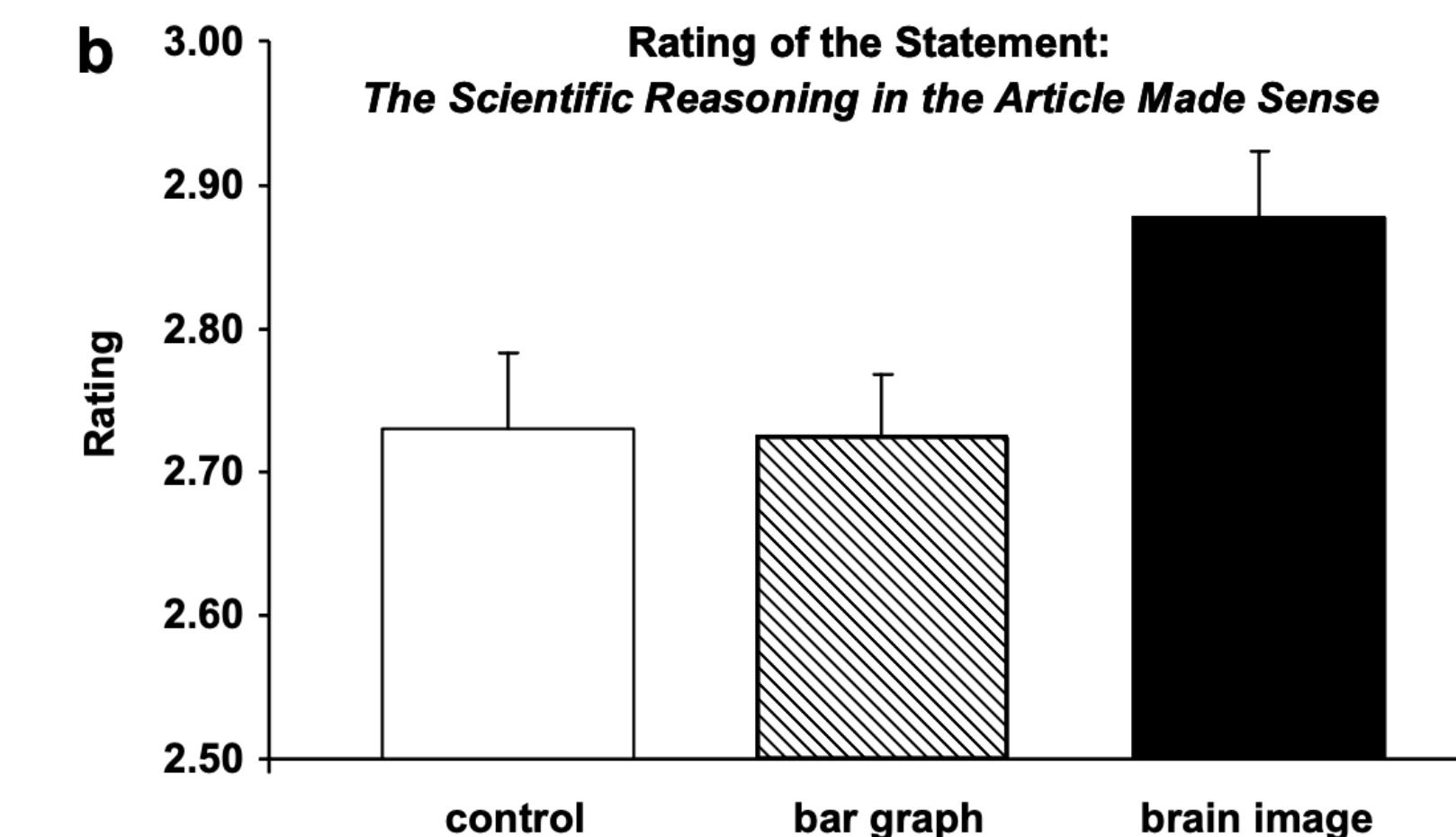
Abstract



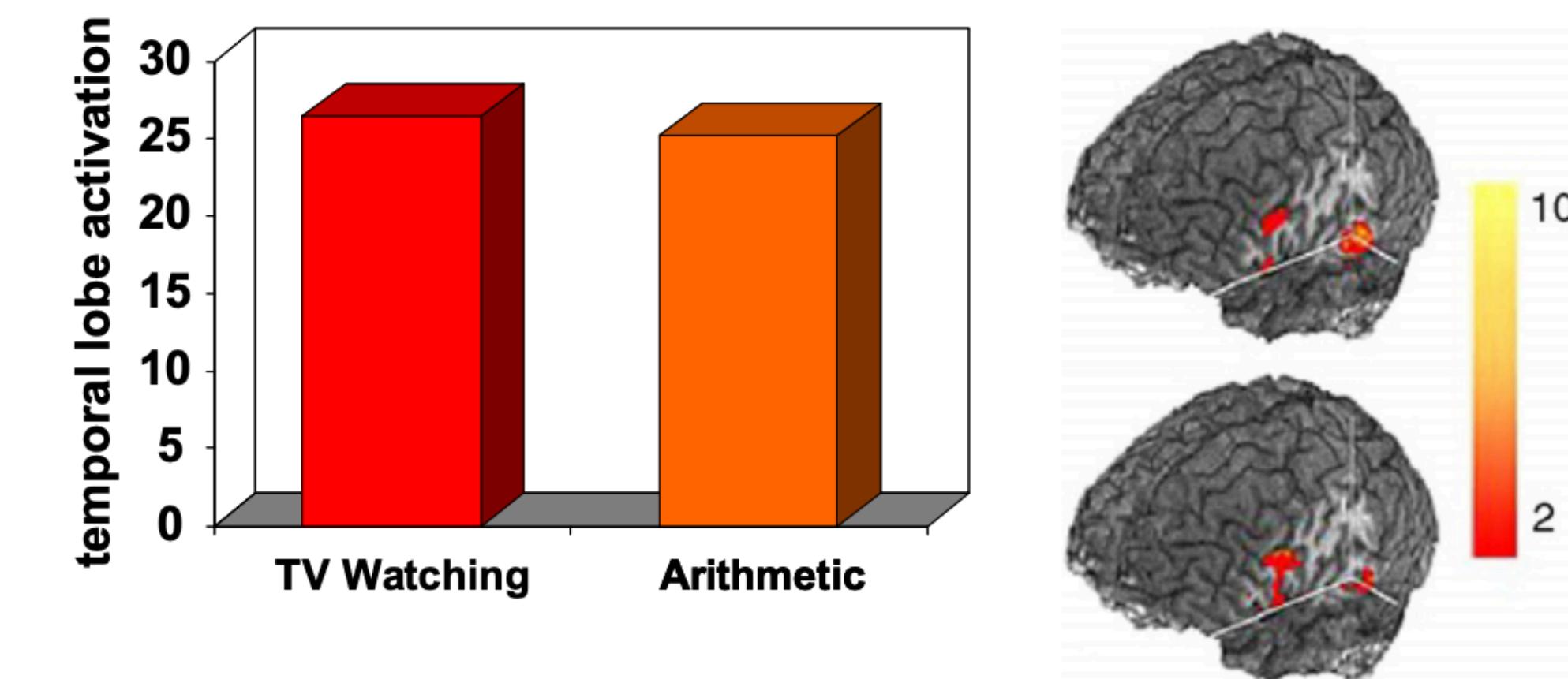
Functionality vs. Decoration

The inclusion of visual elements to grab attention, but are not directly relevant to enhancing comprehension, are decorative.

