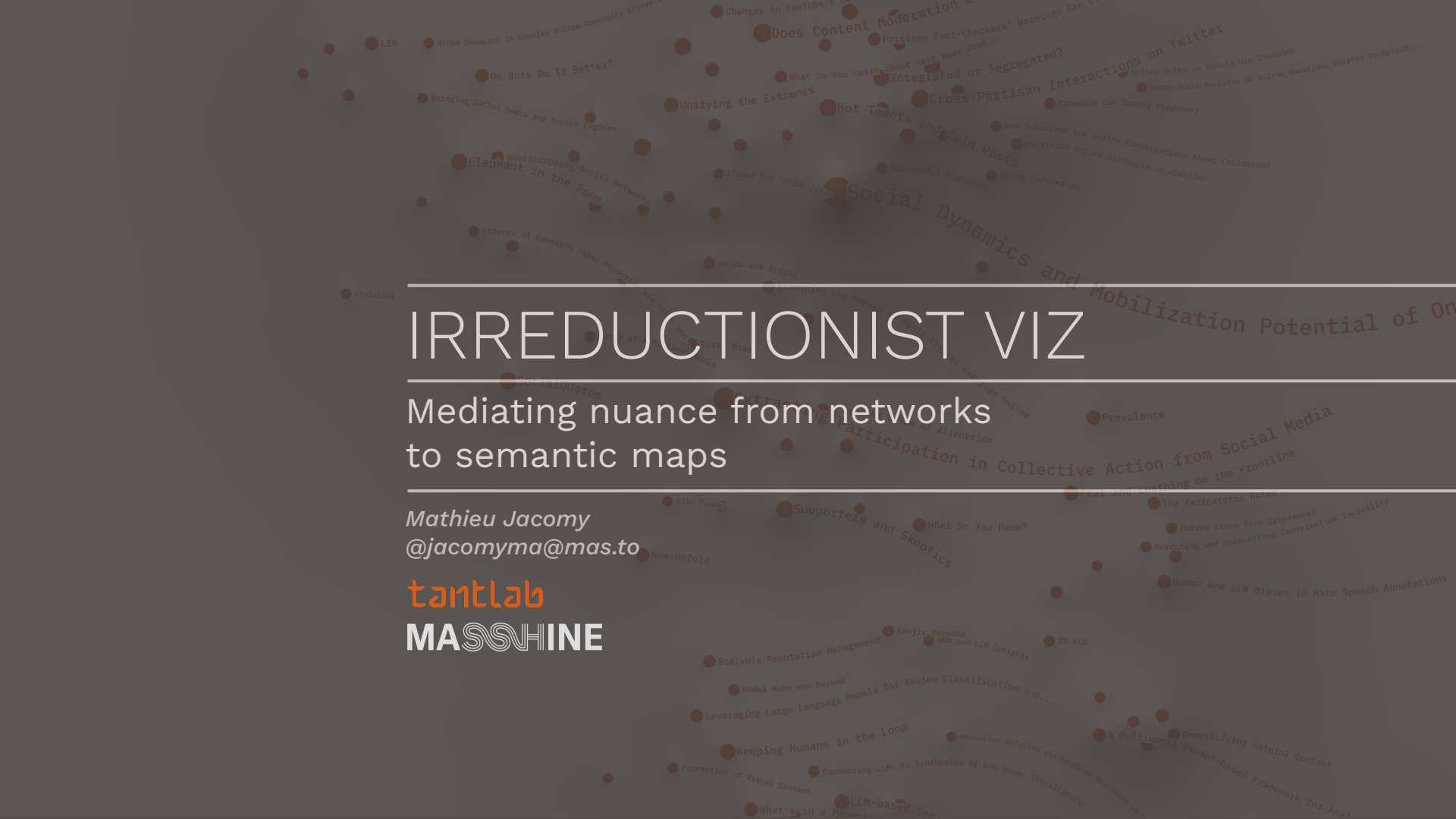


IRREDUCTIONIST VIZ

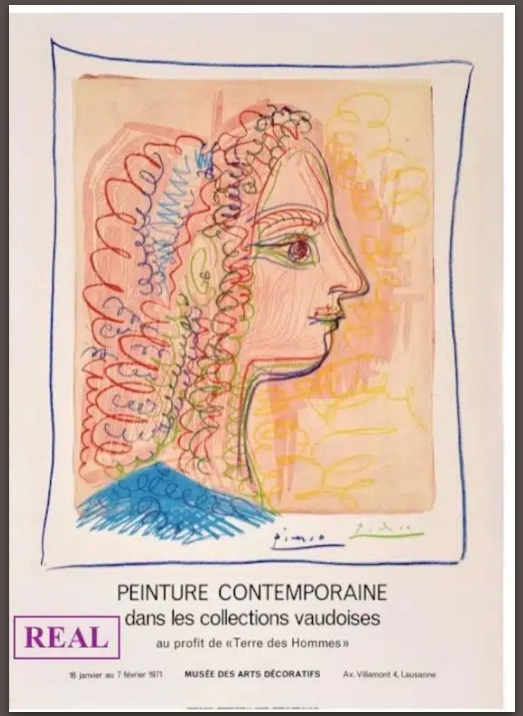
Mediating nuance from networks to semantic maps

Mathieu Jacomy
@jacomyma@mas.to

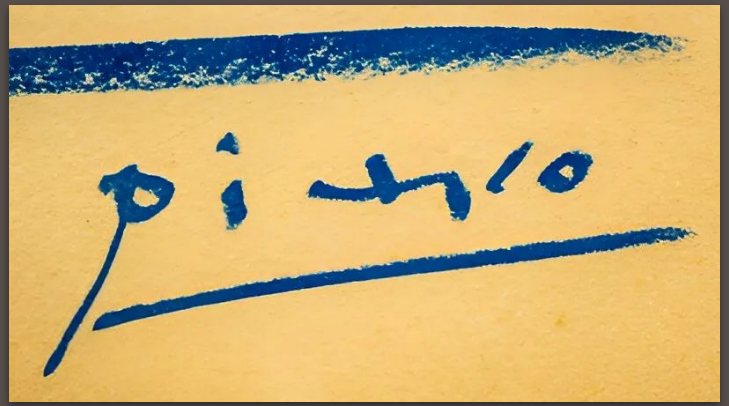
tantlab
MASSHINE

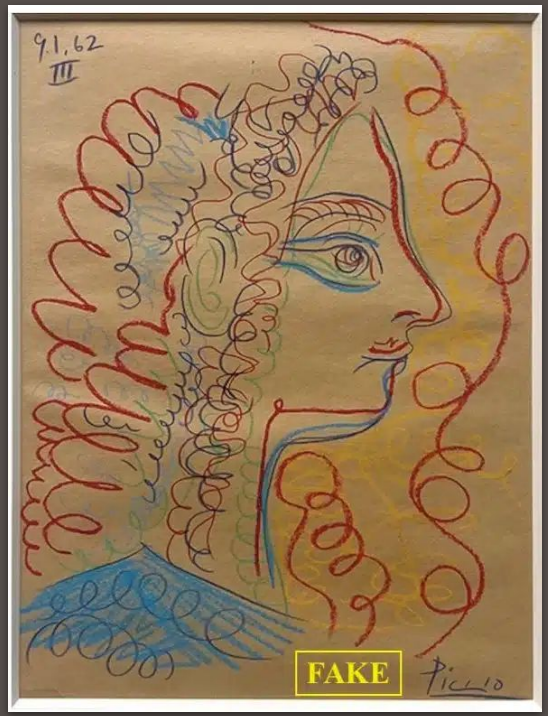
What is ambiguity?

What is ambiguity?



Is this Picasso signature real or fake?





What is ambiguity?

Is the “liger” a lion or a tiger?

Lion

Tiger

What is ambiguity?

Is the okapi a zebra or a donkey?

Zebra

Donkey

What is ambiguity?

River bank

What does “bank” refer to?

Financial institution

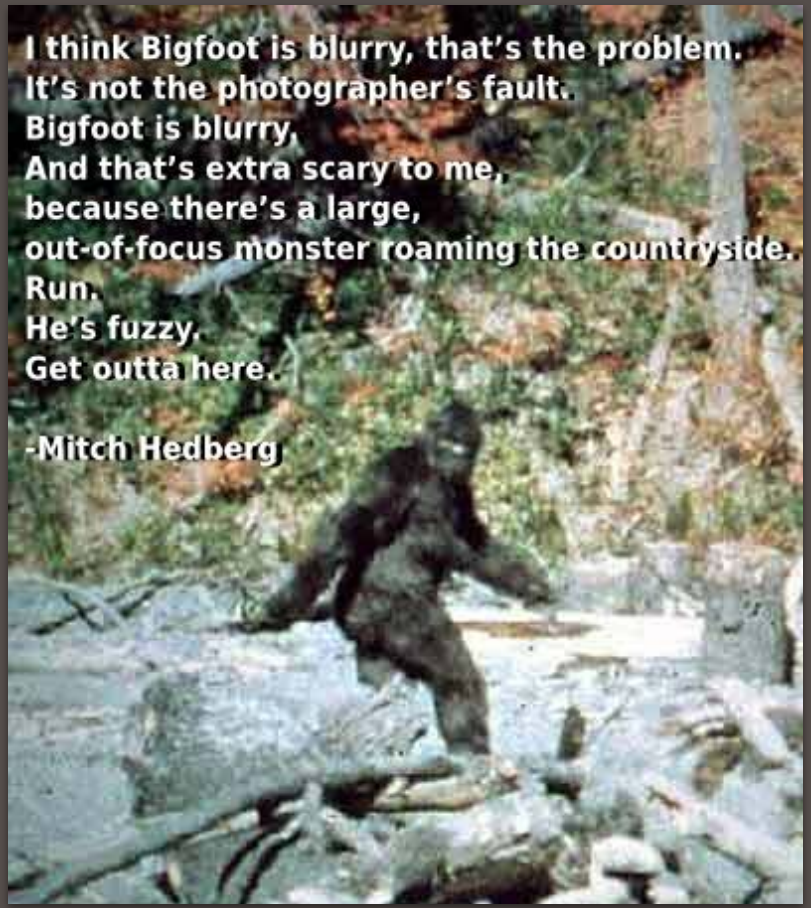
What is ambiguity?

Let's make the distinction between:

- Ambiguity
- Uncertainty
- Polyvalence
- Contradiction
- etc.

The point is to avoid conflating two very different things:

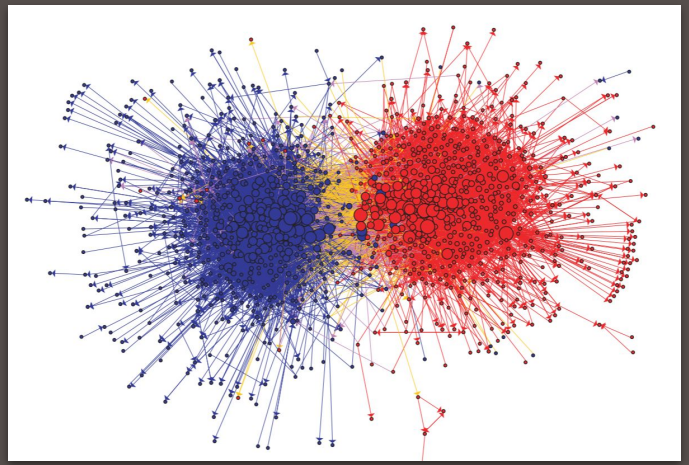
- A **blurry picture** of a sharp thing *(i.e., the measurement process has an accuracy problem)*
- An accurate picture of a **fuzzy thing** *(i.e., no measurement issue)*



What is ambiguity: the *wink*

What is ambiguity: with networks

Clusters are non-ambiguous
(there are two; they are big and clear)



