

Zooming, Focus + Context, and Distortion

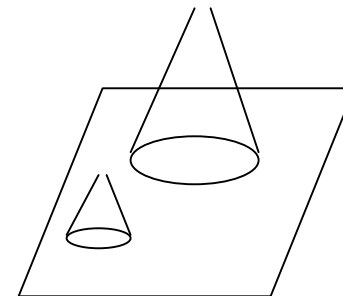
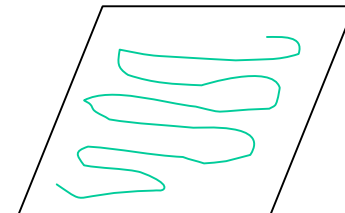
- Large amount of data in small space
- Maximize use of screen real estate
- Allow examination of a local area in detail within context of the whole data set
- Today's tools use one, two or all three of these techniques

Zooming

- Zoom in: ability to see a portion in detail while seeing less of the overall picture
- Zoom out: see more of overall picture, but in less detail
- Animation (also provides Focus+Context)

Pad + +

- A toolkit
 - (superceded by Piccolo, nee Jazz)
 - <http://www.cs.umd.edu/hcil/piccolo/index.shtml>
 - <http://www.cs.umd.edu/hcil/piccolo/applications/index.shtml>
- An infinite 2D plane
- Can get infinitely close to the surface too
- Navigate by panning and zooming
- Pan:
 - move around on the plane
- Zoom:
 - move closer to and farther from the plane



Semantic Zooming

- Geometric (standard) zooming:
 - The view depends on the physical properties of what is being viewed
- Semantic Zooming:
 - When zooming away, instead of seeing a scaled-down version of an object, see a different representation
 - The representation shown depends on the meaning to be imparted.

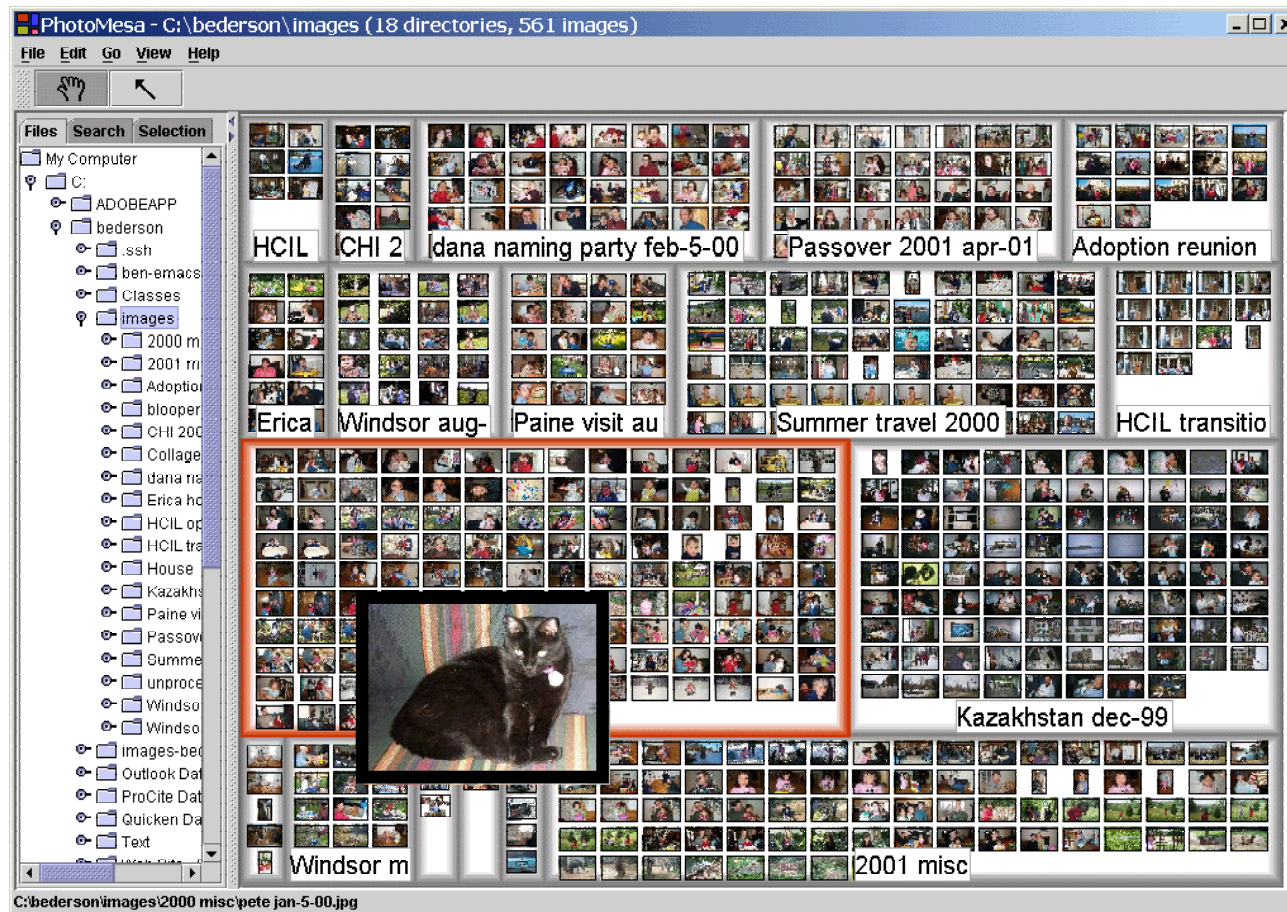
Examples of Semantic Zoom

- Infinitely scalable painting program
 - close in, see flecks of paint
 - farther away, see paint strokes
 - farther still, see the wholistic impression of the painting
 - farther still, see the artist sitting at the easel