Functional



Decorative

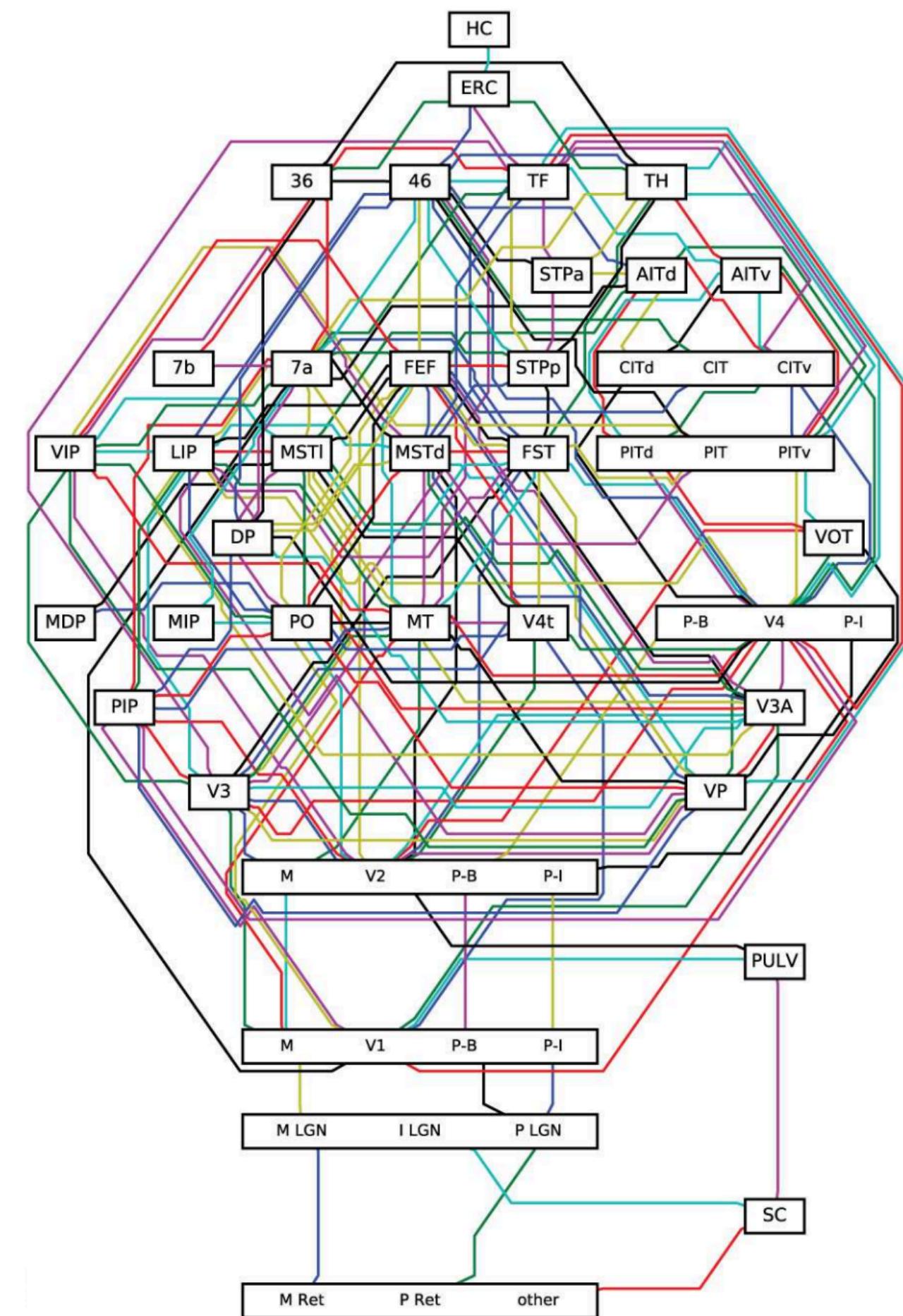


