

Focus + Context

Data Visualization

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Why embed?

- Enable display with simultaneous overview and detail
- Avoid disorientation with view changes
 - Use external memory to lower cognitive load
- Enable reduction in amount of data shown

Implementation

Sophisticated combination of visual encoding + navigation which is usually dynamic

Embed : Design choices

④ Embed

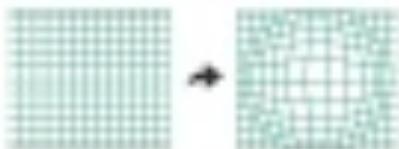
→ Elide Data



→ Superimpose Layer



→ Distort Geometry



Reduce

④ Filter



④ Aggregate



④ Embed

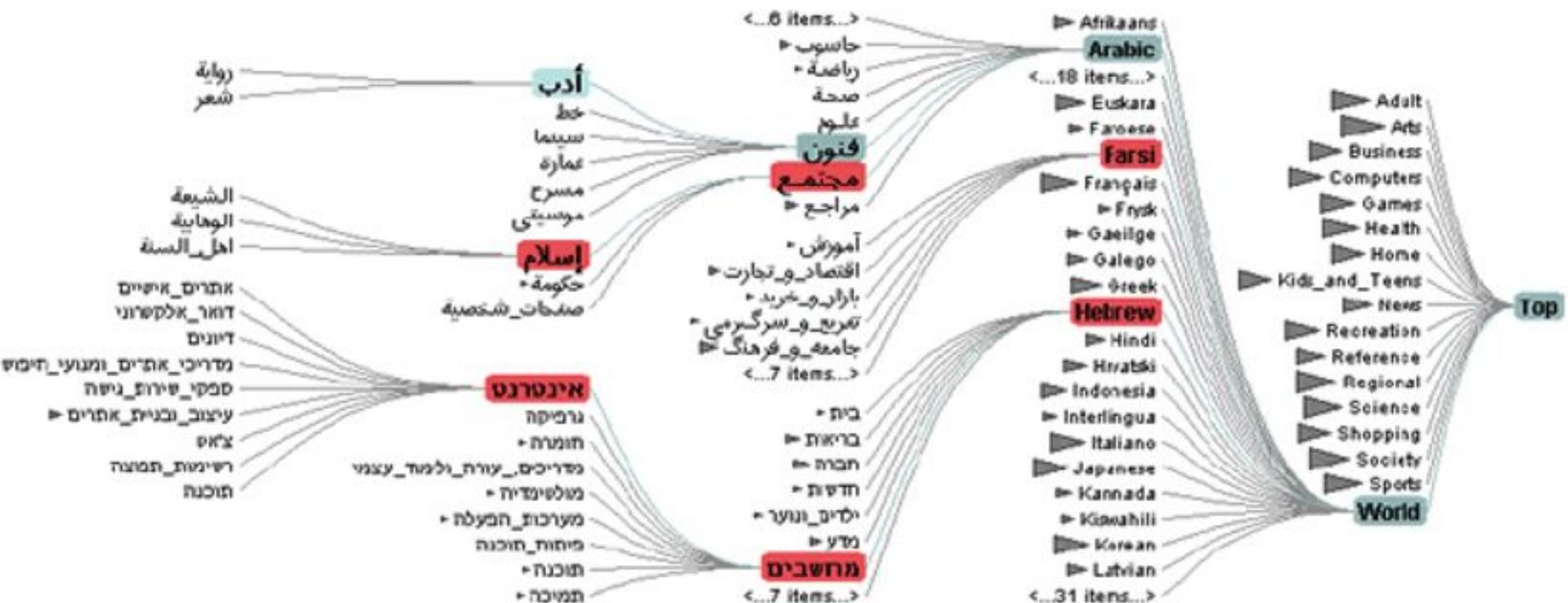


Embed : Design choice: Elide

Elision

- Focus on items that are shown in detail
- Omit some items via filtering (dynamic)
- Summarize other items via aggregation (dynamic) to provide context