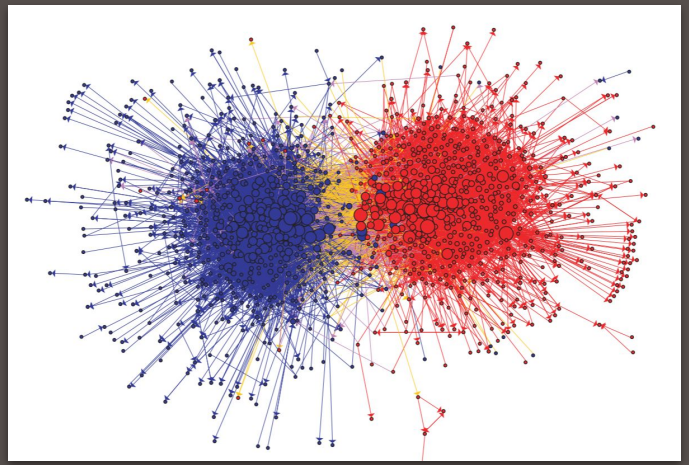
Adamic, L. A., & Glance, N. (2005). The political blogosphere and the 2004 US election: Divided they blog. Proceedings of the 3rd International Workshop on Link Discovery, 36–43. http://www.cyberjournalist.net/news/001461.php

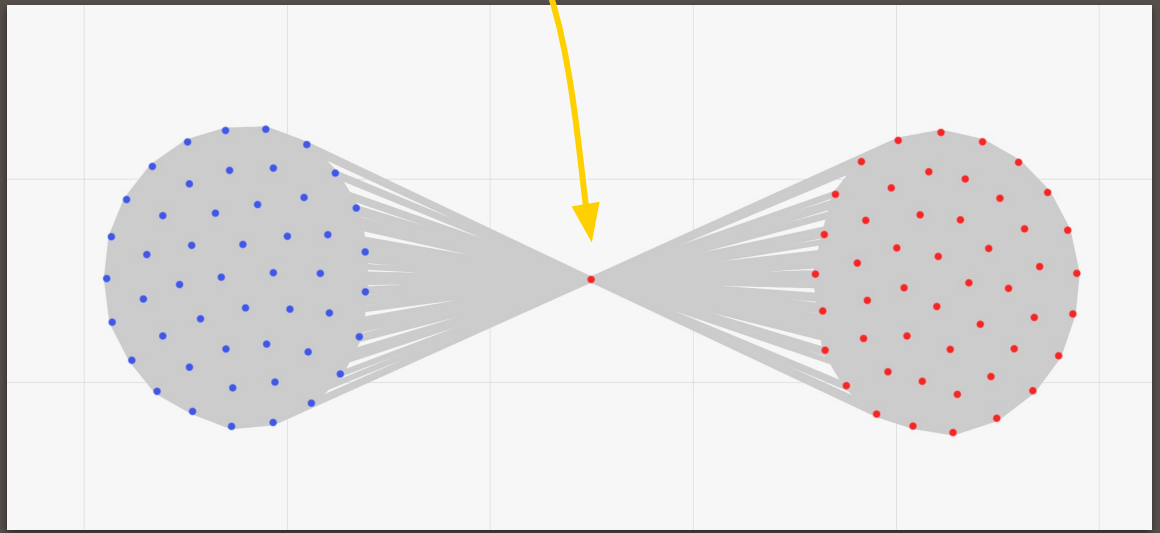
No obvious divide in two clusters
(although there are some tiny clusters)

Venturini, T., Jacomy, M., & Jensen, P. (2021). What do we see when we look at networks: Visual network analysis, relational ambiguity, and force-directed layouts. Big Data & Society, 8(1), 20539517211018488. https://doi.org/10.1177/20539517211018488

What is ambiguity: with networks

Which cluster does this node belong to?

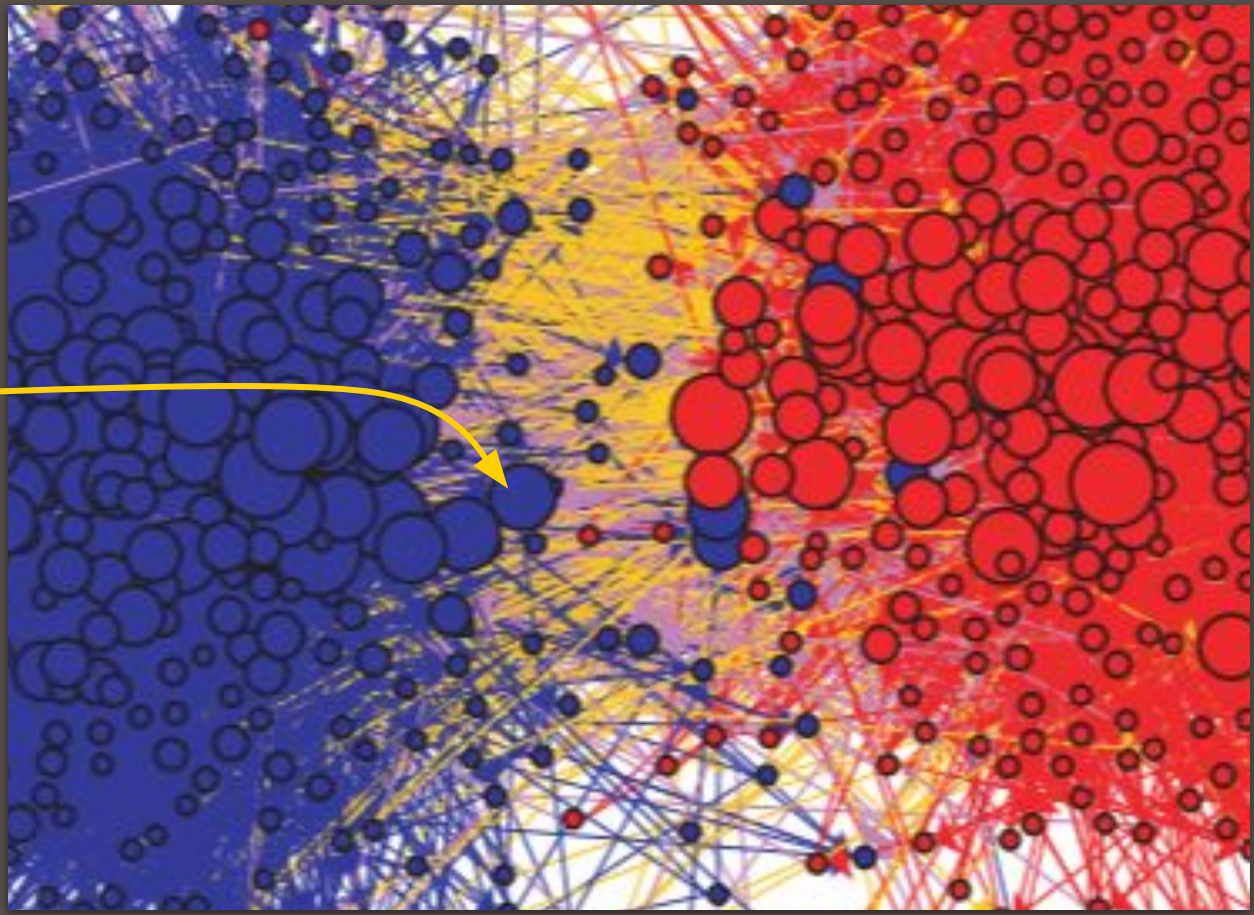




Adamic, L. A., & Glance, N. (2005). The political blogosphere and the 2004 US election: Divided they blog. Proceedings of the 3rd International Workshop on Link Discovery, 36–43. http://www.cyberjournalist.net/news/001461.php

What is ambiguity: with networks

Why is this node
at that place?
(or any node, in fact)

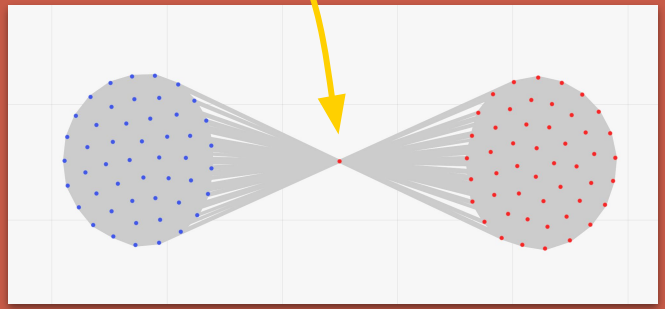


Community detection ambiguity

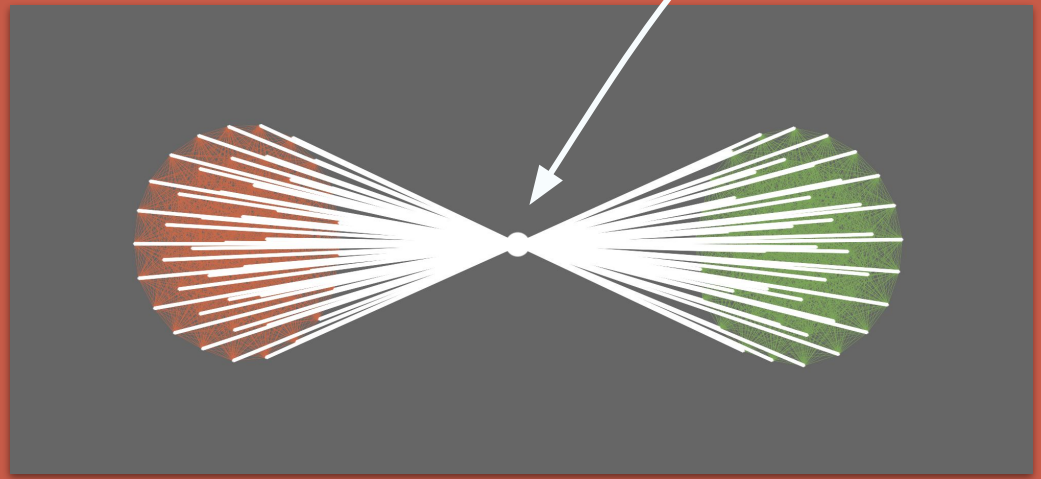
Jacomy, M., Elli, T., Benedetti, A., Plique, G. Ooghe-Tabanou, B., Girard, P., and Jacomy, A. (2025; forthcoming) Cluster ambiguity in networks as substantive knowledge. CHR2025

Community detection ambiguity in Gephi Lite

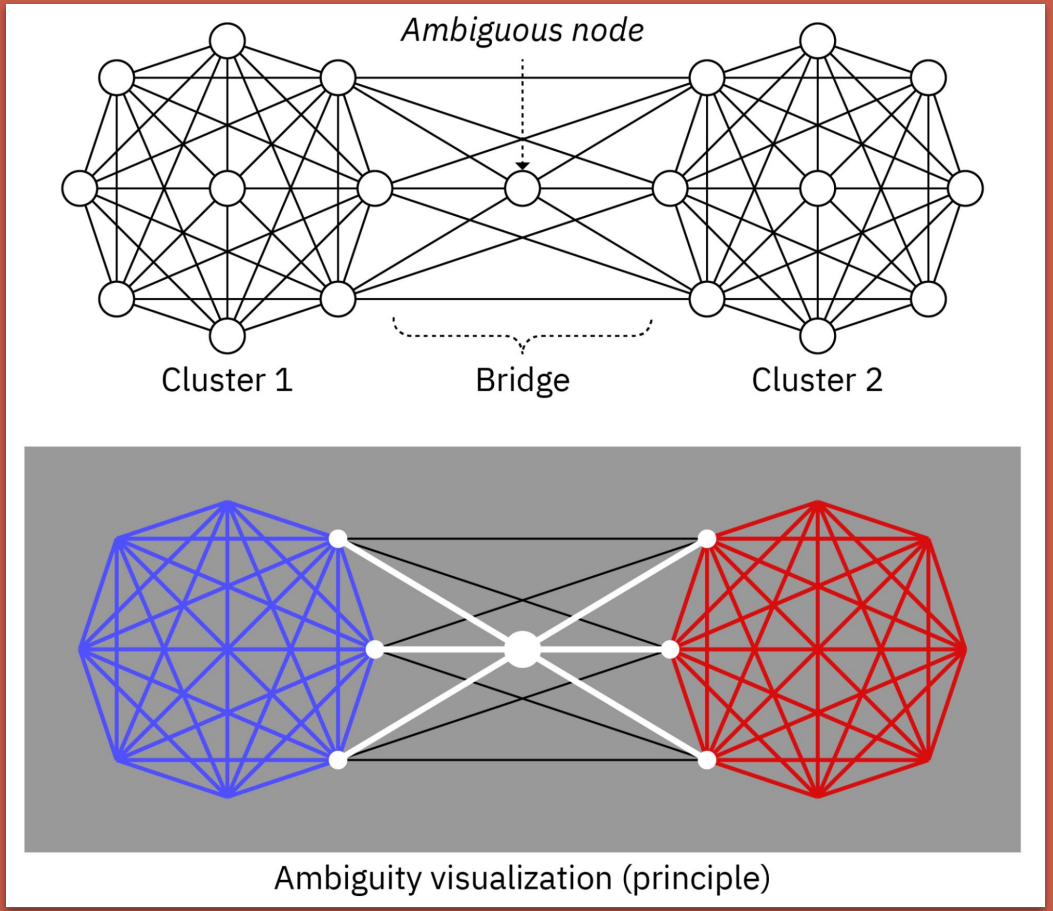
This node is equally well suited to belonging to each cluster