Density vs. Lightness

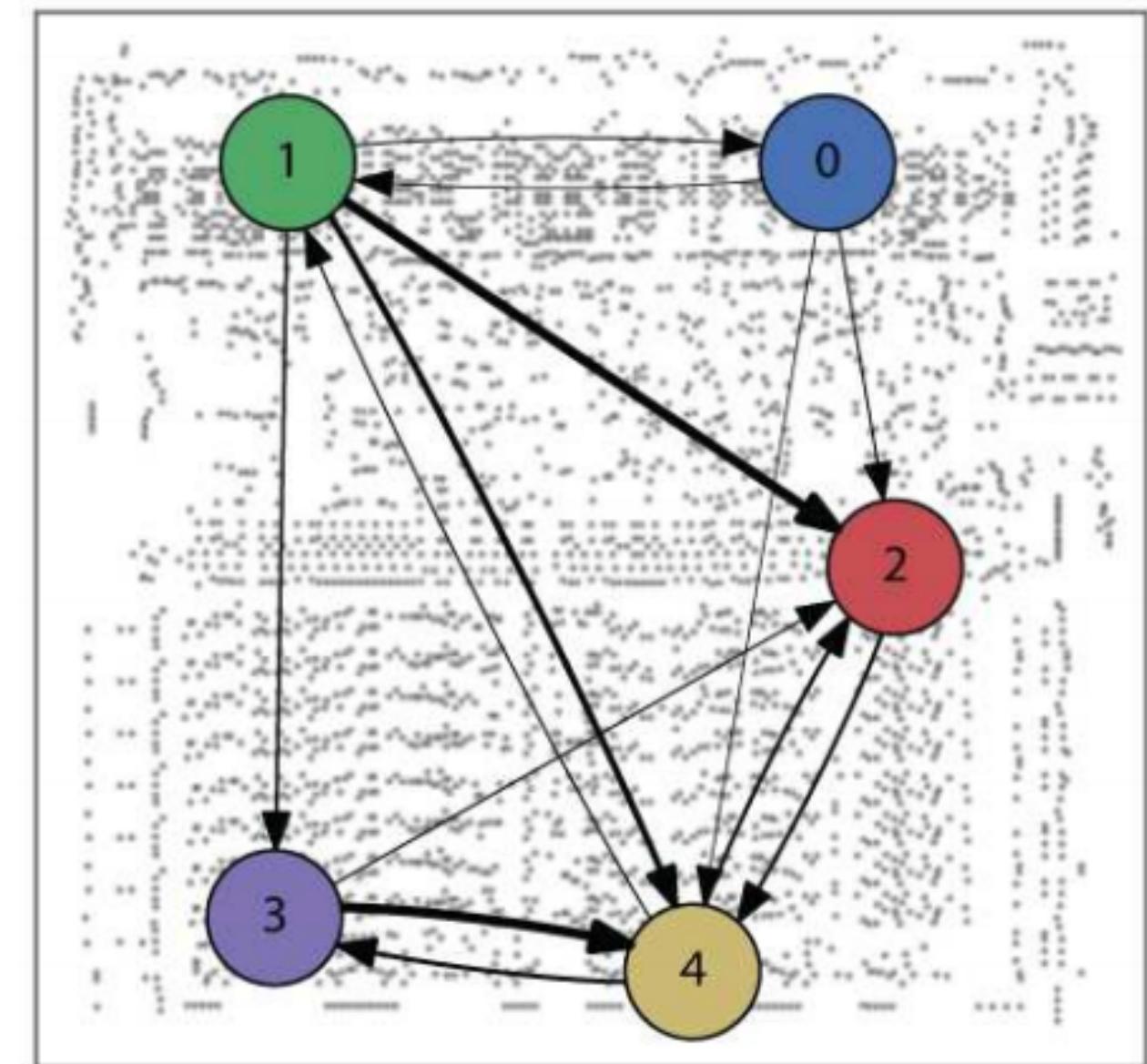
(Jonas & Körding 2017)