DOITrees



System DOITrees Revisited

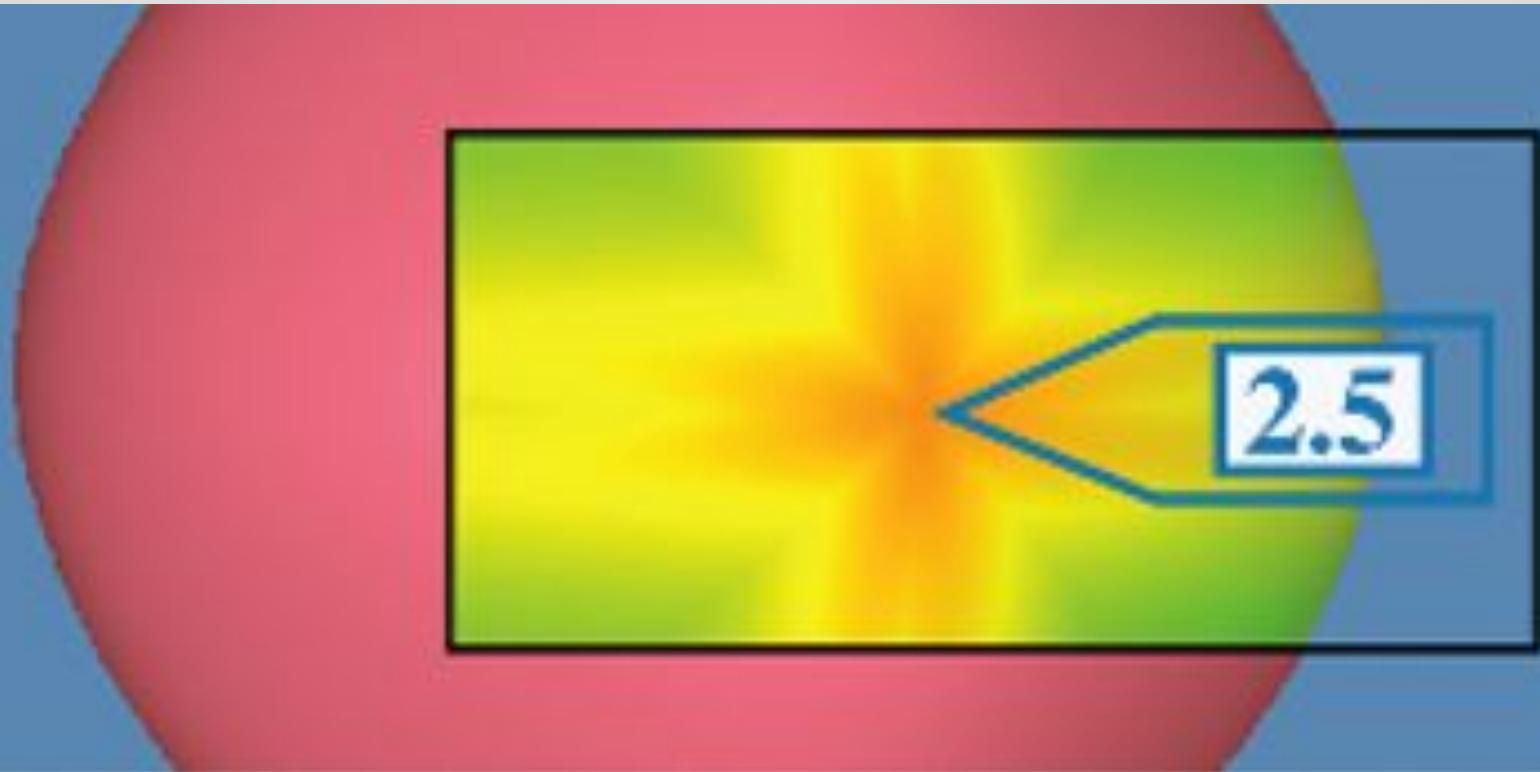
What: Data	Tree
How: Encode	Node-link
How: Reduce	Embed: Elide, multiple foci
Scale	Nodes:: hundreds of thousands