In white, we highlight the ambiguous nodes and clusters

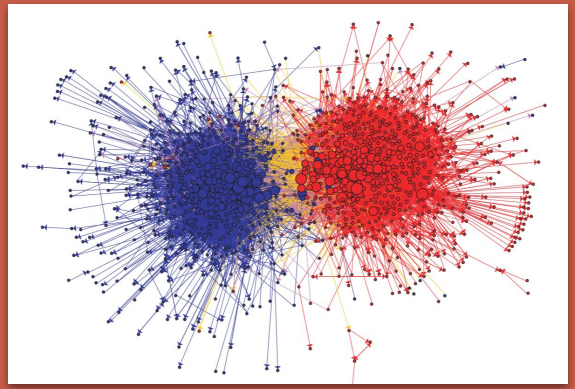


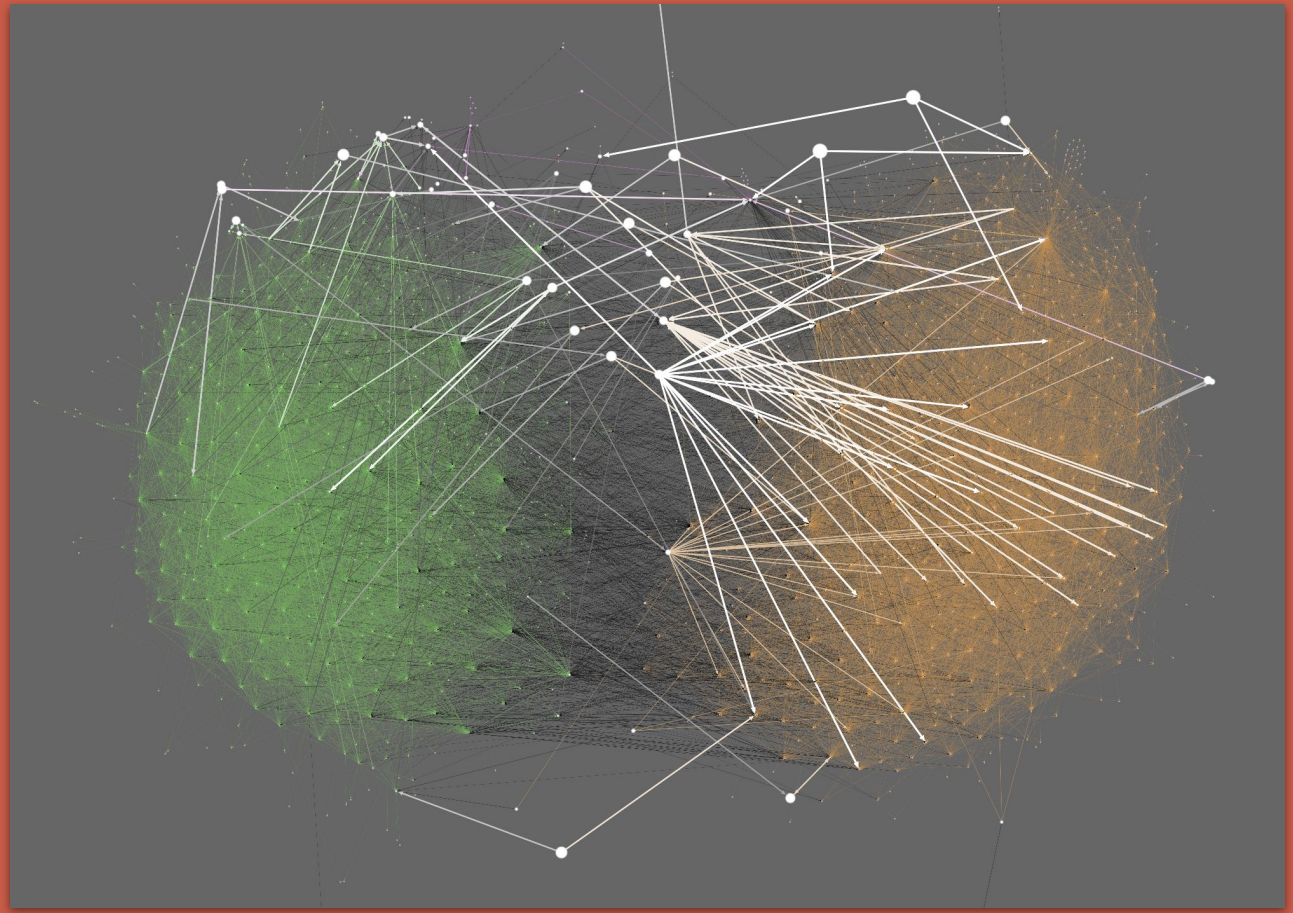
Community detection ambiguity in Gephi Lite



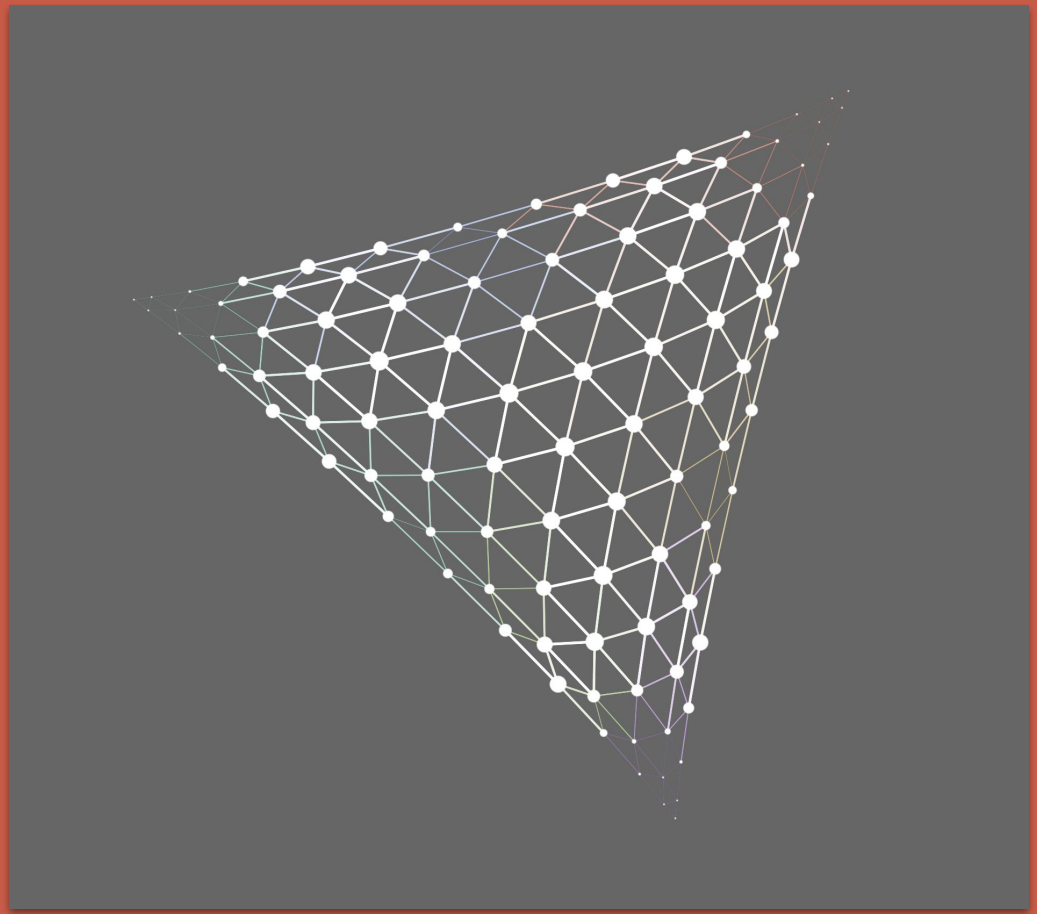
Ambiguity visualization (principle)