The greater the density of visual information, the more complex the demands to decode the information.

Dense



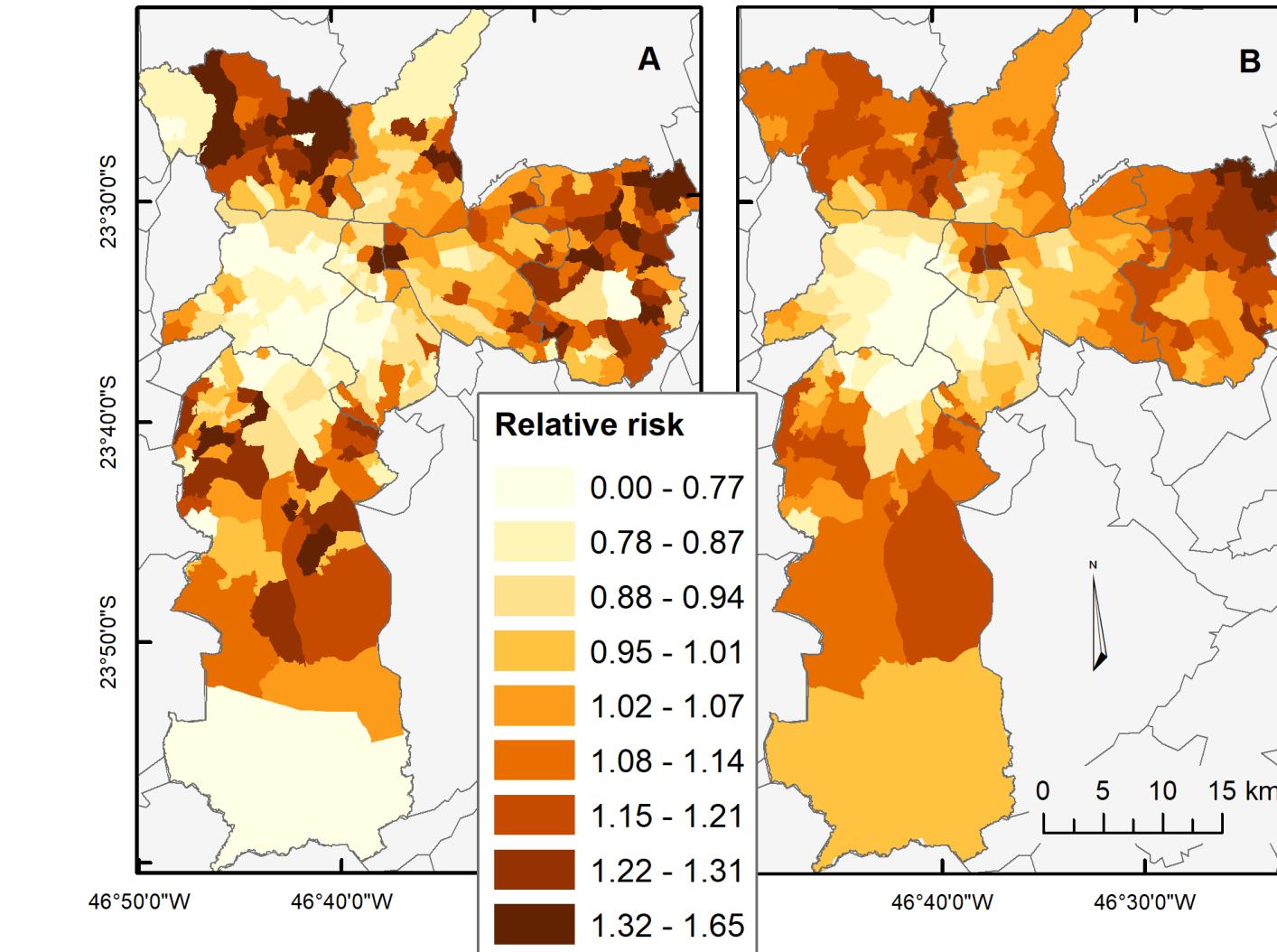
Light



Multidimensional vs. Unidimensional