Embed : Design choice: Superimpose

Superimpose

Focus layer in a local region is superimposed

Toolglass and Magic Lenses



System Toolglass and Magic Lenses

What: Data Spatial, quantitative curvature data on surface

How: Encode Color by curvature

How: Reduce Embed: Superimpose

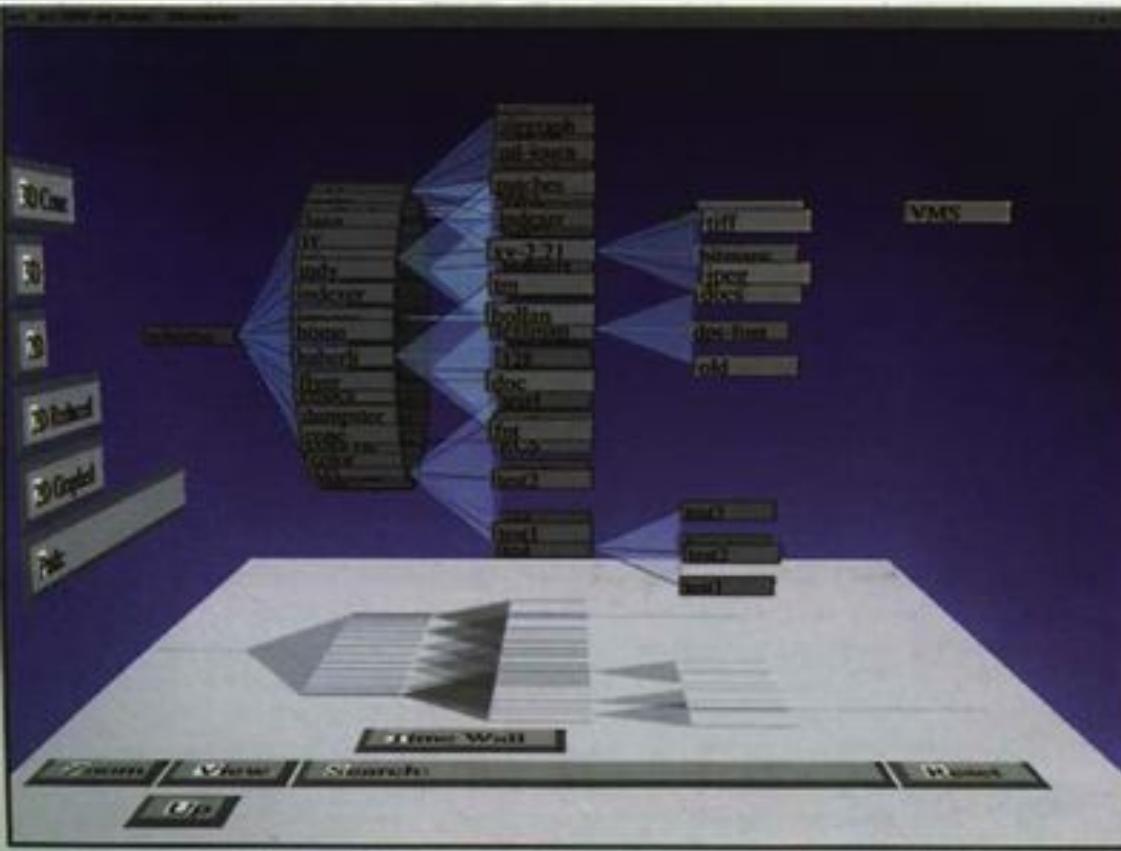
Embed : Design choice: Distort

Distort

Minimize the contextual region to make room for details in focus regions.

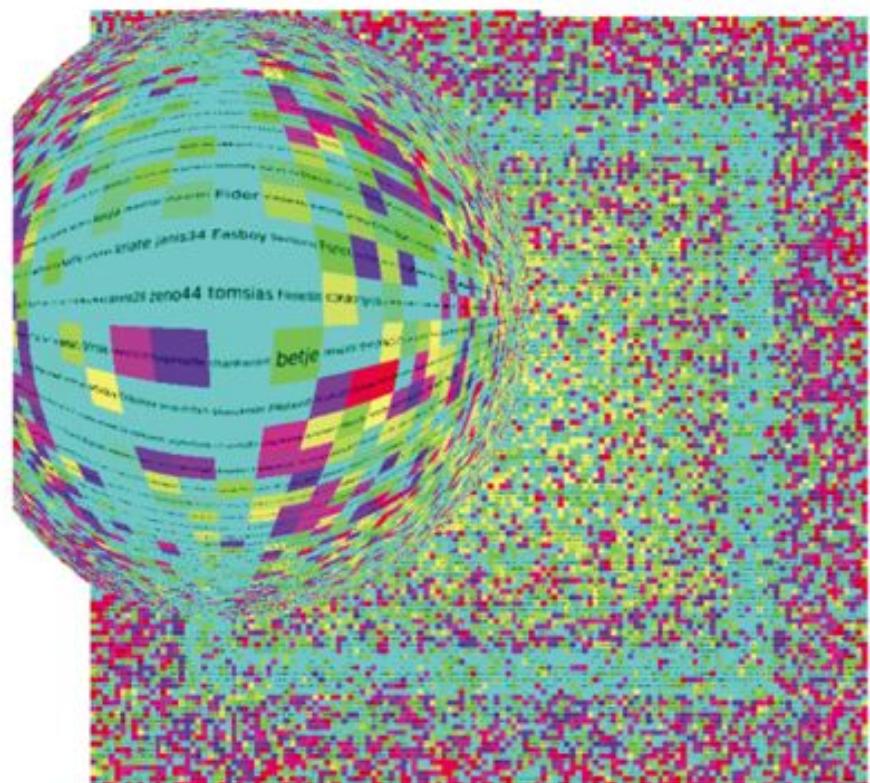
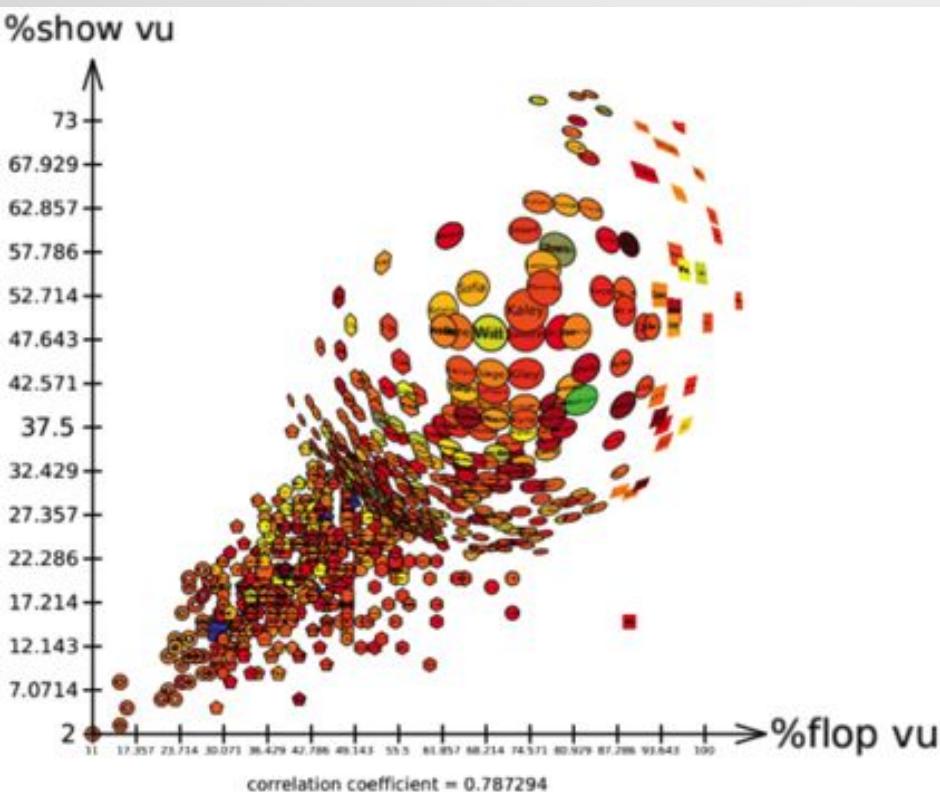
1. Focus: Single or multiple
2. Focus shape: Radial, rectangular or arbitrary
3. Focus extent: Global or locally constrained
4. Interaction
 - a. Geometry constrained (e.g. 3d perspective)
 - b. Moveable lens (e.g. magnifying glass lens)
 - c. Stretch and squish (e.g. rubber sheet)
 - d. Vector fields

