

# Embed: Focus+Context

## Paper: Fisheye Followup

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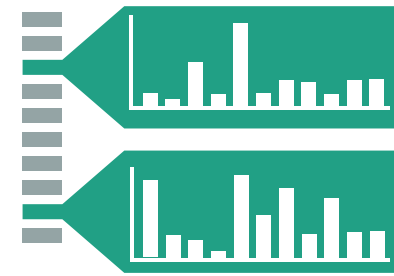
<http://www.cs.ubc.ca/~tmm/courses/547-14/#chap14>

# Embed: Focus+Context

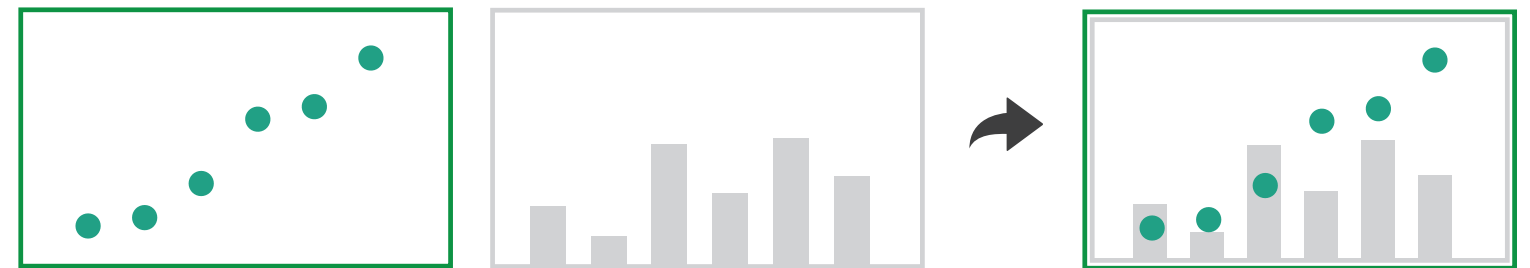
- combine information within single view
- elide
  - selectively filter and aggregate
- superimpose layer
  - local lens
- distortion design choices
  - region shape: radial, rectilinear, complex
  - how many regions: one, many
  - region extent: local, global
  - interaction metaphor