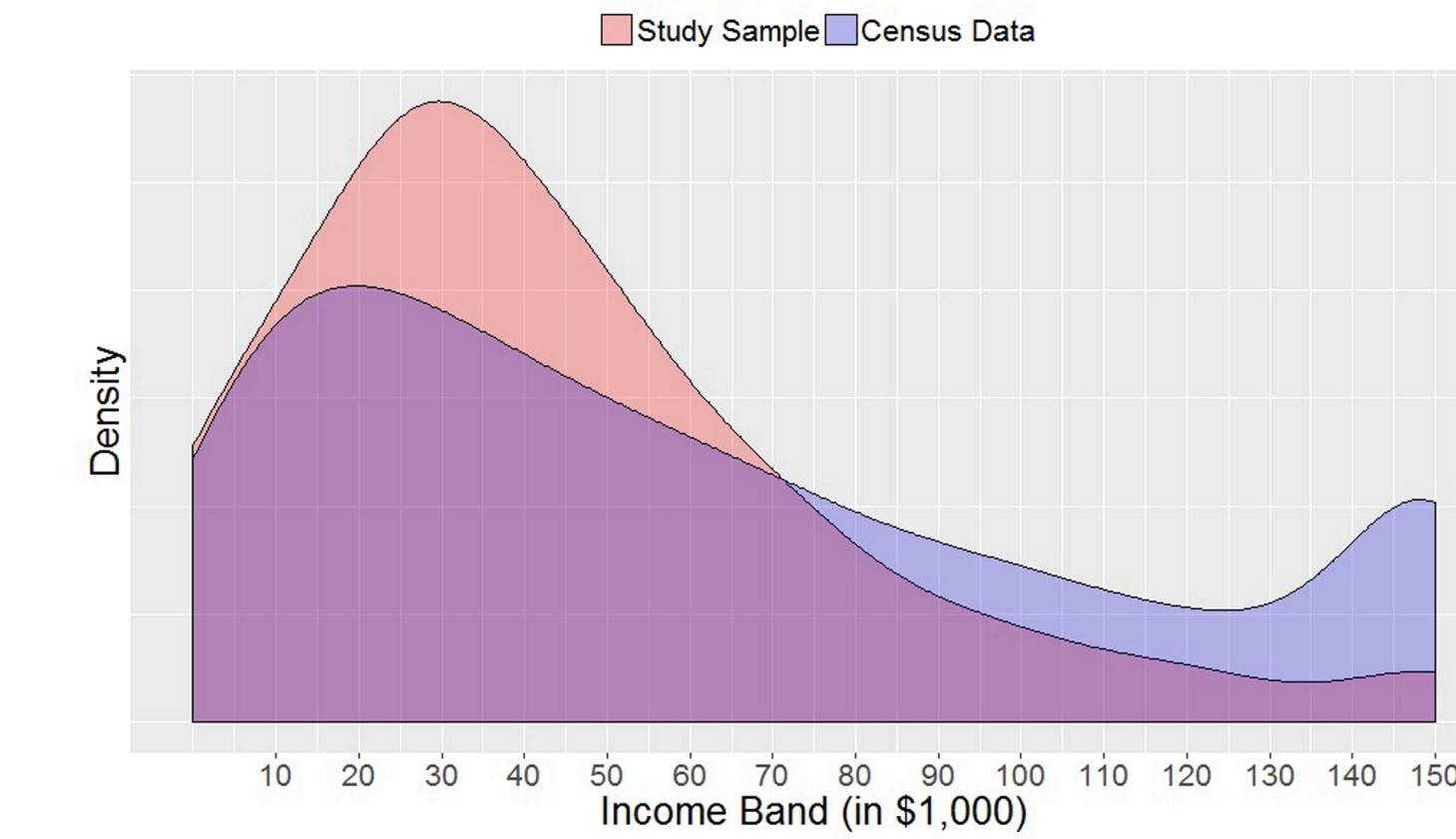
The more layers of depth,
the greater the range of
ways to decode
information, but with
increased decoding effort.

Multidimensional



(Vizeu Barrozo et al. 2020)