Distort: 3D perspective



System	Cone Trees
What: Data	Tree
How: Encode	3d node-link layout
How: Reduce	Embed: distort with 3D perspective; single global focus region.
Scale	Nodes: thousands

Distort: Fisheye Lens



System Fisheye Lens

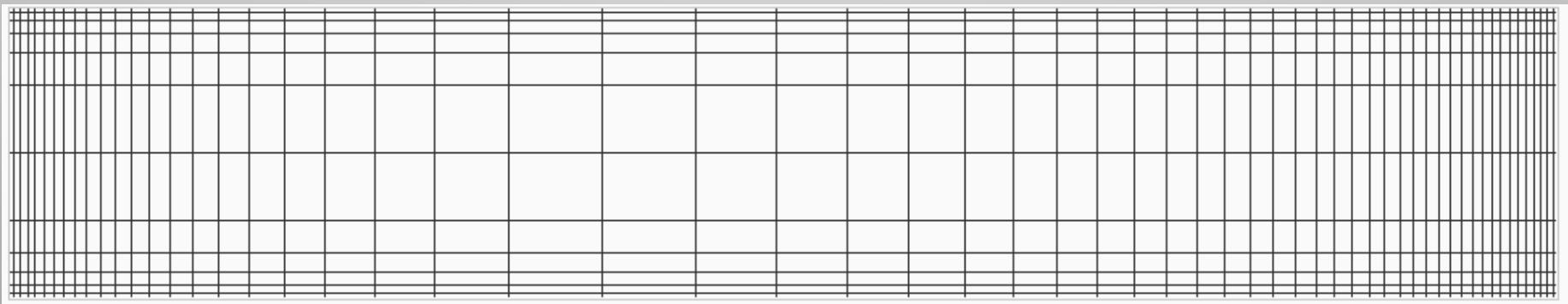
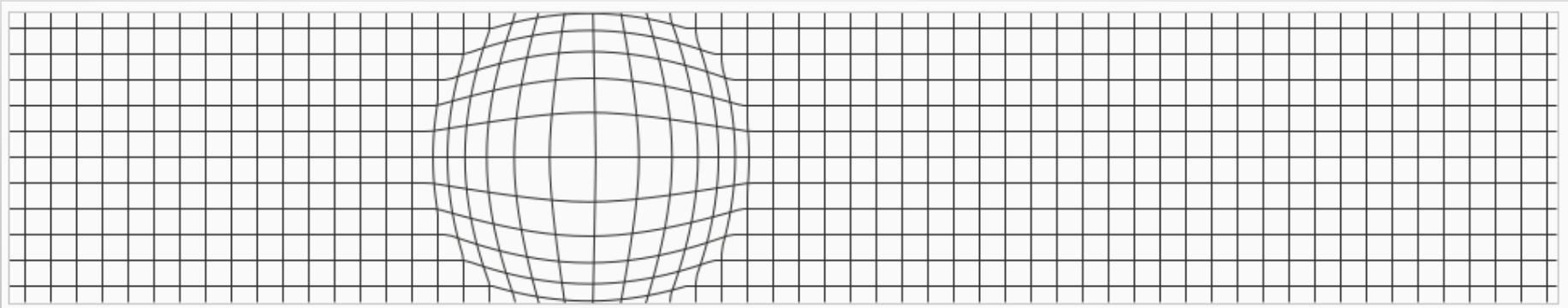
What: Data Any