## → Embed

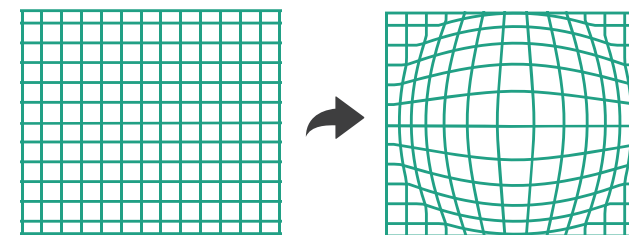
→ Elide Data



→ Superimpose Layer

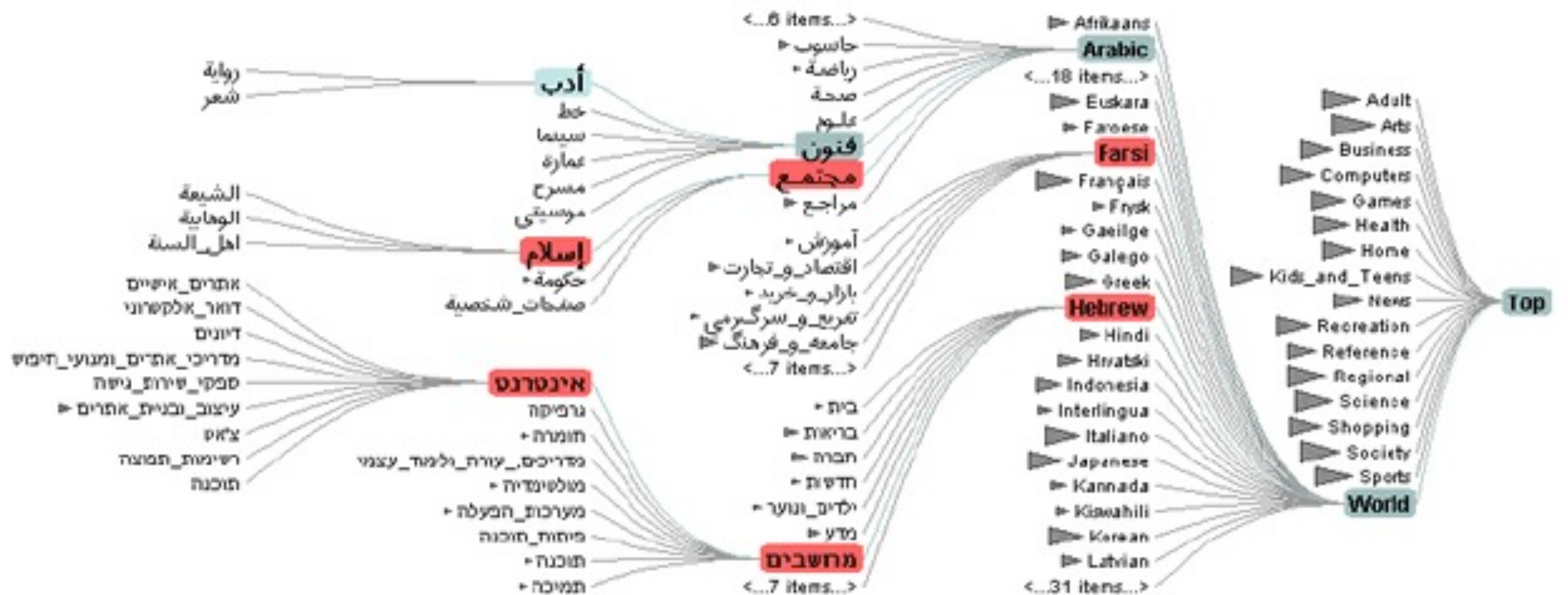


→ Distort Geometry