Community detection ambiguity in Gephi Lite

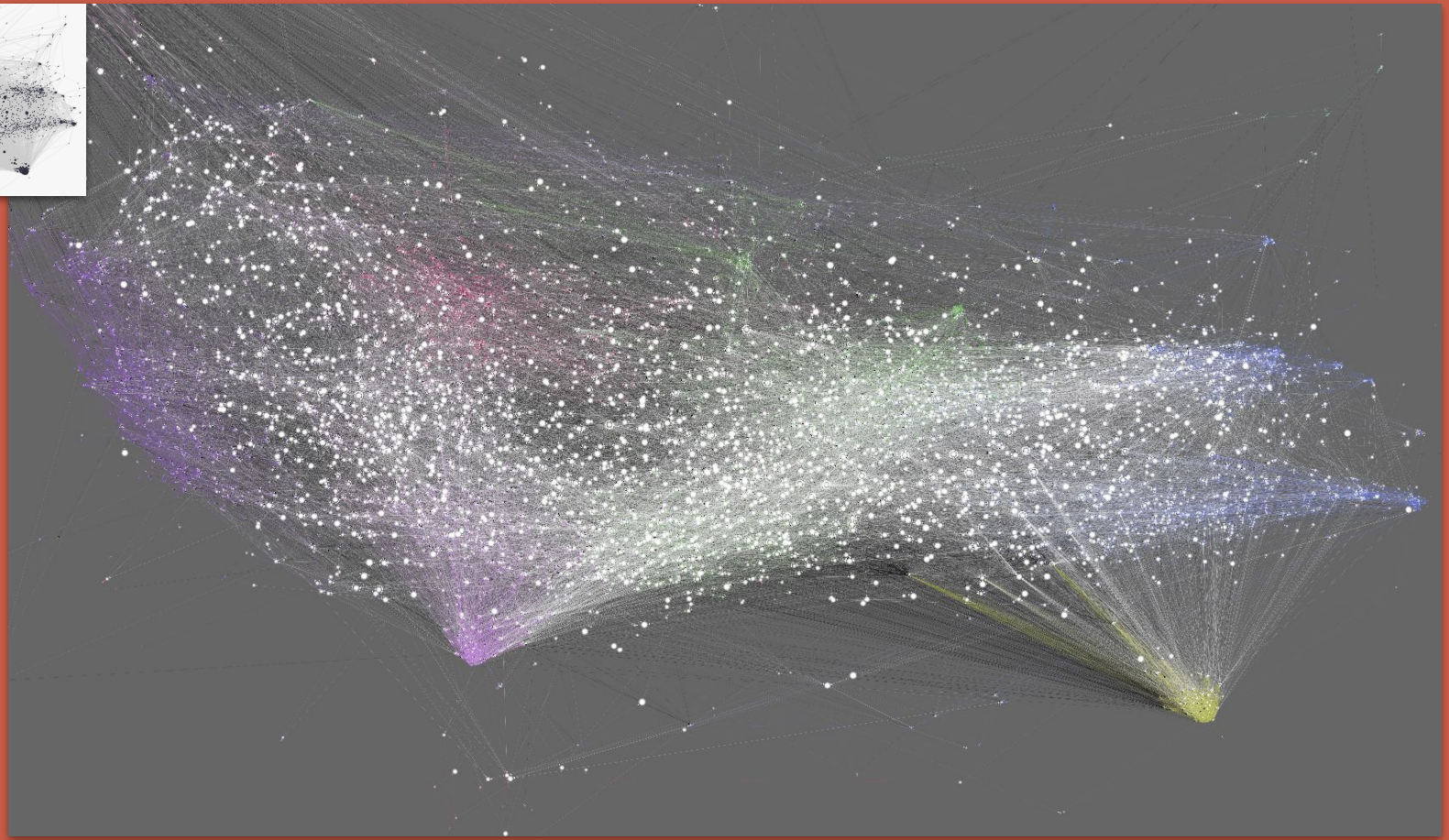




Community detection ambiguity in Gephi Lite



Community detection ambiguity in Gephi Lite



Irreductionist visualization

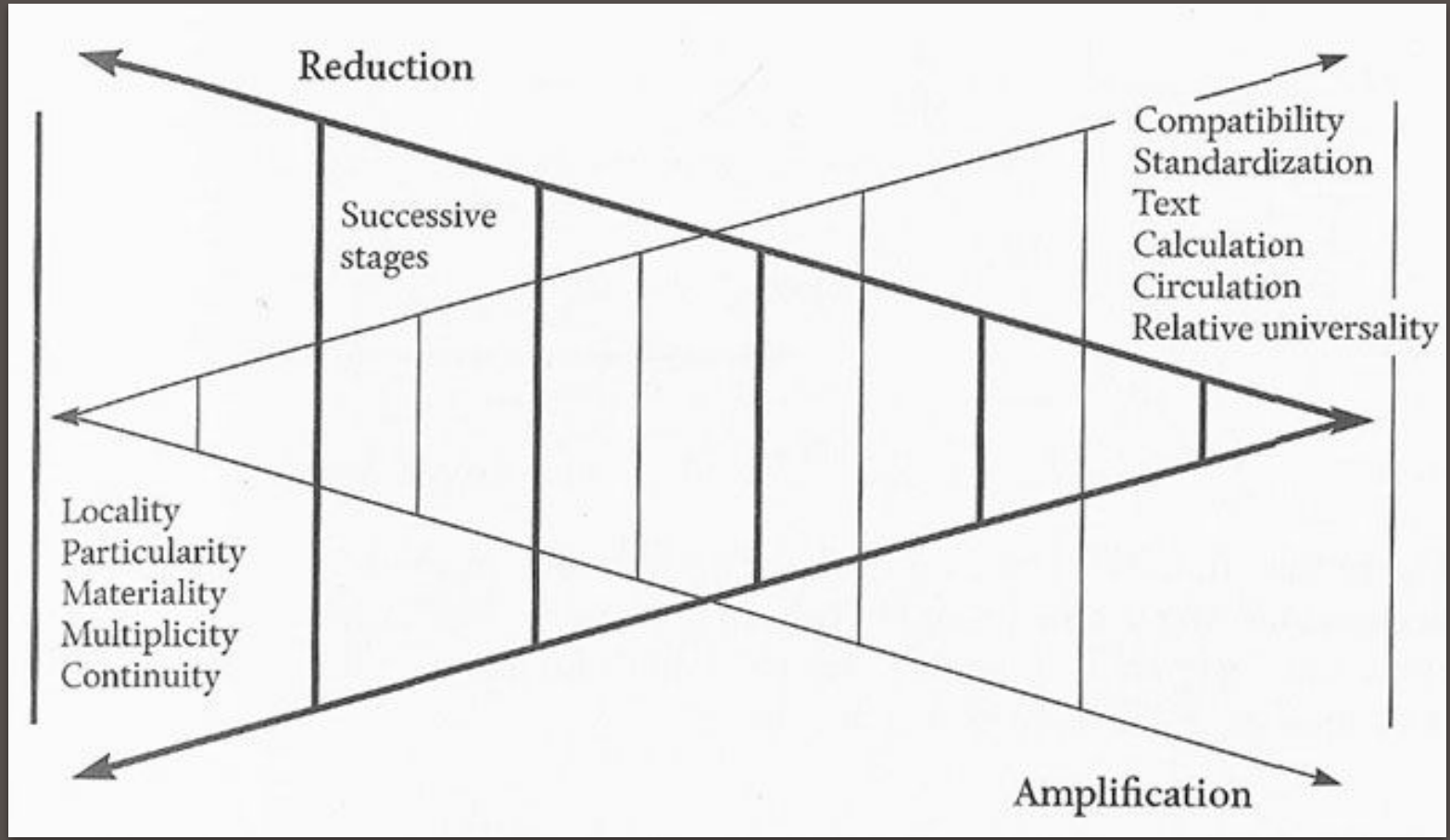
Visual patterns conveying polyvalence, ambiguity, multistability…

Irreductionism is not anti-reductionism

> “1.1.1. Aucune chose n’est par elle-même, réductible ou irréductible à aucune autre.”
>
> *No thing is, by itself, reducible or irreducible to another thing.*
>
> —Latour, B. (1984). Irréductions. *Les microbes: guerre et paix; suivi de, Irréductions.*

Irreductionism conceives reduction as translation.
It aims at *reversible* reductions.

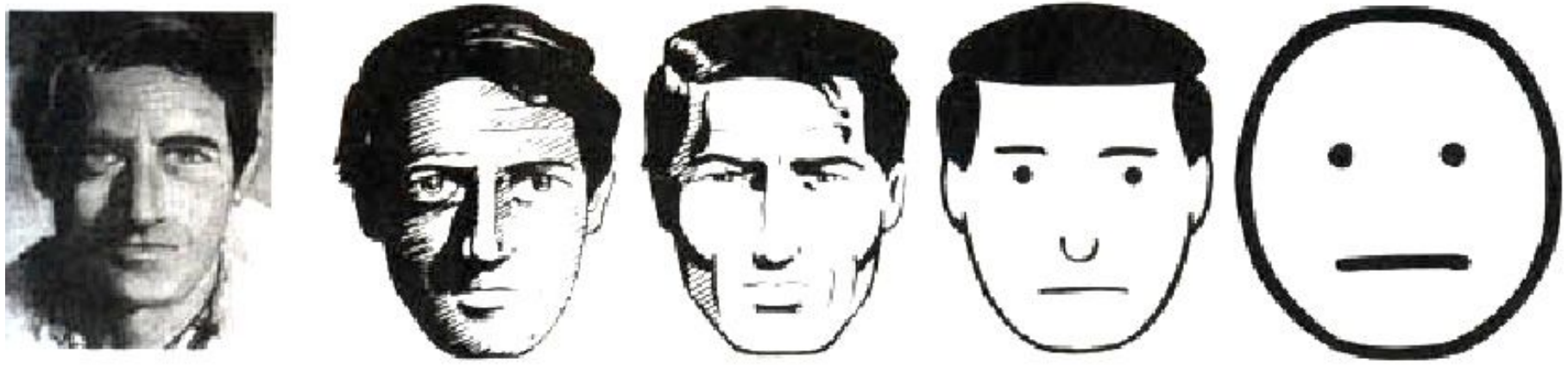
Reduction is a trade-off



Latour, B. (1995). The 'pedofil' of Boa Vista: a photo-philosophical montage. *Common knowledge*, *4*(1).

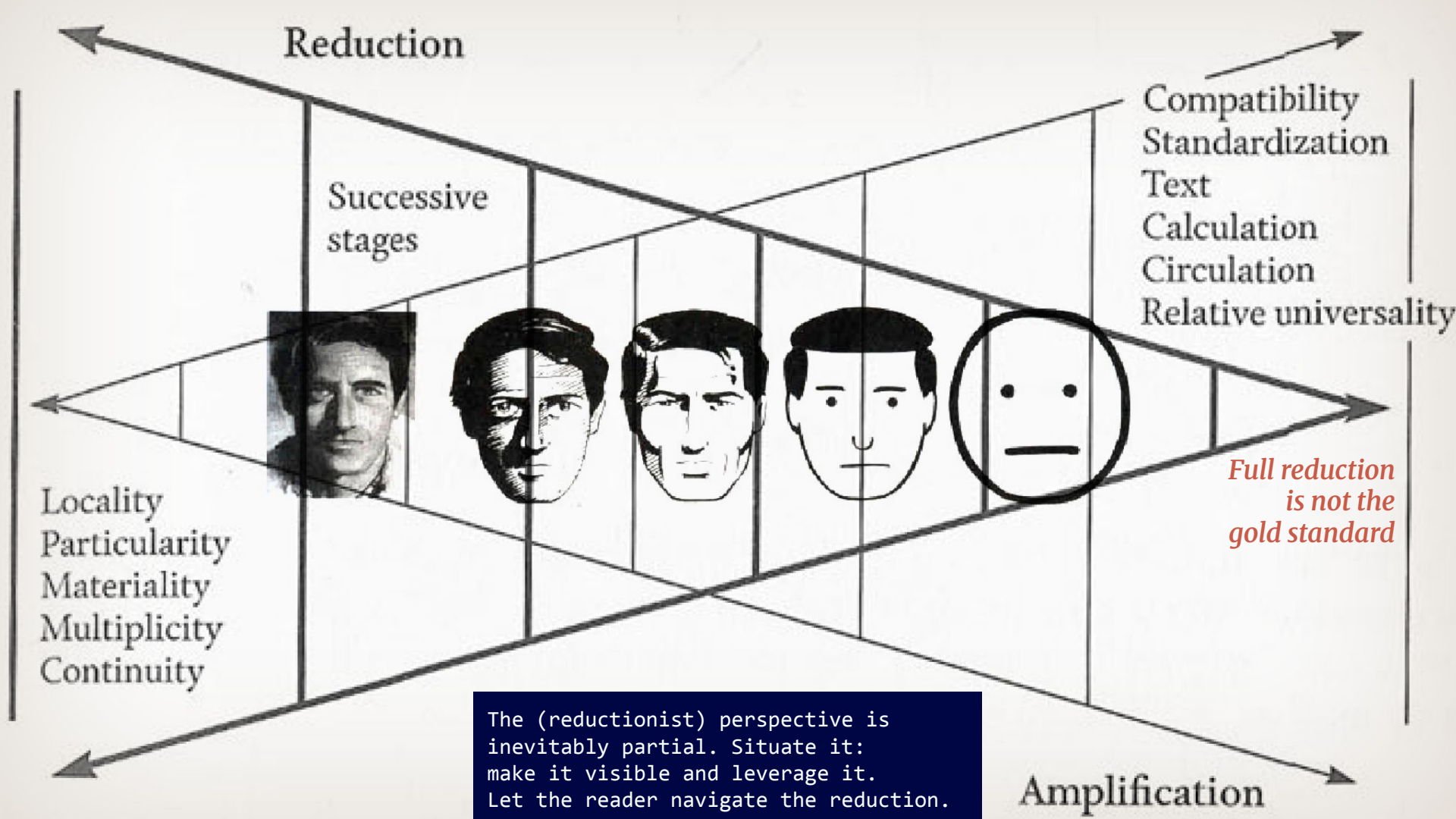
Visualization is a trade-off

Faithful, detailed, specific…



…abstract, legible, universal

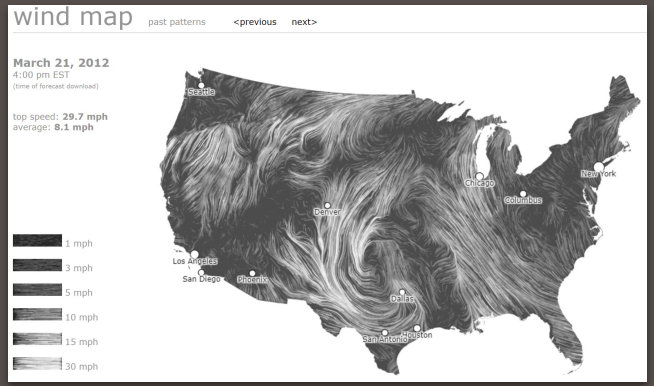
McCloud, S. (1993). *Understanding comics: The invisible art.*



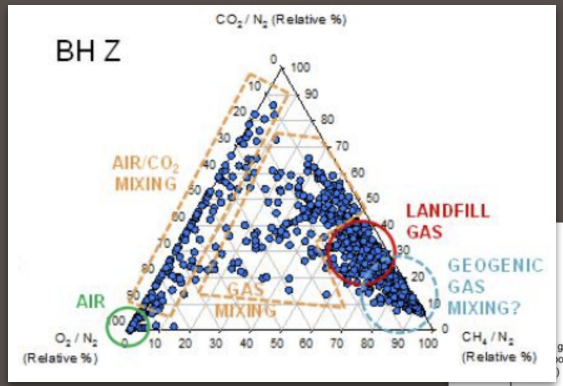
Full reduction is not the gold standard

The (reductionist) perspective is inevitably partial. Situate it: make it visible and leverage it. Let the reader navigate the reduction.