How: Encode Any layout

How: Reduce Embed: distort with fisheye; single focus, local radial region, moveable lens interaction metaphor

Figures by Tamara Munzner

Distort: Fisheye Lens Vs Cartesian

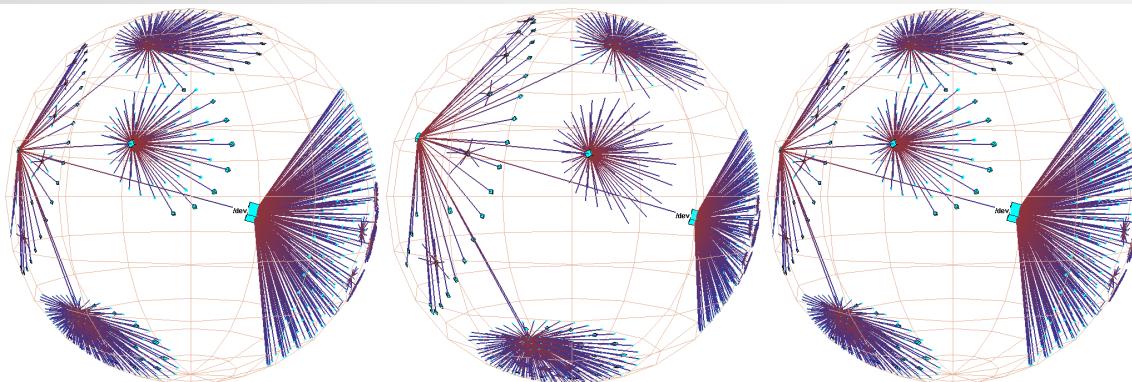


Fisheye

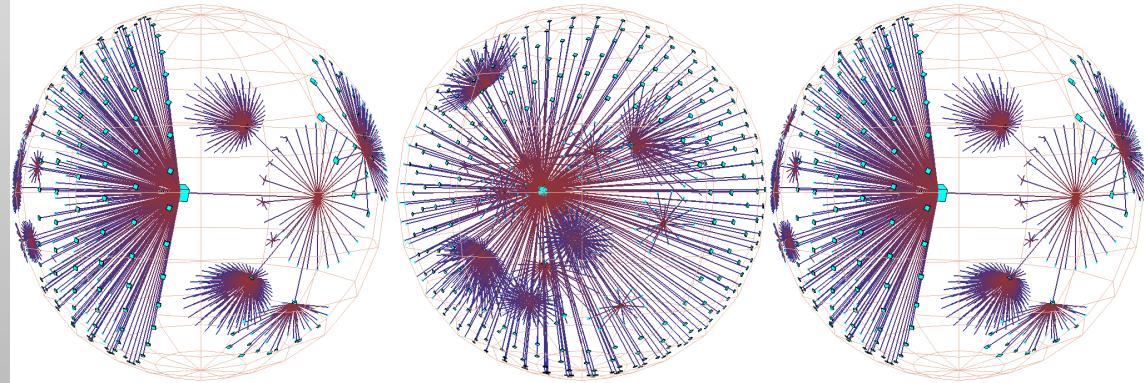
Cartesian

Strength	Local distortion	Continuous axis independent magnification Linear grid
Weakness	Compression at circumference Curved grid	Global distortion