# Idiom: DOI Trees Revisited

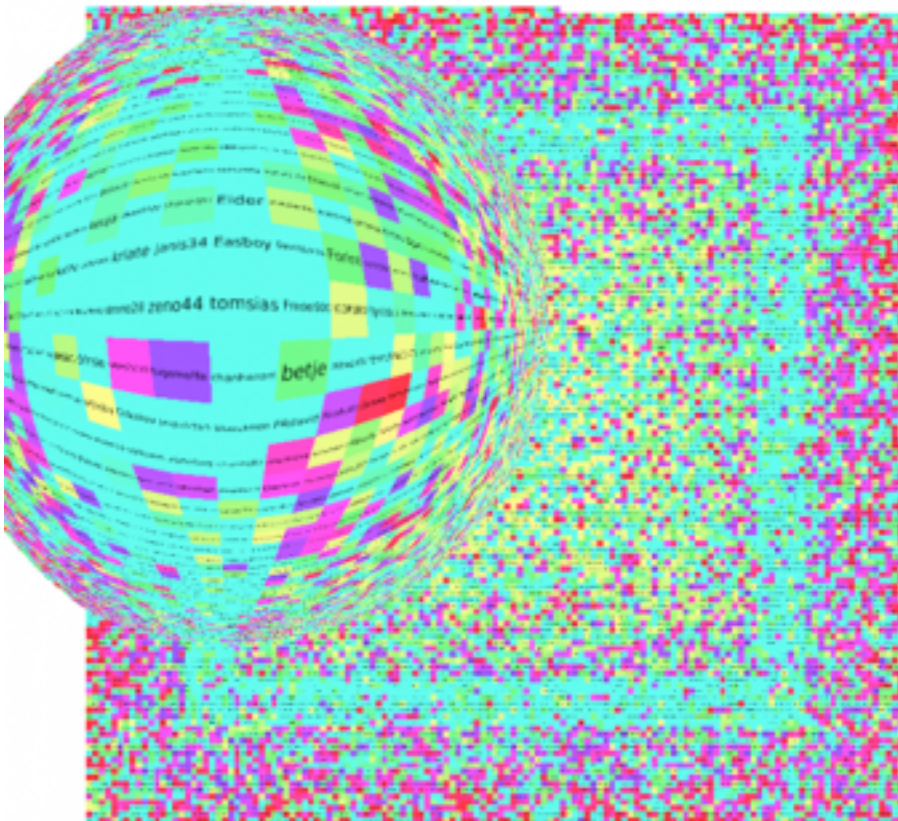
- elide
  - some items dynamically filtered out
  - some items dynamically aggregated together
  - some items shown in detail