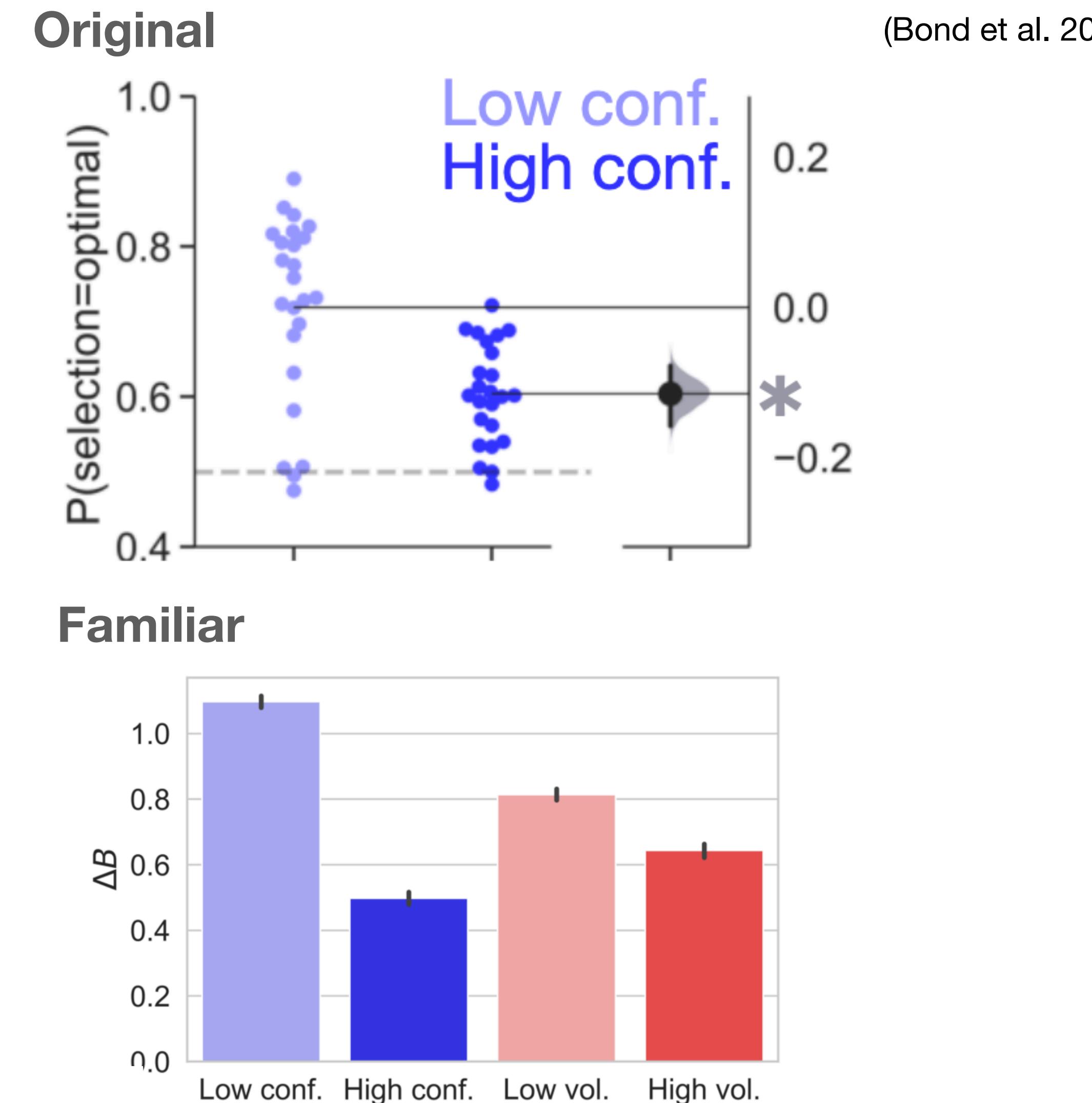
Unidimensional



(Matz 2019)