Other irreductionist visualizations

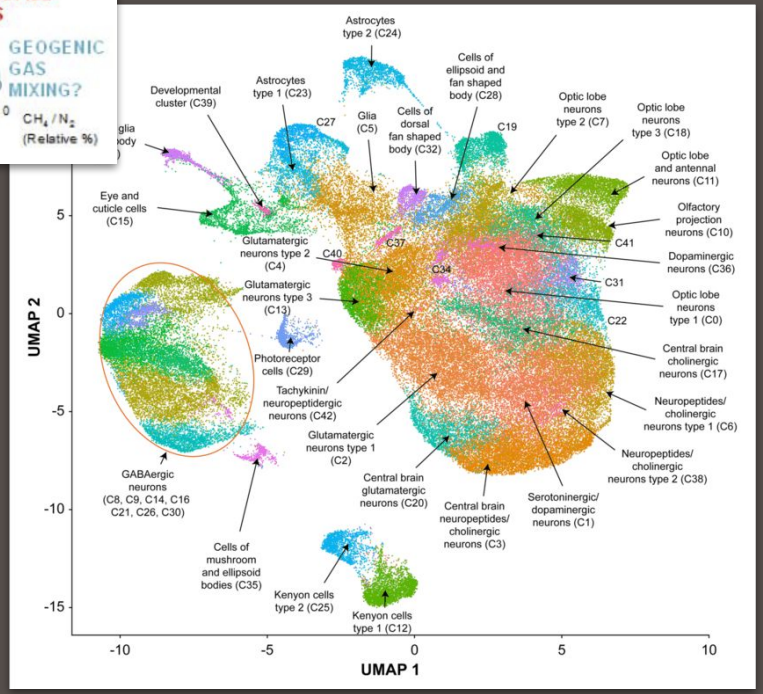


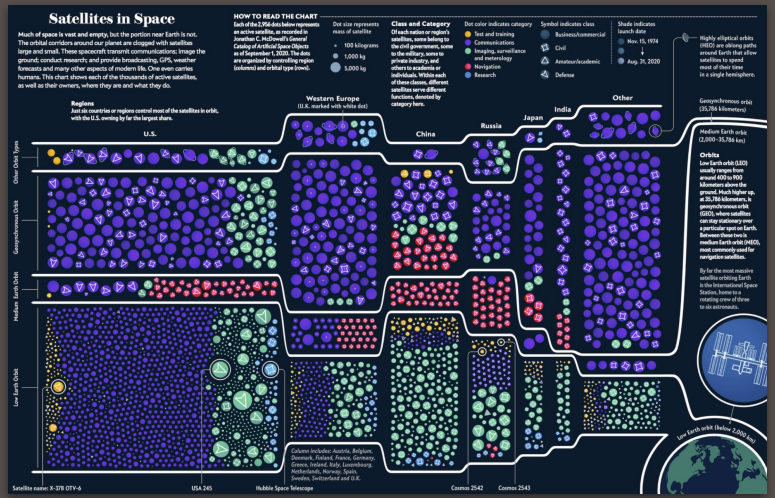
The Wind Map project by Fernanda Bertini Viégas and Martin Wattenberg



A ternary plot from a natural science paper

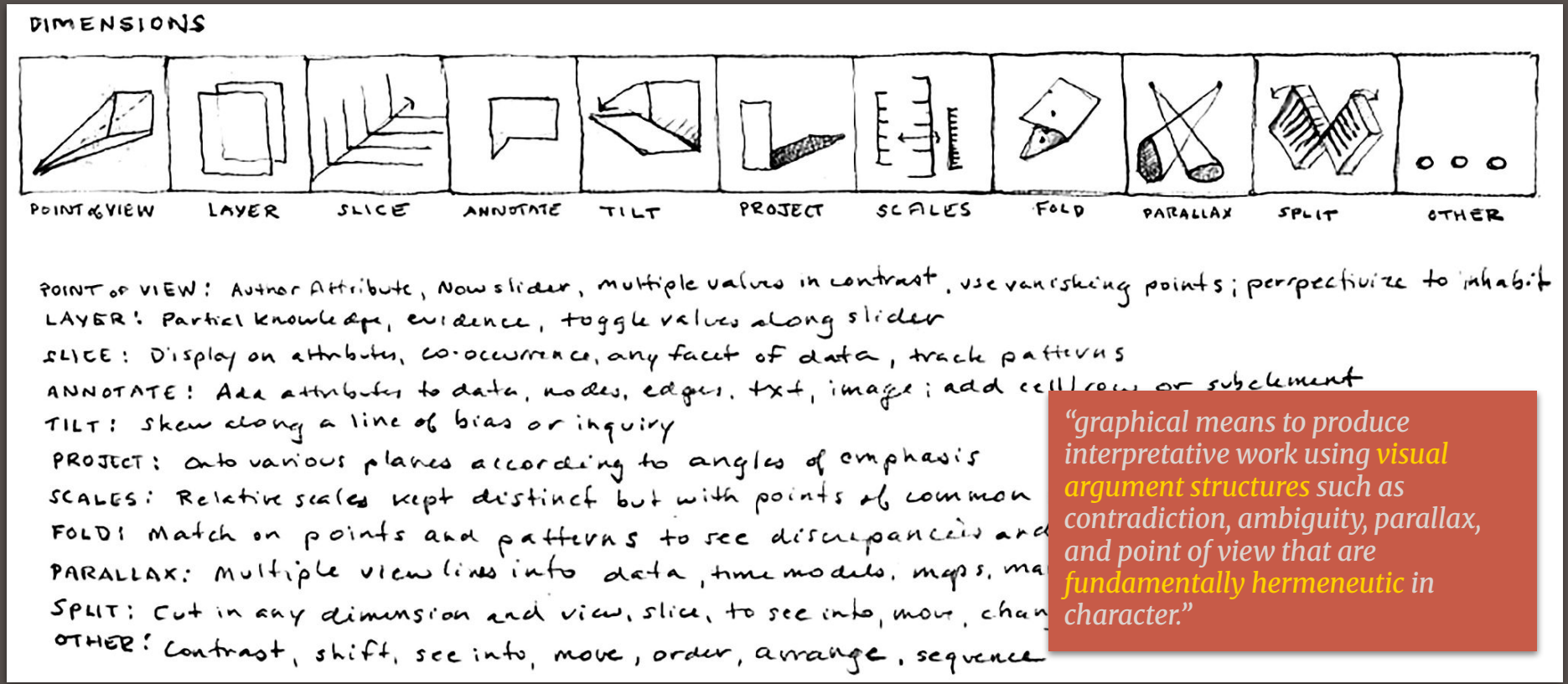
Dimensionality reduction plot of cells having a similar "expression pattern".





Space Wars, by Nadieh Bremer, for the *Scientific American* (2020)

Dimensions of interpretation and “non-representational” approaches



“graphical means to produce interpretative work using visual argument structures such as contradiction, ambiguity, parallax, and point of view that are fundamentally hermeneutic in character.”

Drucker, J. (2018). Non-representational approaches to modeling interpretation in a graphical environment. *Digital Scholarship in the Humanities*, *33*(2), 248-263.

Dimensions of interpretation and “non-representational” approaches

“non-representational approaches use graphical means as a primary method of **modeling** human-authored interpretation *rather than* to **display** pre-existing data sets.”

Why is it either or?

DISPLAY

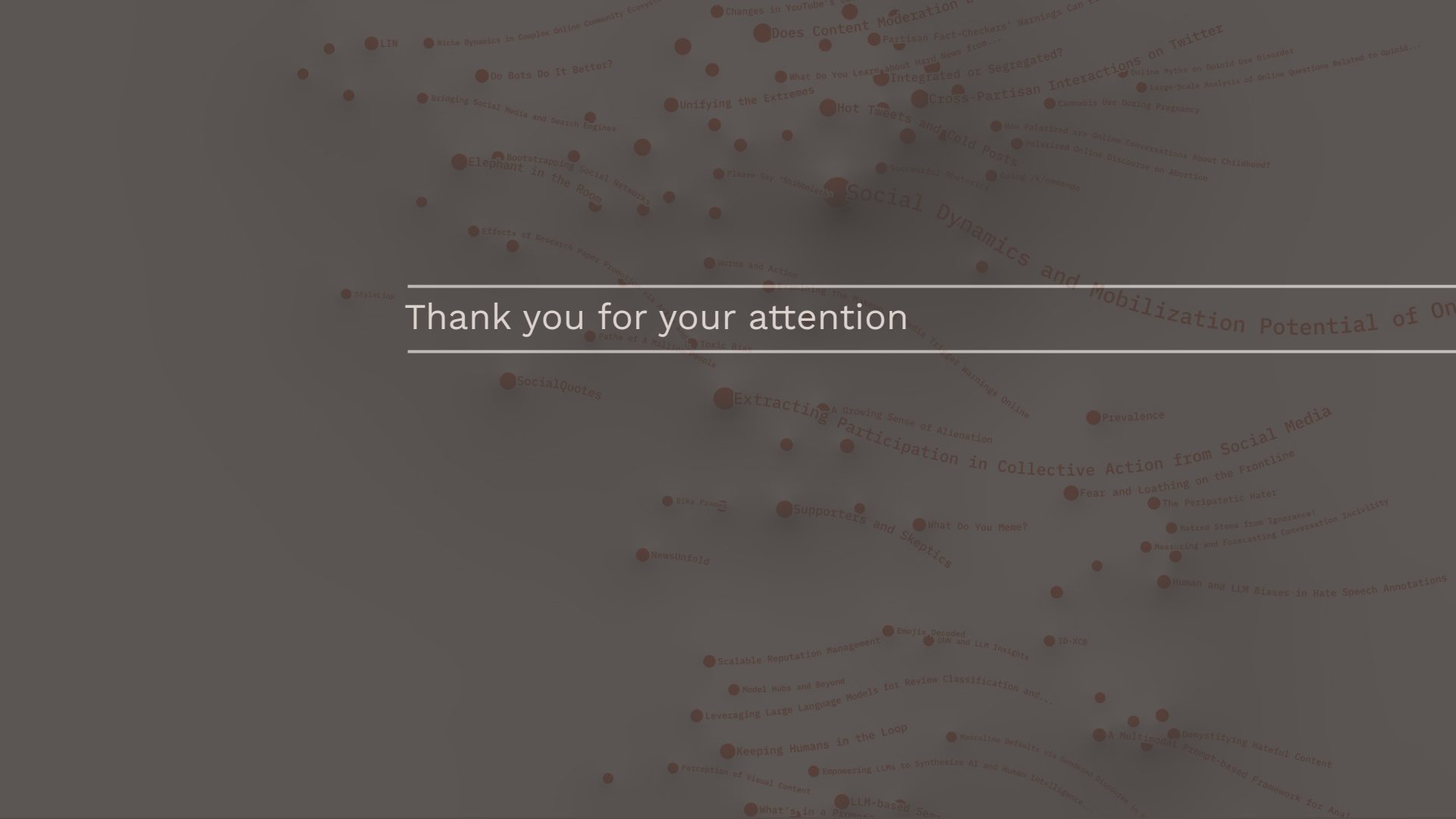
“The display functions as a **surrogate** for the data—which is itself a surrogate, adequate or inadequate, for some phenomena.”

“In a representational paradigm, … the display stands for the data, is a re-presentation of the data.”

MODELING

“is a primary mode of creating an abstract scheme or structure of analysis or argument. … [It] uses graphical means to **produce interpretative work** using visual argument structures such as *contradiction, ambiguity, parallax, and point of view* that are fundamentally hermeneutic in character.”