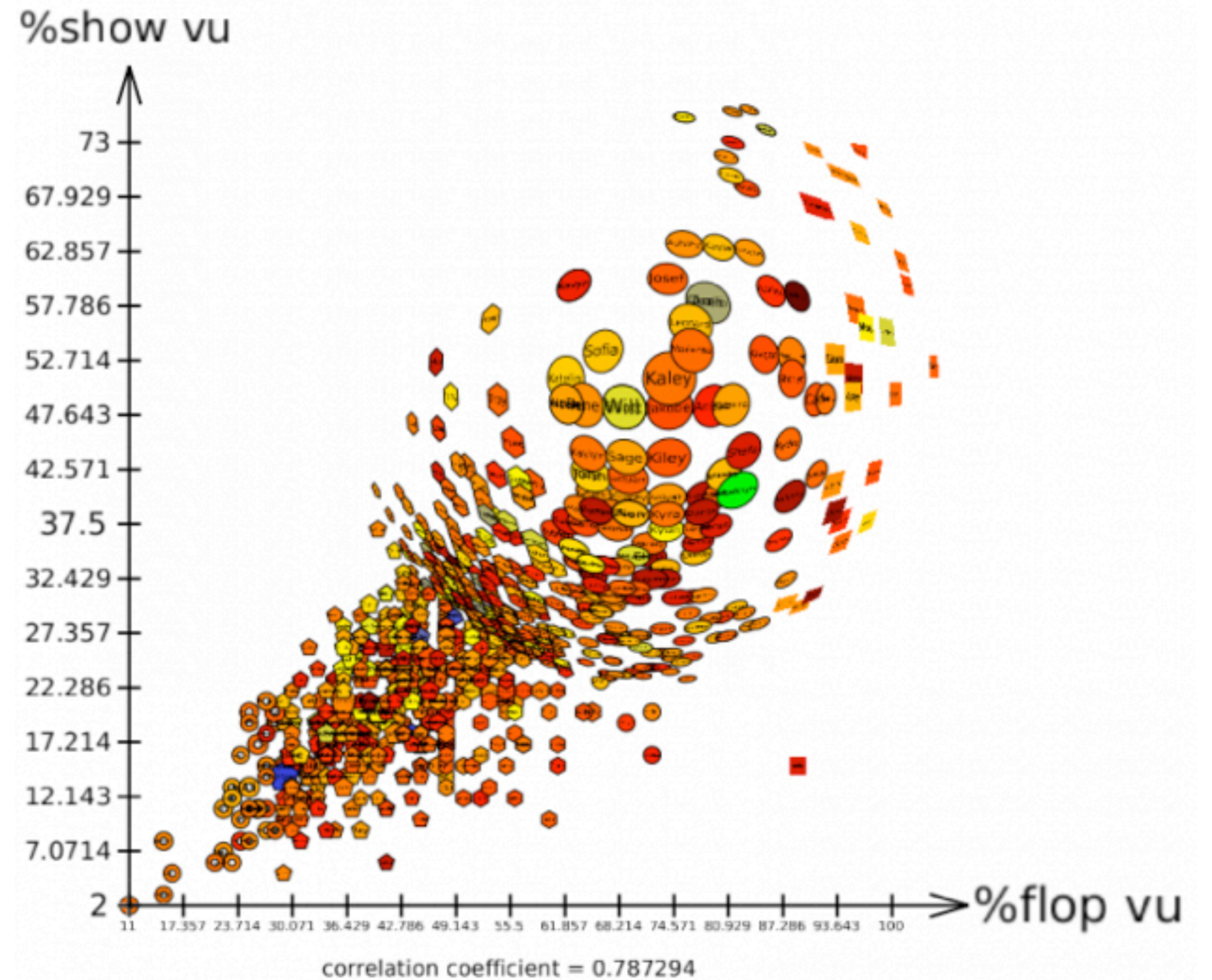


# Idiom: **Fisheye Lens**

- distort geometry
  - shape: radial
  - focus: single extent
  - extent: local
  - metaphor: draggable lens



