# Information Visualization

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**Abstract, multidimensional, multi-type info with no simple physical (2D or 3D) analog**


**1. Introduction**

**2. Hierarchies**

**3. Fisheye and distortion**

**4. Multiscale**

**5. Graph drawing**

**6. Statistical graphics**

**7. Interaction**

**8. Animation**

**9. Systems**

# Why Computers?
## *Class Ideas*

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- **Experiment with designs**
- **Eliminate tedious work**
- **Animation**
- **Large range of scales**
- **That's where the data is**
- **That's where the data is going**
- **Interaction**
- **Precision**
- **Automate**
- **Large amounts of data**

# Why Computer?

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- **Complexity**
  - **size**
  - **diversity**
  - **rate**
- **Precision**
- **Tedium**
- **Digital media**
- **Interaction**
- **Animation**

Given these characteristics/constraints,
How would Tufte's rules be augmented?

# Hierarchies

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- **Examples**
  - **Organizational charts**
  - **Directory structure**
  - **Class hierarchies**
  - **Abstractions**
- **Techniques**
  - **Outlines: Apple finder**
  - **Tree: Org charts**
  - **Treemaps**
  - **Cone trees**

**Figures**

- **4 visualizations (Shneiderman)**
- **Slice and dice treemap (Johnson)**
- **Cone tree display (RMC'91)**
- **Cone tree of the www (RMC'91)**

# Distortion

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- **Problem**
  - **Small displays / Large information spaces**
  - ***Tunnel vision***
  - ***Seeing the forest through the trees***
  - ***The devil is in the details***
- **Views**
  - **local detail or focus**
  - **global context**
- **Taxonomy**
  - **Multiple windows (overview and detail)**
  - **Fisheye lens or selective distortion**
  - **Pan and zoom**

See "A review and taxonomy of distortion-oriented presentation techniques," Y.K. Leung, M.D. Apperley, *ACM Trans. CHI* 1(2), 126-160, 1994.

# Fisheye Techniques

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- **Bifocal display**
  - **Spence and Apperley ‘81**
- **Generalized fisheye**
  - **Furnas ‘86**
- **Perspective wall**
  - **Mackinlay, Card, Robertson ‘91**
- **Fisheye views of graphs**
  - **Sarkar and Brown ‘92**
- **Rubber sheet**
  - **Sarkar, Snibbe, Tversky, Reiss ‘93**
- **Pliable surfaces**
  - **Lamping and Rao ‘95 (2D)**
  - **Munzner and Burchard ‘95 (3D)**

# Semantic Zoom

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## Degree of interest + importance = Level of detail

## Zoom

- Items shrink as they move out of focus
- Remove items as a function of lod
- Simplify

## Example: document

- pixel
- rectangle
- lines of text (colored dots for each character)
- Scott Kim's "block characters"
- character glyphs

# Scale-Space Diagrams

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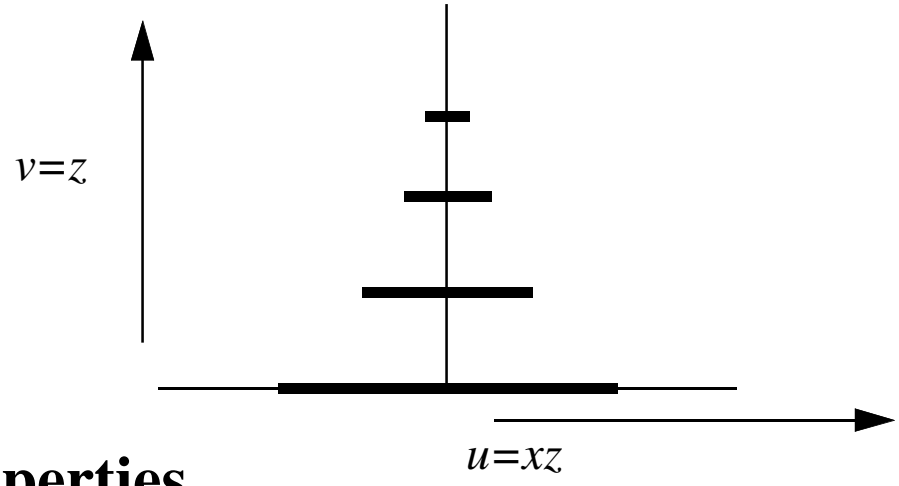
## Furnas and Bederson CHI '95




## Properties

1. **Pans and zooms are trajectories**
2. **Simultaneous pan and zoom**
   - **straight path is a quadratic zoom**
3. **Shortest path in pan-zoom space**
   - **Information: pan = $d\beta$, zoom = $d\beta \log r$**
   - **Path: zoom out, pan over, zoom in**
4. **Scale-space editing of lod**
5. **Fisheye distortions as curved windows**