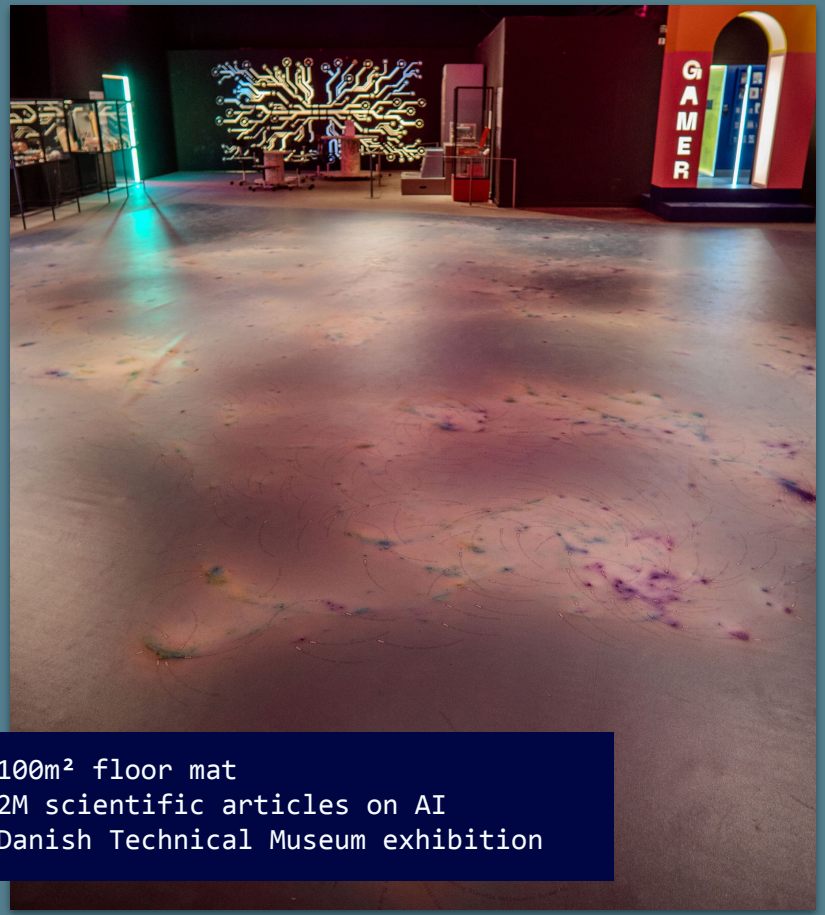
Drucker, J. (2018). Non-representational approaches to modeling interpretation in a graphical environment. *Digital Scholarship in the Humanities, 33*(2), 248-263.


Thank you for your attention

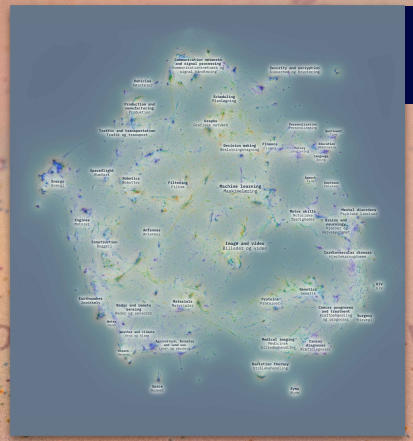
Grounding AI Project

Project showcase

Printed to walk on it (2025)

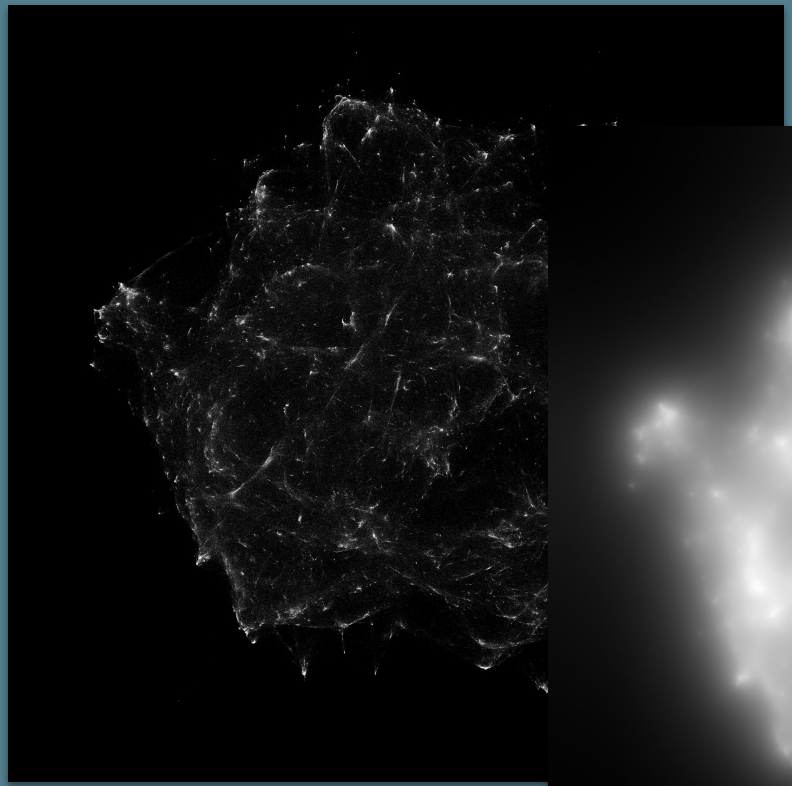


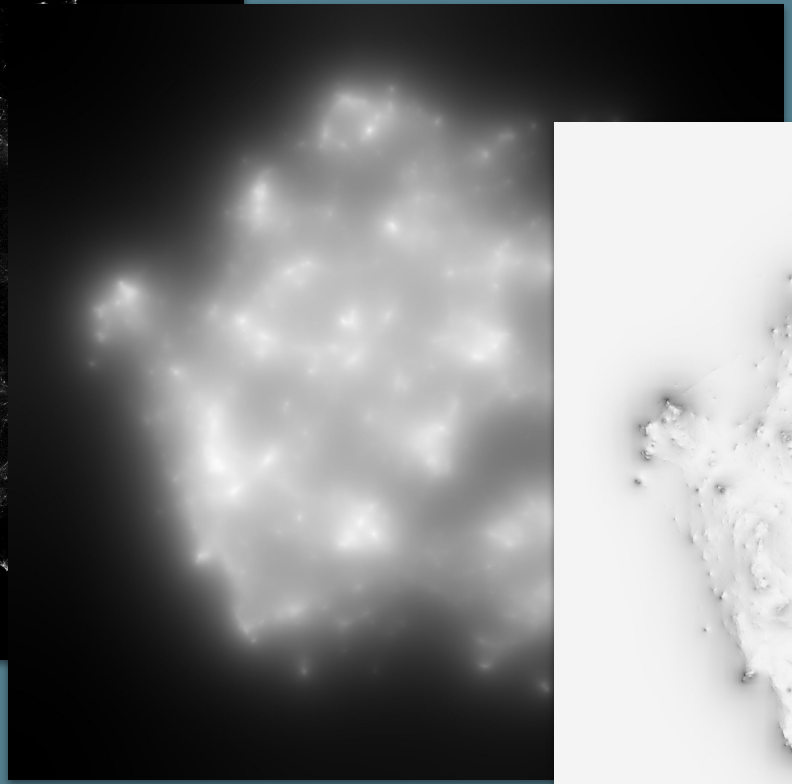
100m² floor mat
2M scientific articles on AI
Danish Technical Museum exhibition

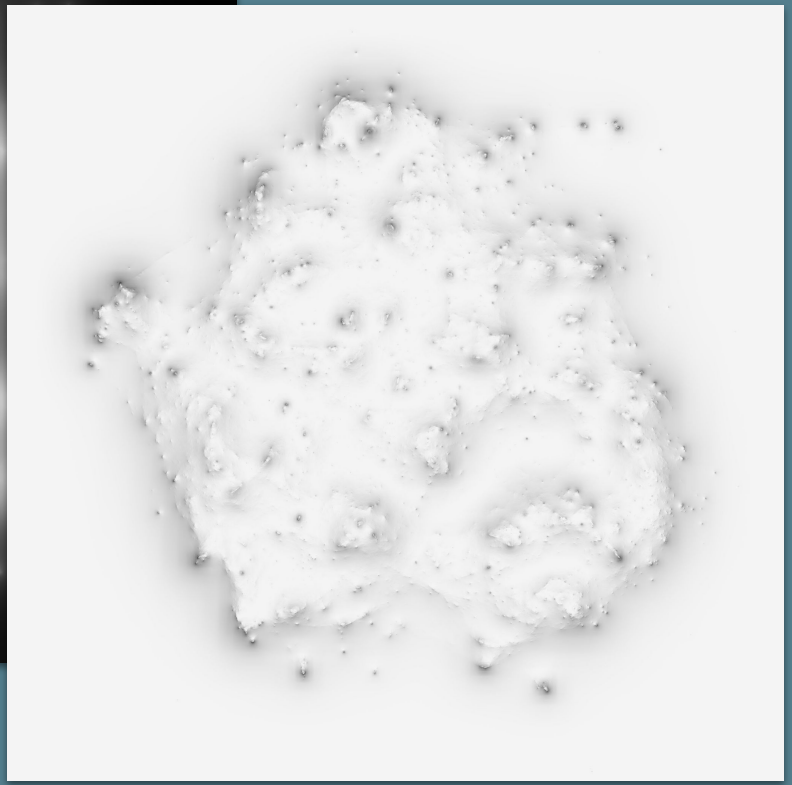


https://grounding-ai.github.io/

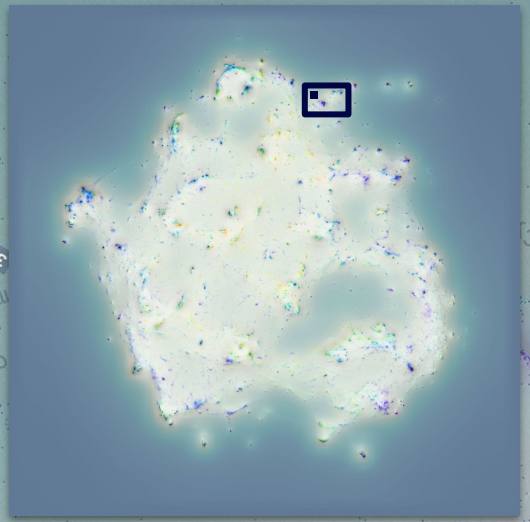

HVORDAN LÆSER MAN KORTET
HOW TO READ THE MAP
KUNSTIG INTELLIGENS ER ALLE STEDER
ARTIFICIAL INTELLIGENCE IS EVERYWHERE
KUNSTIG INTELLIGENS ER INGEN STEDER
ARTIFICIAL INTELLIGENCE IS NOWHERE