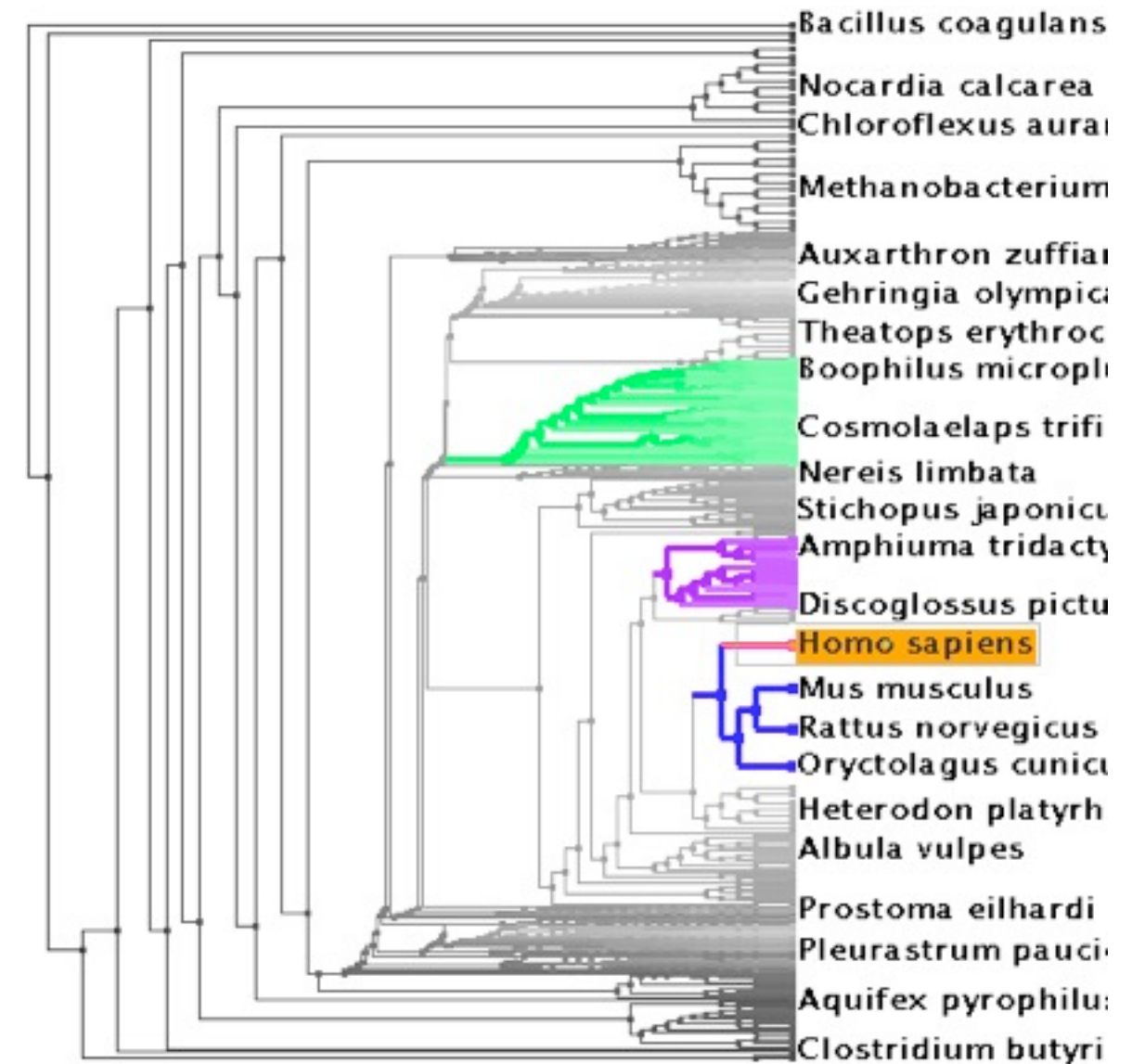
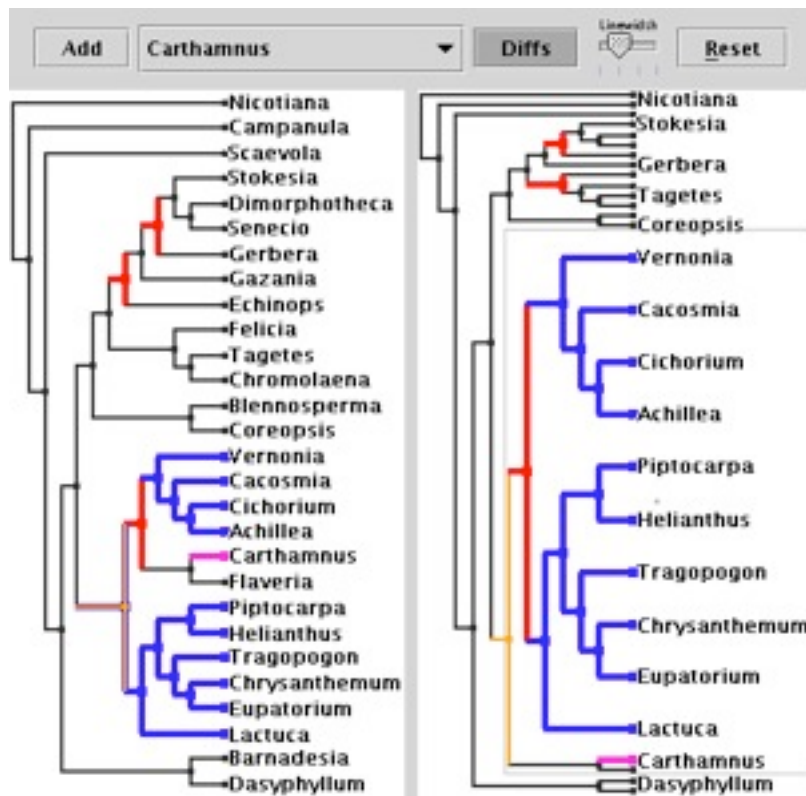
<http://tulip.labri.fr/TulipDrupal/?q=node/351>  
<http://tulip.labri.fr/TulipDrupal/?q=node/371>