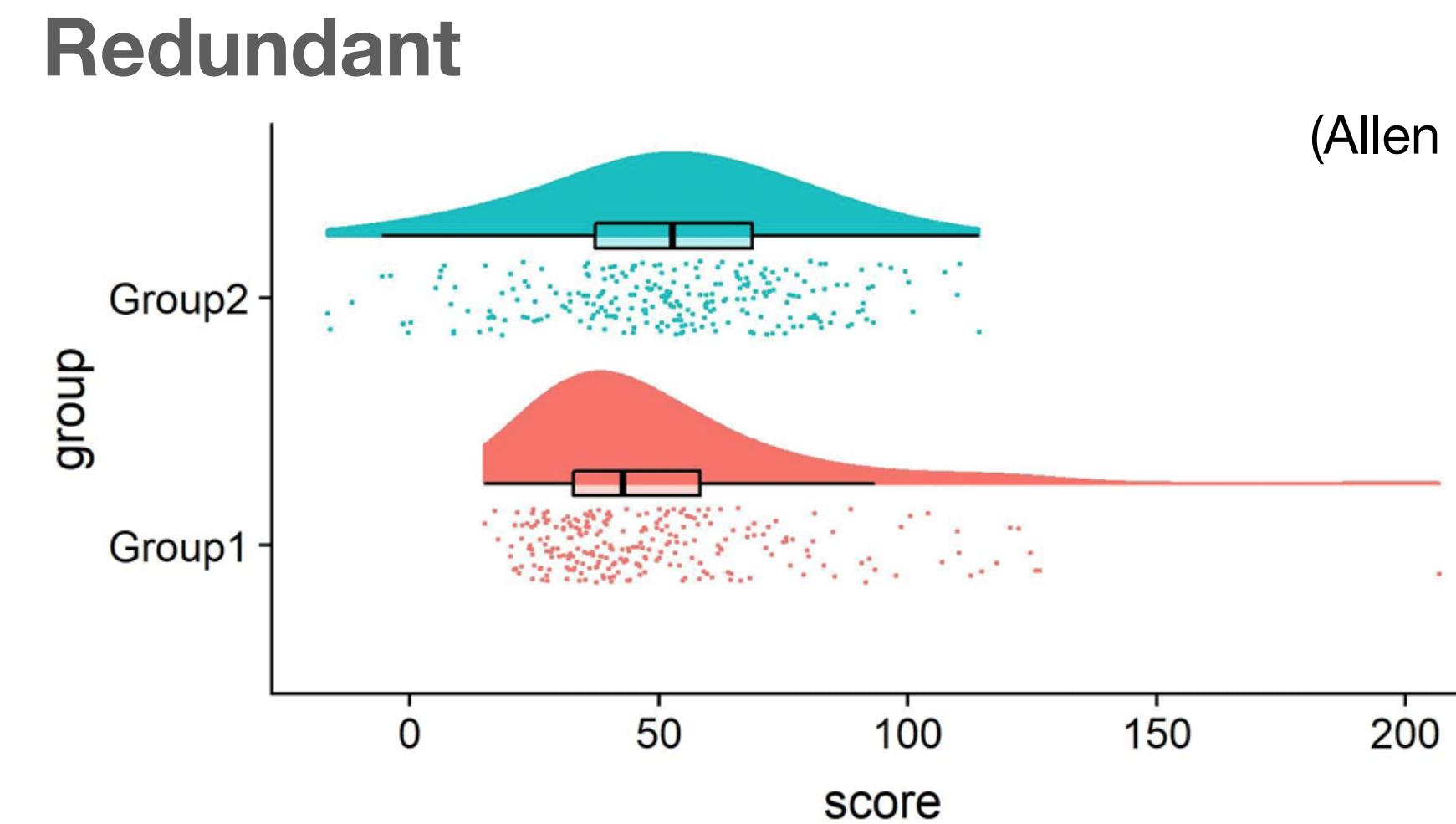
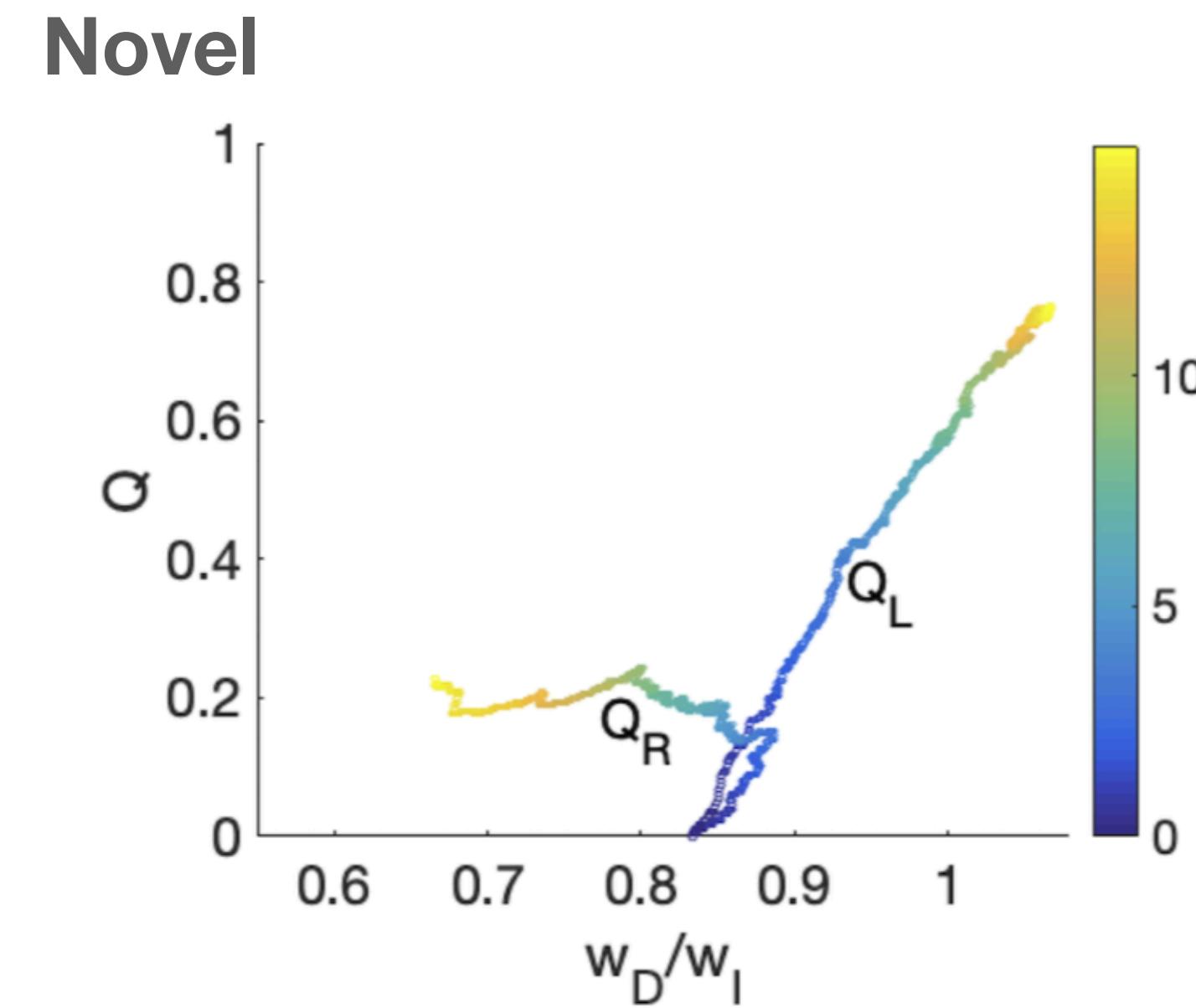
Originality vs. Familiarity