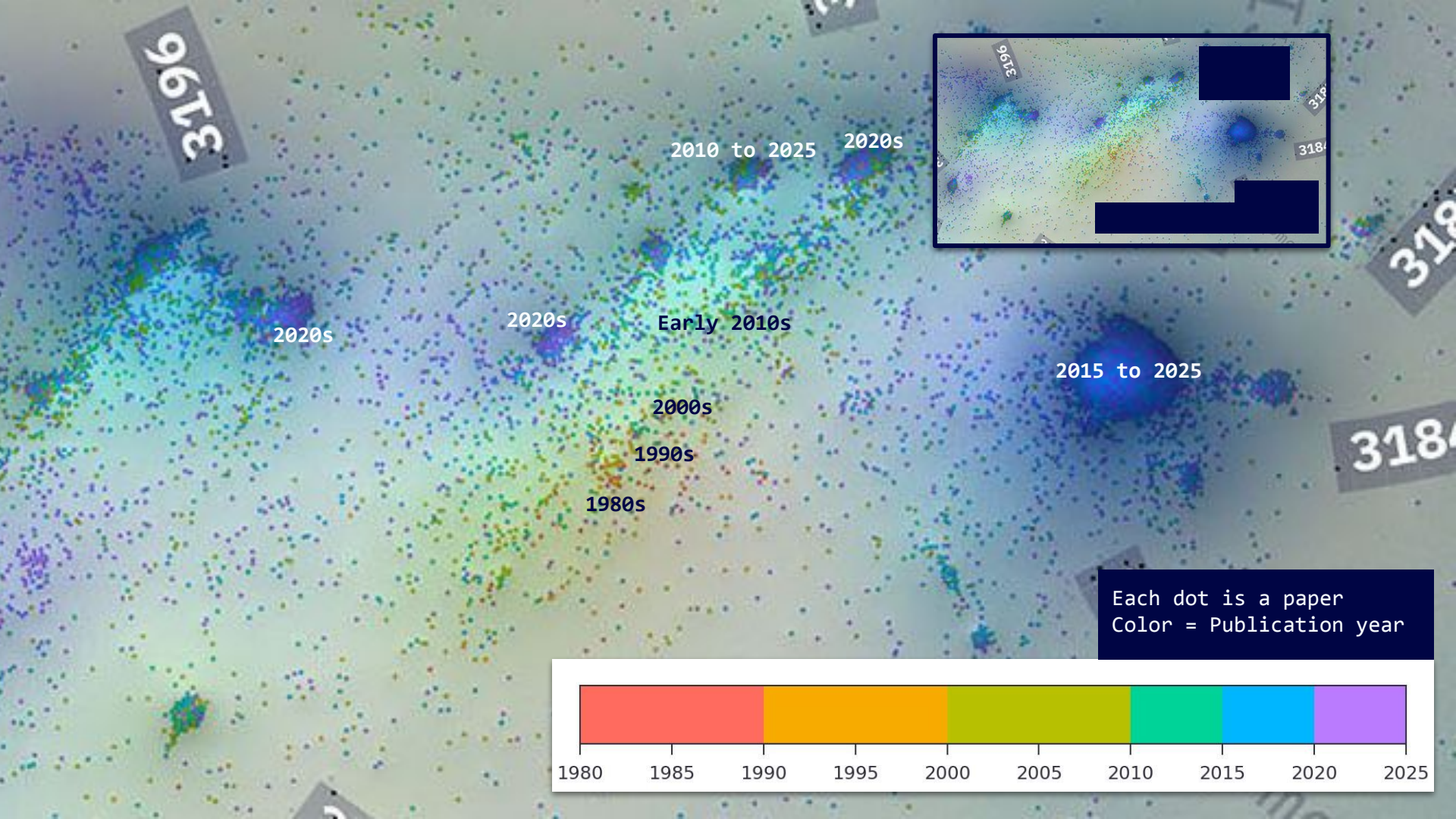




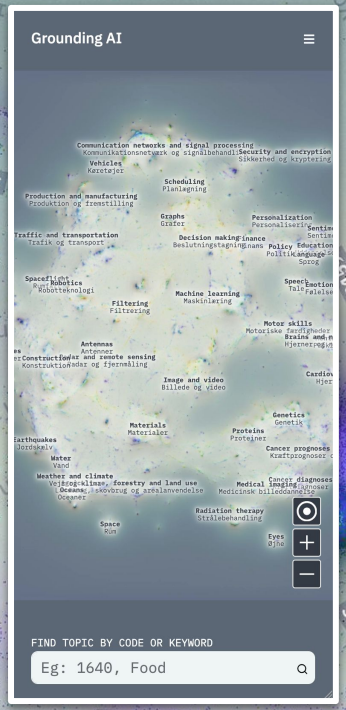
The design aims to bring focus to the clusters (“islands” of this “atoll”)

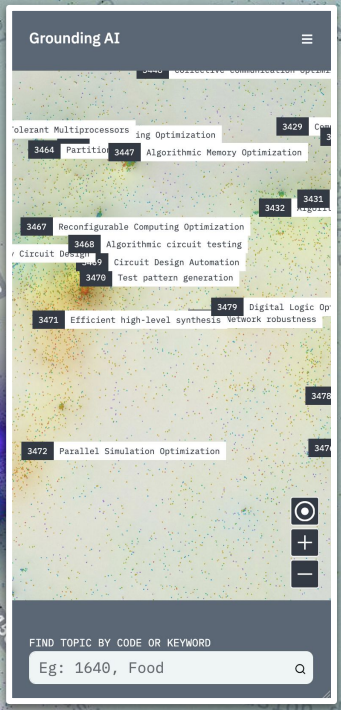


The map is big.

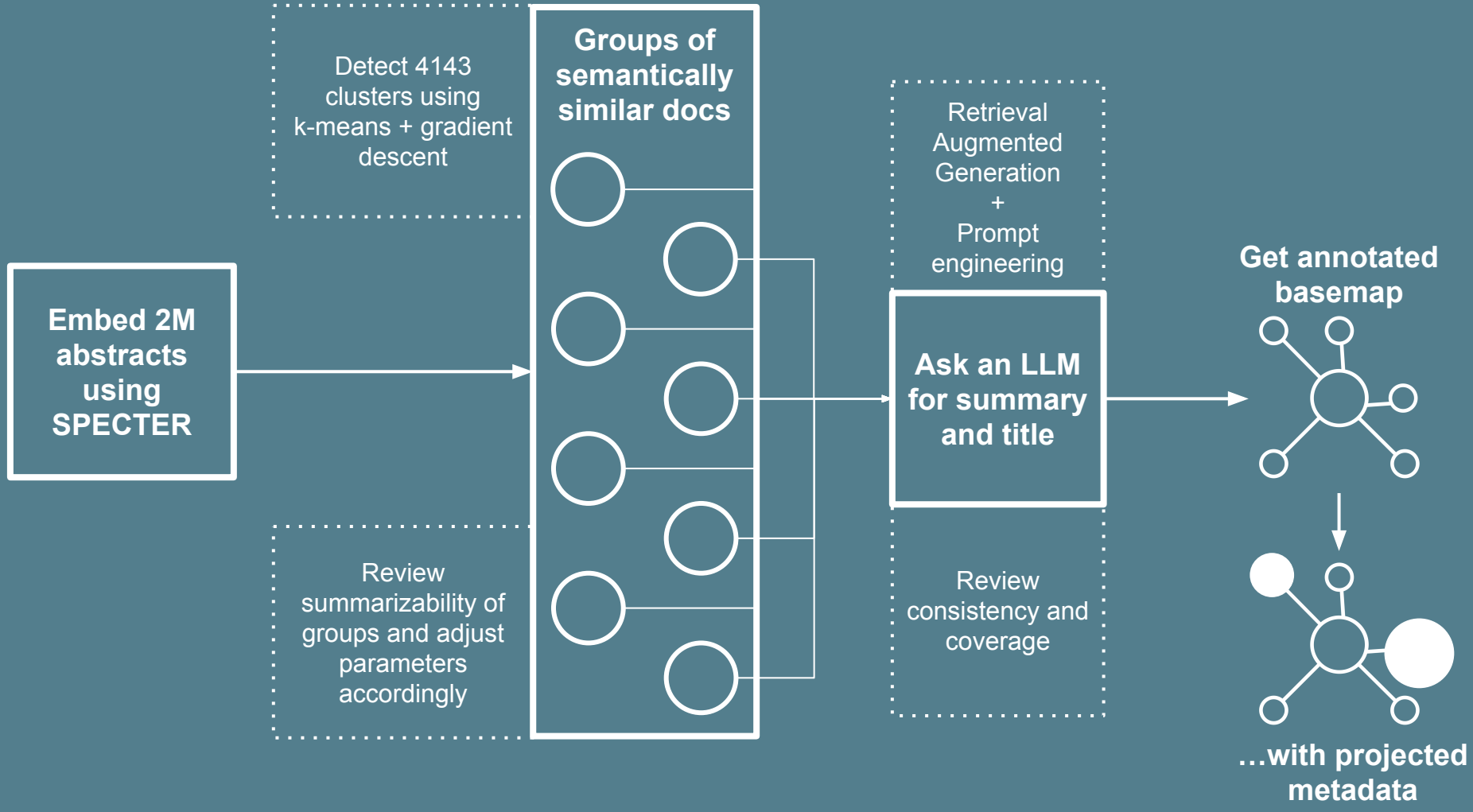

3196
2010 to 2025
2020s
2020s
2020s
Early 2010s
2015 to 2025
2000s
1990s
1980s
Each dot is a paper
Color = Publication year
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025

Each label is a cluster summarized and titled using a LLM.





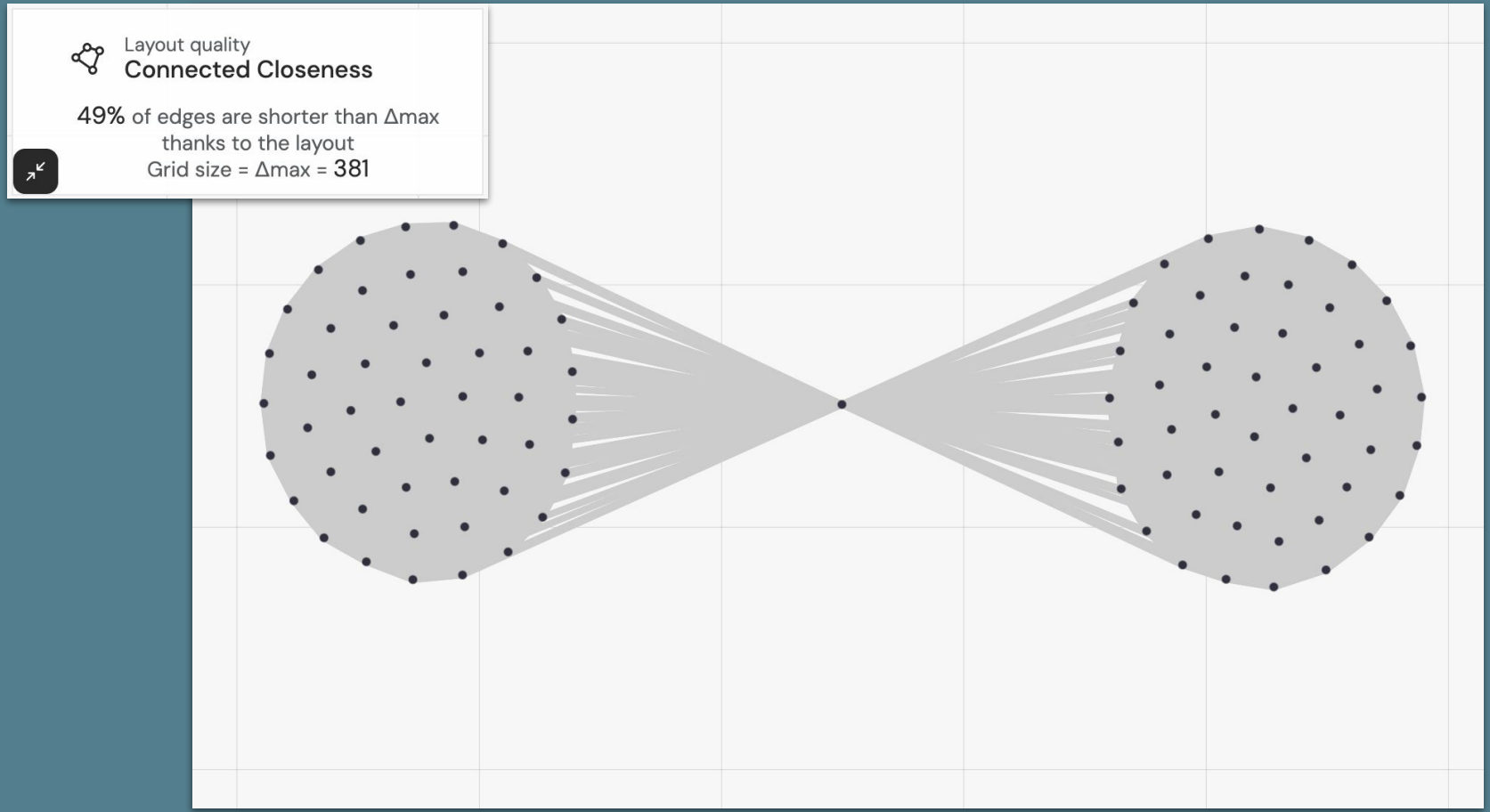
Application / smartphone app:
https://grounding-ai.github.io/web-application/


Embed 2M abstracts using SPECTER
Detect 4143 clusters using k-means + gradient descent
Review summarizability of groups and adjust parameters accordingly
Groups of semantically similar docs
Retrieval Augmented Generation + Prompt engineering
Ask an LLM for summary and title
Review consistency and coverage
Get annotated basemap
…with projected metadata