# Idiom: Stretch and Squish Navigation

- distort geometry
  - shape: rectilinear
  - foci: multiple
  - impact: global
  - metaphor: stretch and squish, borders fixed

## System: TreeJuxtaposer



[TreeJuxtaposer: Scalable Tree Comparison Using Focus+Context With Guaranteed Visibility. Munzner, Guimbretiere, Tasiran, Zhang, and Zhou. ACM Transactions on Graphics (Proc. SIGGRAPH) 22:3 (2003), 453– 462.]



# Distortion costs and benefits

- **benefits**
  - combine focus and context information in single view
- **costs**
  - length comparisons impaired
    - network/tree topology comparisons unaffected: connection, containment
  - effects of distortion unclear if original structure unfamiliar
  - object constancy/tracking maybe impaired

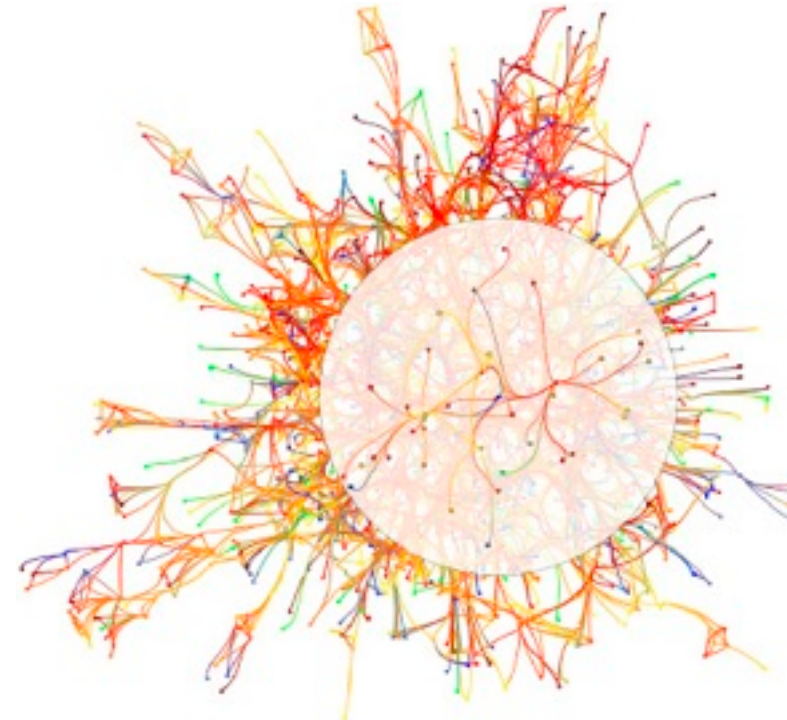
fisheye lens



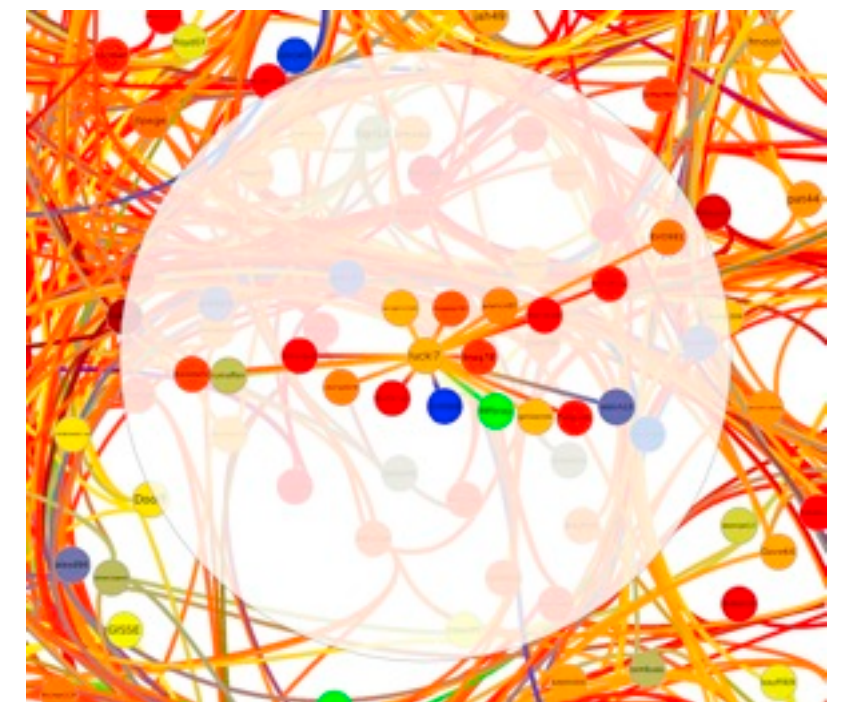
magnifying lens



neighborhood layering



Bring and Go



## Further reading

- Visualization Analysis and Design. Munzner. AK Peters / CRC Press, Oct 2014.  
– *Chap 14: Embed: Focus+Context*
- *A Review of Overview+Detail, Zooming, and Focus+Context Interfaces*. Cockburn, Karlson, and Bederson. ACM Computing Surveys 41:1 (2008), 1–31.
- *A Guide to Visual Multi-Level Interface Design From Synthesis of Empirical Study Evidence*. Lam and Munzner. Synthesis Lectures on Visualization Series, Morgan Claypool, 2010.
- *Hierarchical Aggregation for Information Visualization: Overview, Techniques and Design Guidelines*. Elmqvist and Fekete. IEEE Transactions on Visualization and Computer Graphics 16:3 (2010), 439–454.
- *A Fisheye Follow-up: Further Reflection on Focus + Context*. Furnas. Proc. ACM Conf. Human Factors in Computing Systems (CHI), pp. 999–1008, 2006.

# Fisheye Followup

- what to show vs how to show
- beyond visualization (visual encoding)
- why might users need focus and context together?

*[A Fisheye follow-up: further reflections on focus+context. George W. Furnas, CHI 2006, p 999-1008.]*