Distort: Hyperbolic geometry



Interaction: Change in focus



3D rotation

Idiom

Hyperbolic Geometry

What: Data

Network or Tree

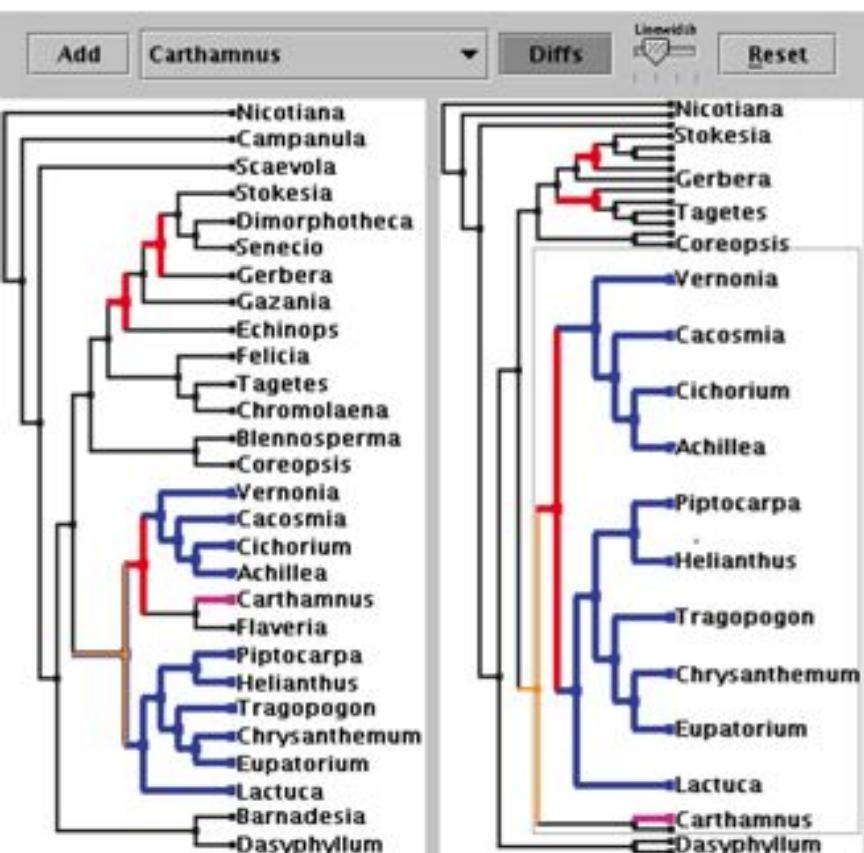
How: Encode

Hyperbolic layout

How: Reduce

Embed: distort by projecting from hyperbolic to Euclidean space; single global radial focus; hyperbolic translation interaction metaphor

Distort: Stretch and squish



(a)