More familiar plotting styles decrease the effort to encode information, but constrain ways of presenting relationships.

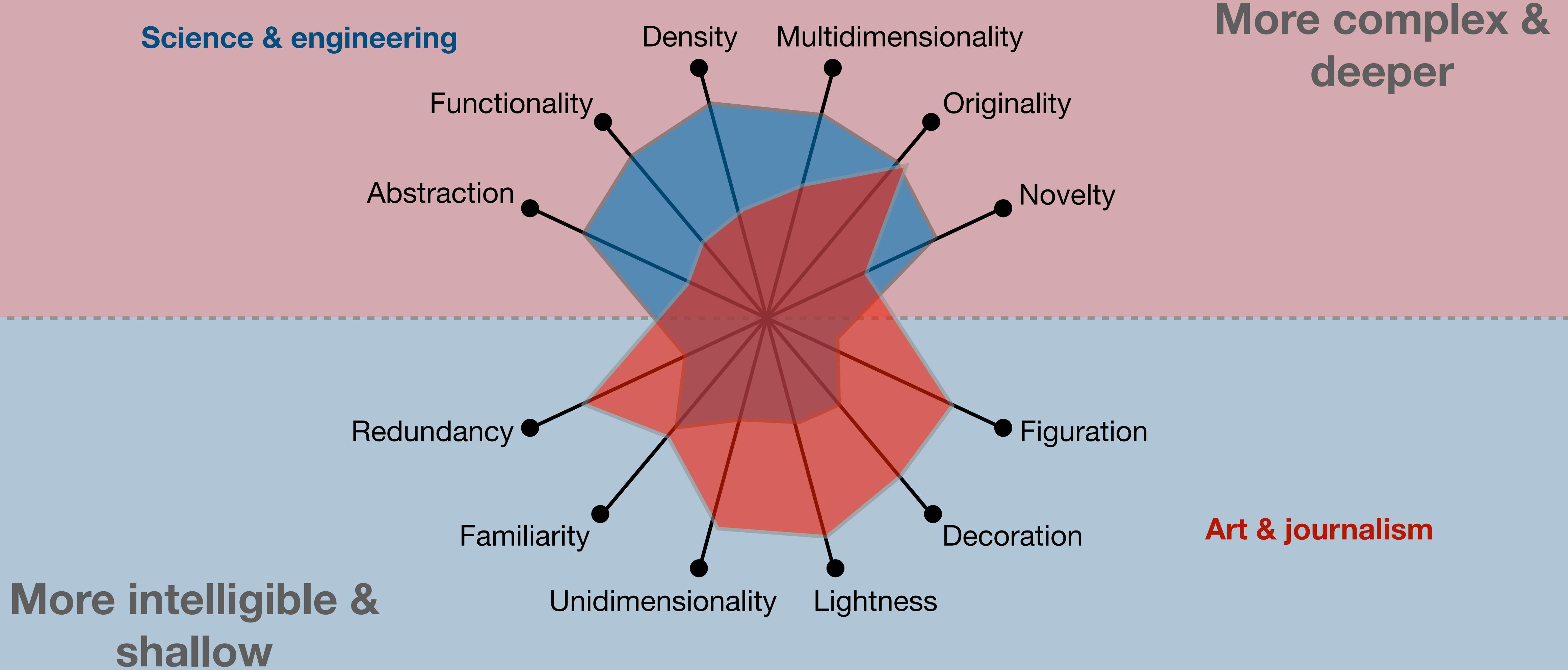


Novelty vs. Redundancy

Explaining many different things once (novelty) provides breadth, while explaining the same thing in different ways (redundancy) provides depth.



A struggle between competing goals



Evaluating comprehension

What the reader should *immediately* understand

1. What is the figure's central topic?
2. What phenomena & variables does the graphic show?
3. What changes does the graphic highlight in the data it represents?
4. Does the graphic present information in an objective manner, or does the author editorialize about the content?

Take home message

- Visualization is your first and most effective tool for understanding and communicating relations in your data.
- Effective visual communication of relations in your data requires balancing multiple competing constraints.