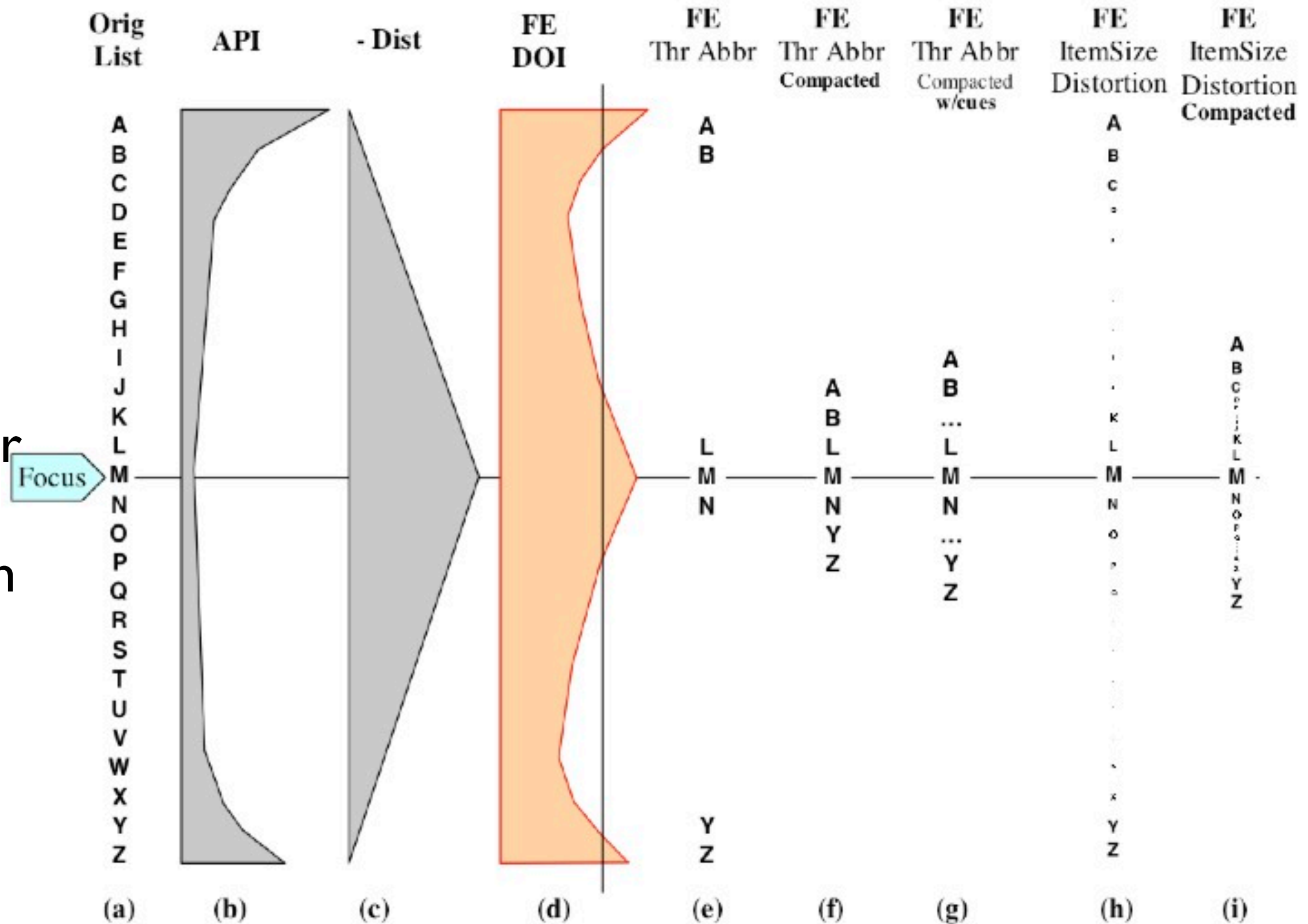


# Generalized Fisheye Views

- Degree of Interest (DOI) model
  - $DOI(\text{current}, \text{focus}) = F(\text{importance}(\text{current}), \text{distance}(\text{focus}, \text{current}))$
  - show when combination above threshold
- Furnas notation
  - API = A Priori Importance, D = Distance, c: threshold criterion
- intuition
  - DOI increases with global importance, decreases with distance from focus
- emphasis
  - selection rather than distortion
  - agnostic to geometry
  - abstraction: interest, importance, distance

# Example

- filter first
- distort layout to save space
- distortion as filter in spatial frequency domain
- size as implicit importance function



[Fig 1, *A Fisheye follow-up: further reflections on focus+context*. George W. Furnas, CHI 2006, p 999-1008.]

# Common analysis framework

- semantic/dynamic/variable zooming (ZUIs)
- multiple (overview/detail) views
  - how many multiscale levels do you need
- multiple-resolution displays
  - spatial frequency domain explicit, not implicit



# Tradeoffs

- **distortion:**
  - pro: simultaneous info display, topological continuity
  - con: geometric distortion, aspect ratios and patterns change outside focus
  - support: mental undo through grids
- **semantic/dynamic zoom**
  - pro: no geometric distortion
  - con: info spread out over time, must track previous views and time/scale location
  - support: scale indicator
- **multiple views, layers**
  - pro: simultaneous info display
  - con: topological discontinuity
  - support: indicator showing detail-overview relationship, linked cursor
- **multi-resolution displays**
  - pros: simultaneous info, no topological/geometric distortion
  - con: expensive/cumbersome hardware requirements
  - support: money, porter :-)

# Beyond Visualization

- me: visual encoding layer in particular, not “visualization” in general
- generalize
  - geometry beyond 2D/3D: lists, trees, networks, DAGs, multitrees, tables...
  - importance beyond size: high-level vs low-level
  - presentation resource: perceptual attributes (book vocab: visual channels)
    - color/sound vs size/resolution
- requirements
  - reasonably static structure with notion of distance
    - text bag-of-words model (as discussed last time)
    - PageRank as GF: recursive linked-to weights as importance
  - independent LOD/importance for different parts of structure
  - interaction focused on point or small region