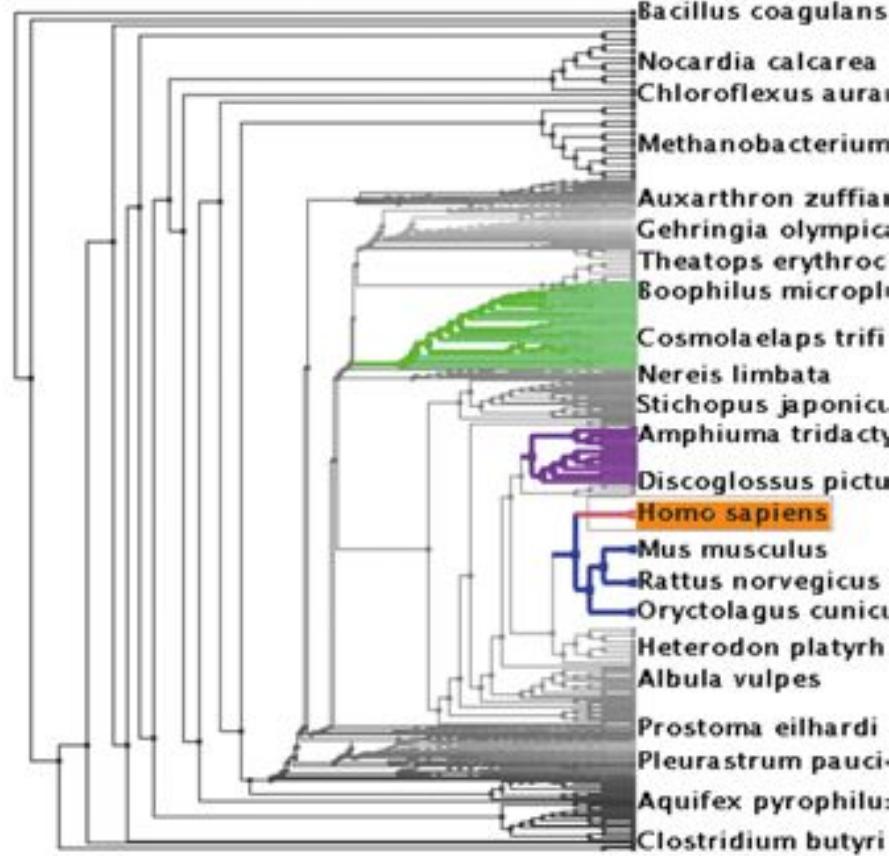
Idiom

Stretch and squish navigation

What: Data Any

How: Encode Any

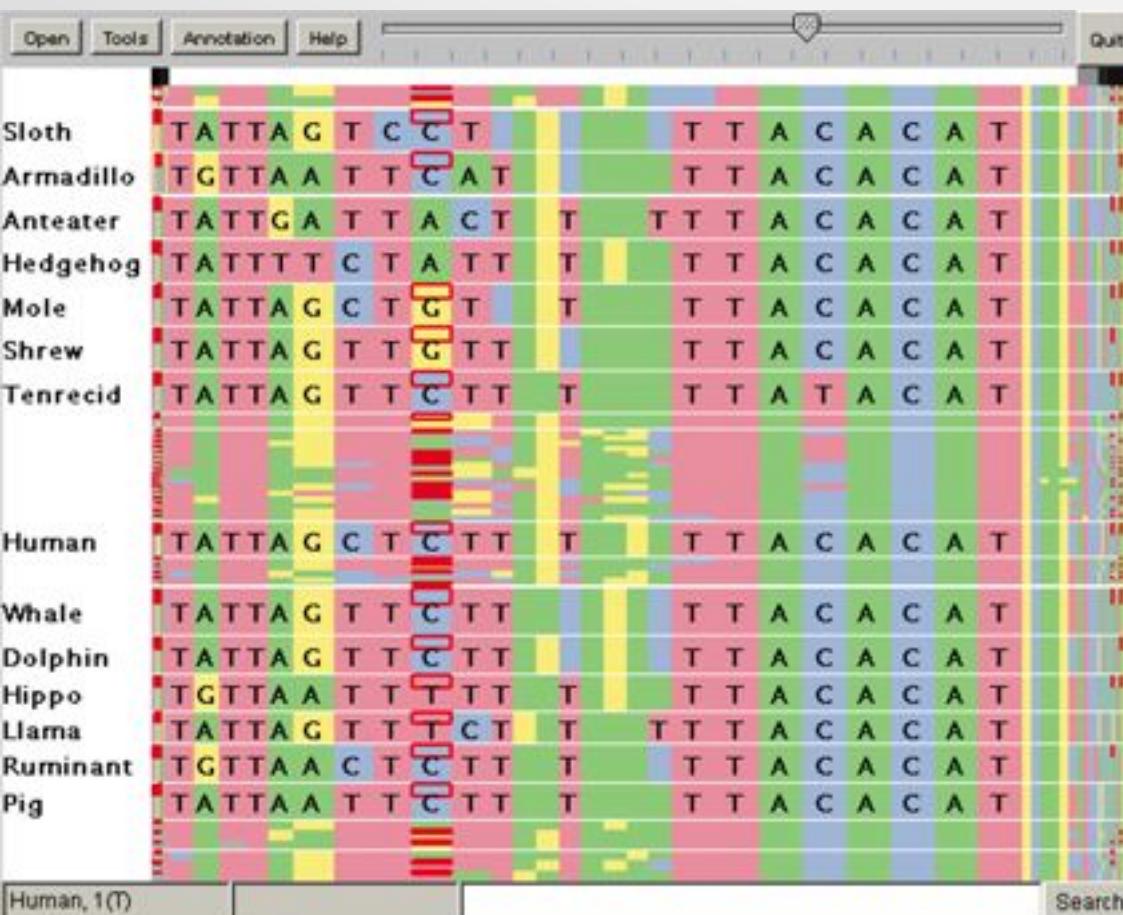
How: Reduce Embed: distort with stretch and squish; multiple foci, global rectangular regions, stretch and squish navigation interaction metaphor.



(b)

Figures by Tamara Munzner

Distort: Stretch and squish



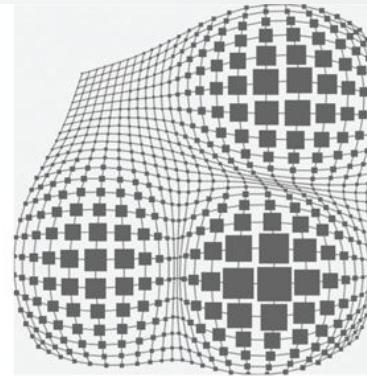
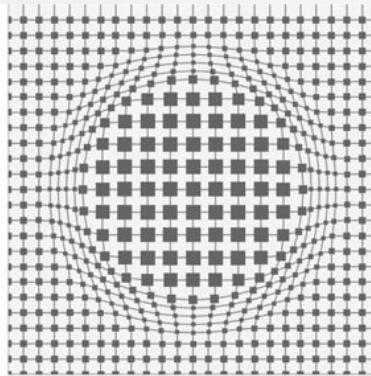
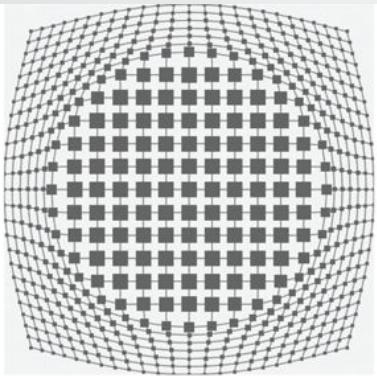
Idiom Stretch and squish navigation

What: Data Any

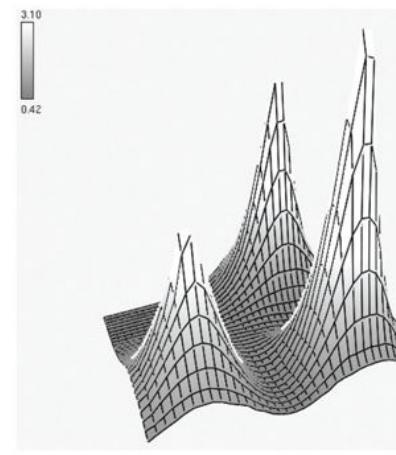
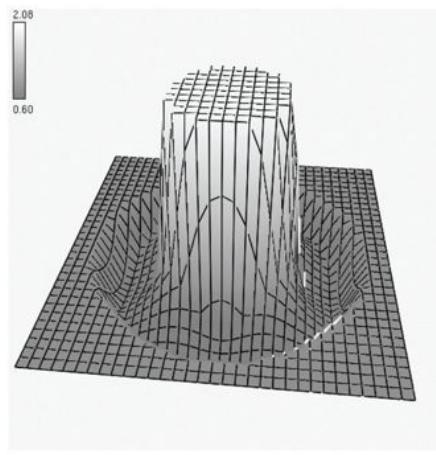
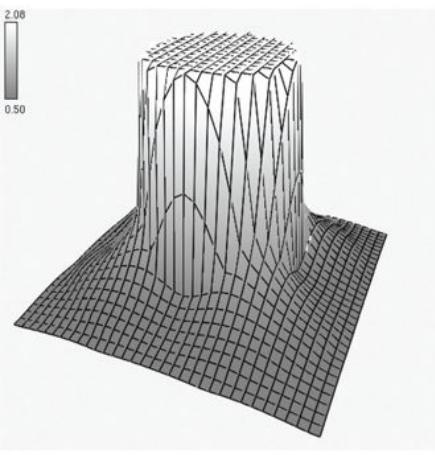
How: Encode Any