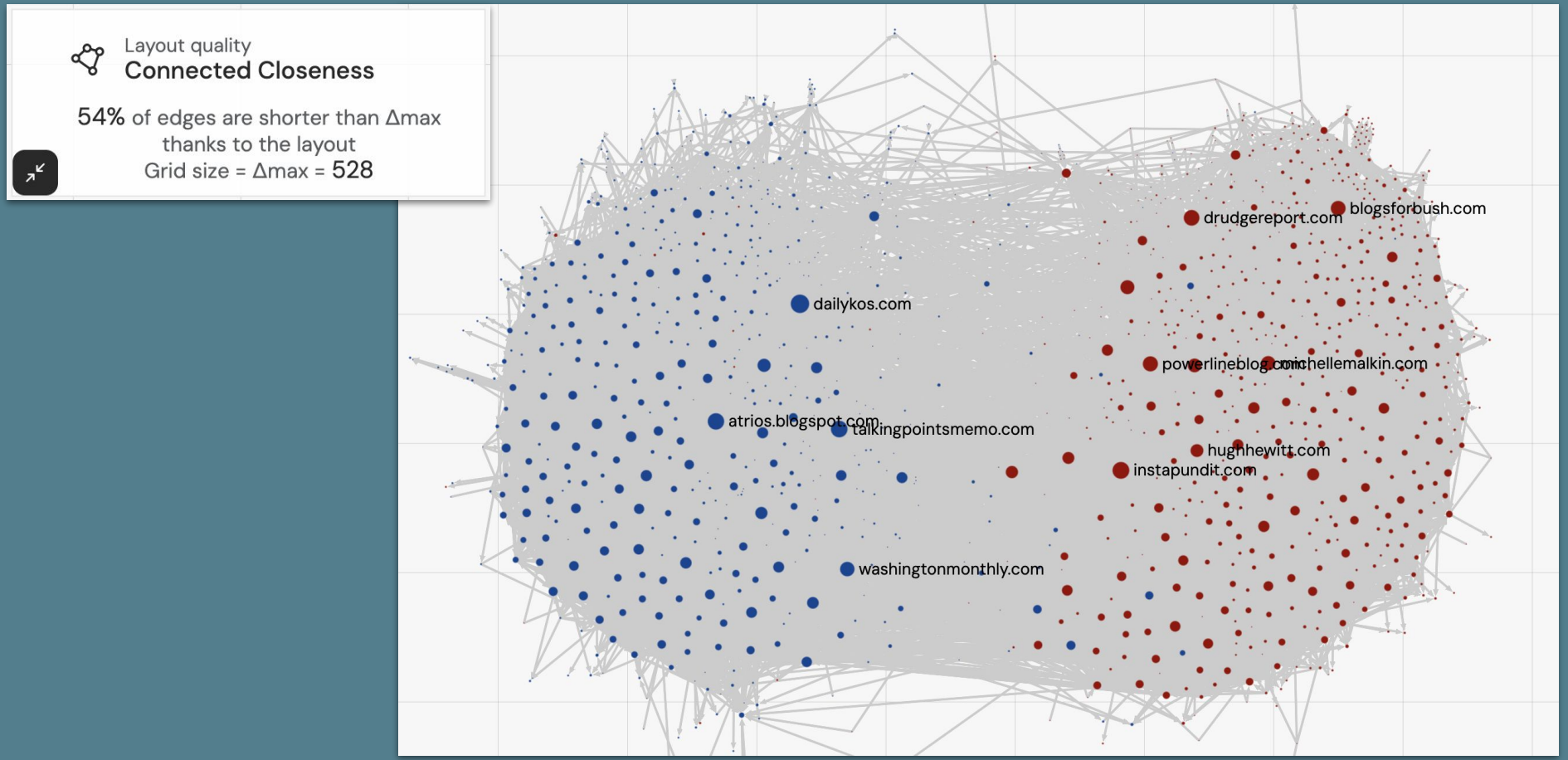
Connected-closeness

Jacomy, M. (2023). Connected-closeness: A Visual Quantification of Distances in Network Layouts. Journal of Graph Algorithms and Applications, 27(5), 341–404. https://doi.org/10.7155/jgaa.00626

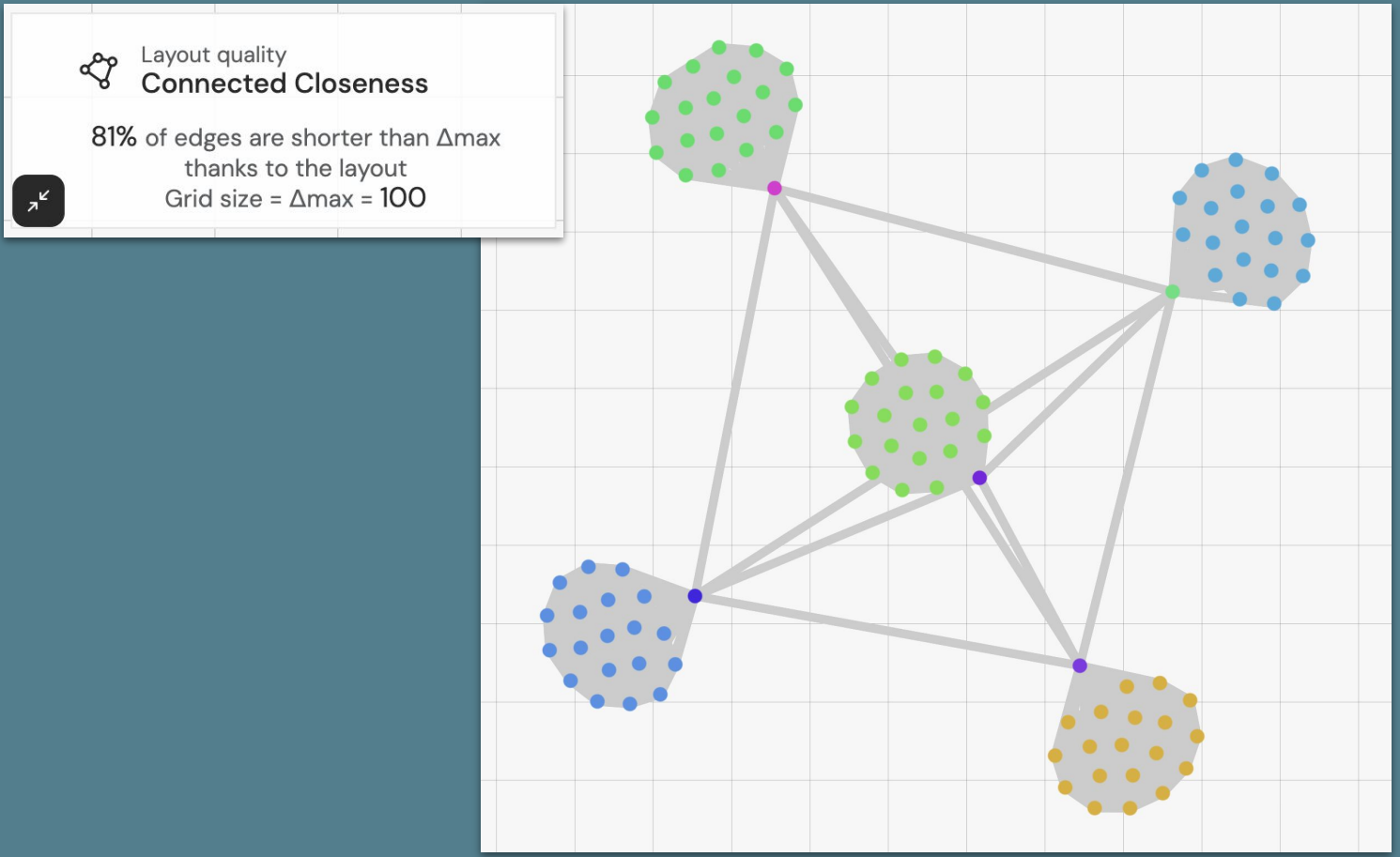
Connected-closeness



Connected-closeness

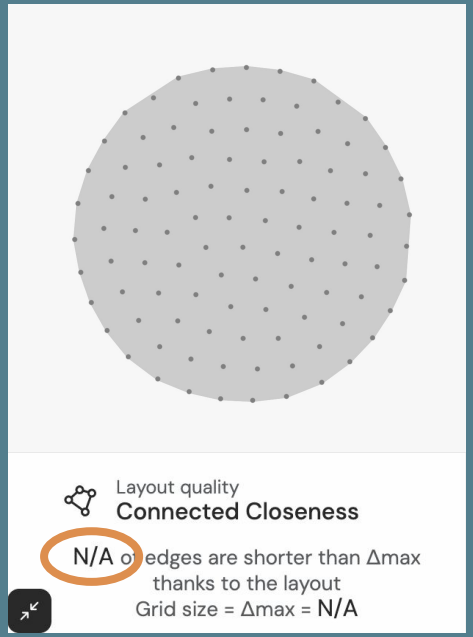


Connected-closeness

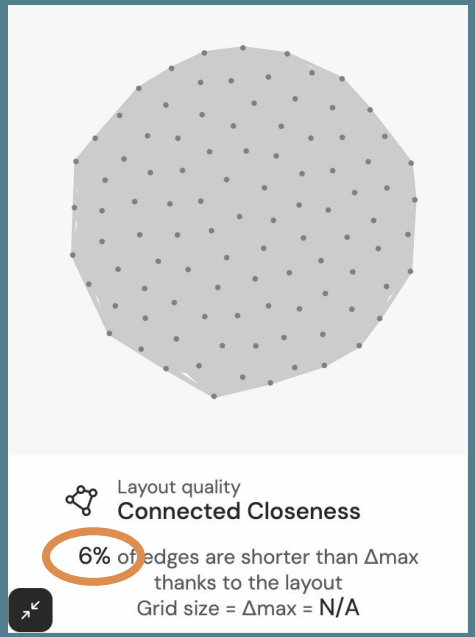


Connected-closeness

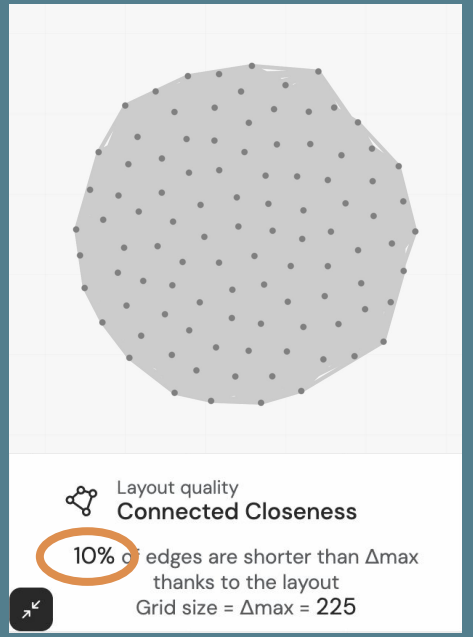
Clique
(everything is connected)



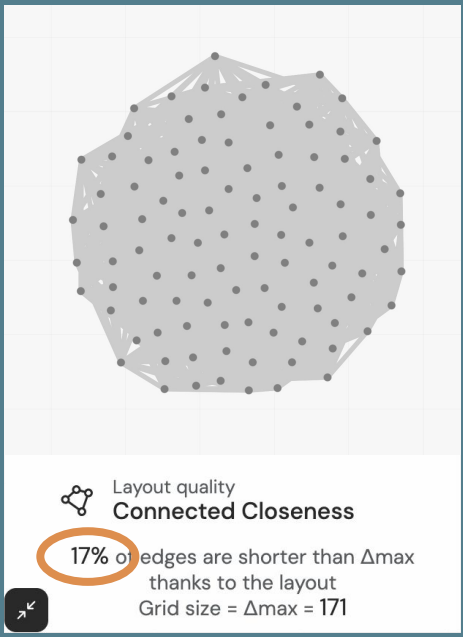
75% chance
that 2 nodes are linked



50% chance
that 2 nodes are linked



25% chance
that 2 nodes are linked



Node positions are
uncharacteristic

Node positions are
increasingly characteristic