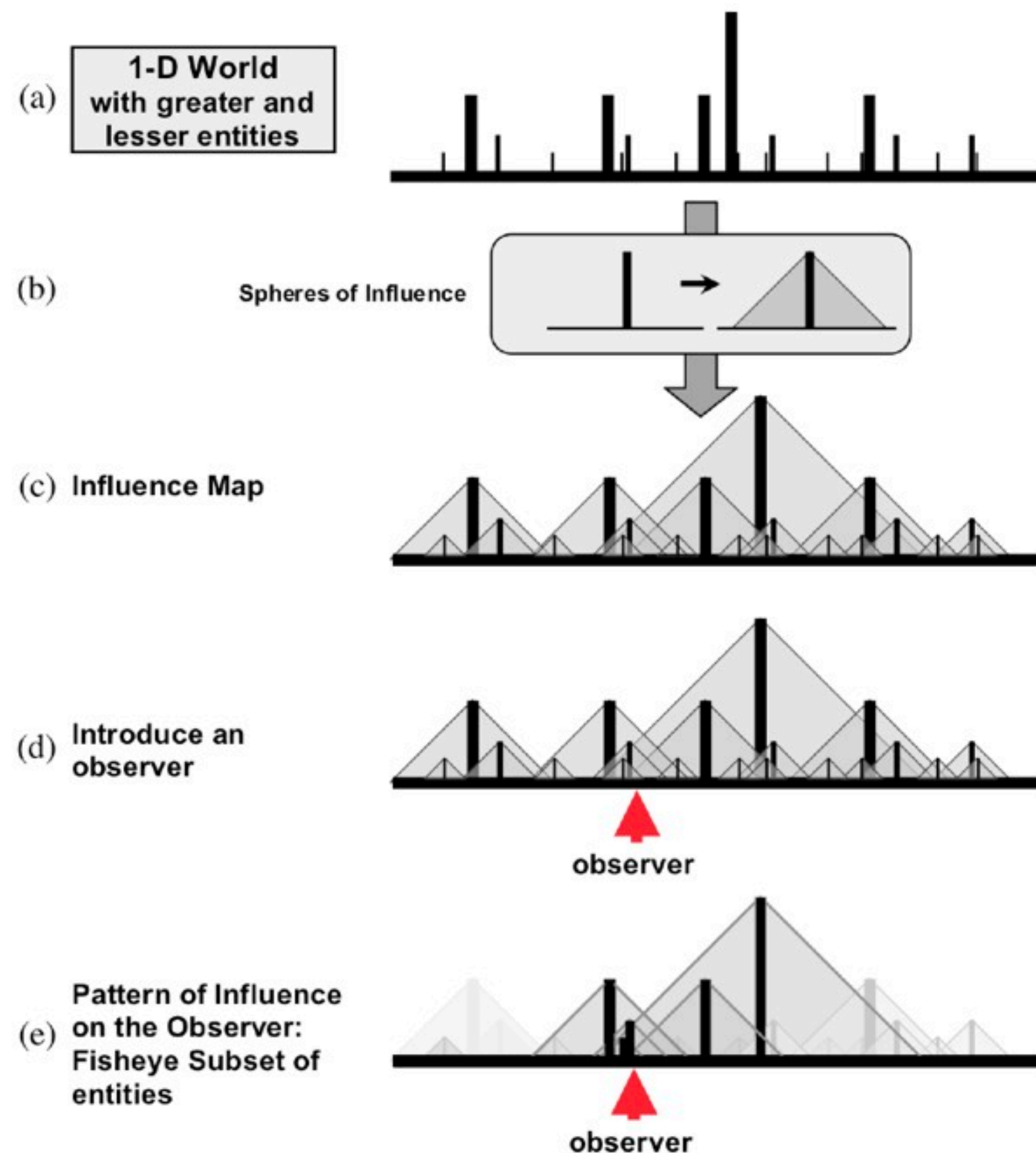
# Multiple Hypotheses

- spheres of influence



# Spheres of Influence

- spheres of influence model
  - has influence on
  - is influenced by



[Fig 2, *A Fisheye follow-up: further reflections on focus+context*. George W. Furnas, CHI 2006, p 999-1008.] 15

# Multiple Hypotheses

- spheres of influence
- nested nearly decomposable systems
  - couplings within subsets strong, between subsets weak but not non-existent
    - remote things need lower spatial and lower temporal resolution
- effective view navigation argument
  - total navigational information at given node will tend to be FE-DOI
- neurological analogs
  - fovea+periphery in human vision
    - periphery gets lower spatial but higher temporal resolution
  - human memory