How: Reduce Embed: distort with stretch and squish; multiple foci, global rectangular regions, stretch and squish navigation interaction metaphor.

Distort: Nonlinear magnification fields



(a)



(b)

Idiom

Stretch and squish navigation

What: Data

Any

How: Encode

Any layout

How: Reduce

Embed: distort with magnification fields; multiple foci, local arbitrary regions, lens or stretch or data-driven interaction metaphors.

Distort: Pros and cons

Cons

- Length judgment severely impaired
- Users may misunderstand distortion
- Maintain object constancy – two different frames represents same object
- Remember before and after transformation

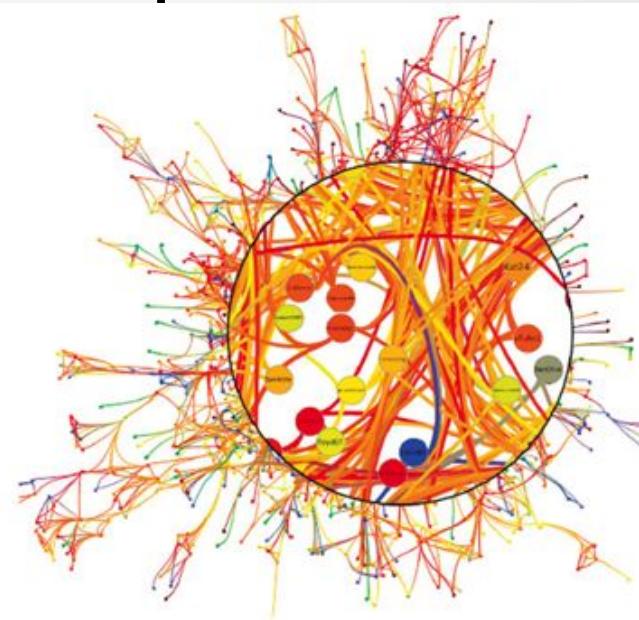
Pros

- Topological structure exploration (not dependent on length or angle)

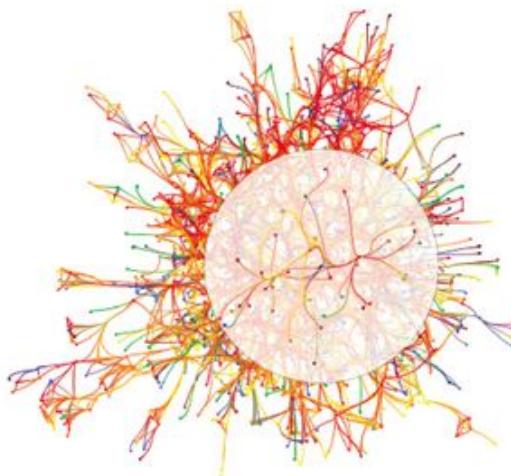
Distort: Graph exploration



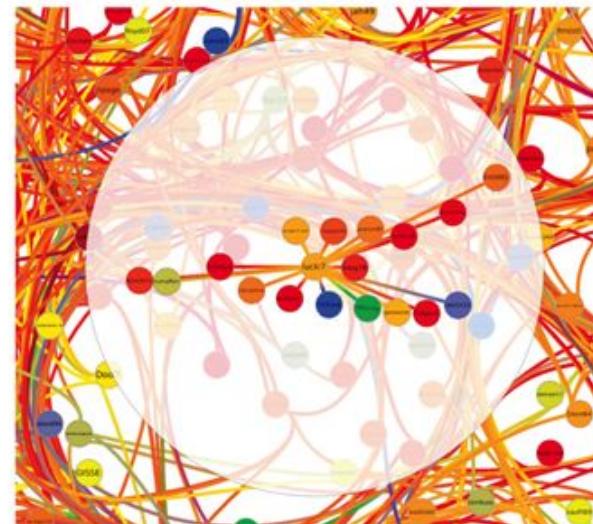
(a)



(b)



(c)



(d)

Readings

- Visual Analysis and Design – Chapter 14