Examples of Semantic Zoom

- Information Maps
 - zoom into restaurant
 - see the interior
 - see what is served there
 - maybe zoom based on price instead!
 - see expensive restaurants first
 - keep zooming till you get to your price range
- Browsing an information service
 - Charge user successively higher rates for successively more detailed information

PhotoMesa



<http://www.cs.umd.edu/hcil/photomesa>

PhotoMesa Interface

PhotoMesa: A Zoomable Image Browser Using Quantum Treemaps and Bubblemaps, B. Bederson, UCM UIST 2001

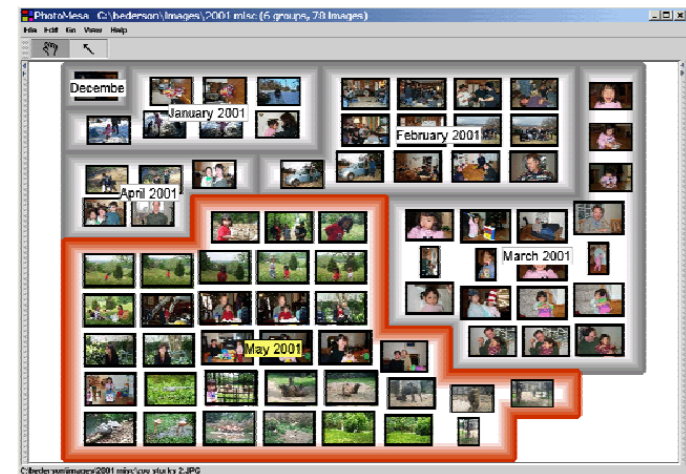
- Zooming is primary presentation mechanism
- Zoom in, zoom out on levels of thumbnails
- Quickly drill down to individual picture (at full resolution)
- Outline shows area of next zoom level
- History of views
- Thumbnail zooms up when hover w/cursor
- Export images
- Cluster by filename

PhotoMesa Goals

- Automatically lay out images
- Use immediately – little setup time
- Large set of images in context
- Default groupings are by directory, time, or filename
 - No hierarchy
 - Makes managing photos difficult: can delete, but reorganization a problem
- Can add metadata

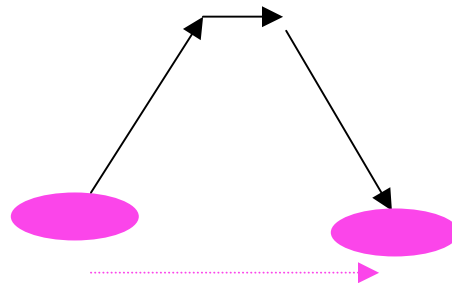
Bubblemaps

- Like Quantum Treemaps, elements guaranteed to be same size
- Arbitrary shapes
- No wasted space
- May be harder to visually parse than QT



Navigation in Pad++

- How to keep from getting lost?
 - Animate the traversal from one object to another using “hyperlinks”
 - If the target is more than one screen away, zoom out, pan over, and zoom back in
 - Goal: help user maintain context



Speed-Dependent Zooming

Speed-dependent Automatic Zooming for Browsing Large Documents, T. Igarashi, K. Hinckley, UIST 2000.

- Navigation technique that integrates rate-based scrolling with automatic zooming.
- Adjust zoom level automatically to prevent “extreme visual flow”
 - Automatically zoom out when going fast, zoom in when slowing down
 - Uses semantic zooming to provide context
- Applied to
 - Large Documents (successful in a small study)
 - Image Collection (not successful)
 - Maps (mixed, needs work)
 - Dictionary (not successful)
 - Sound Editor (not successful)
- Demo and Movie:

<http://www-ui.is.s.u-tokyo.ac.jp/~takeo/research/autozoom/autozoom.htm>

Is it useful?

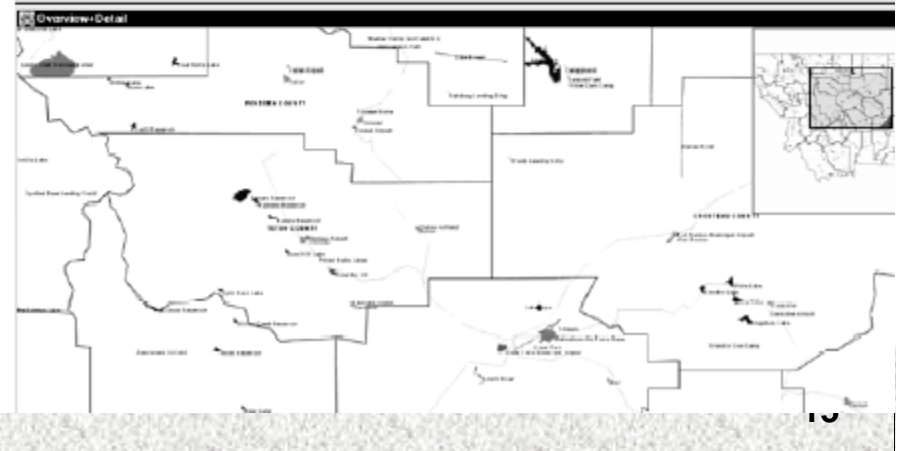
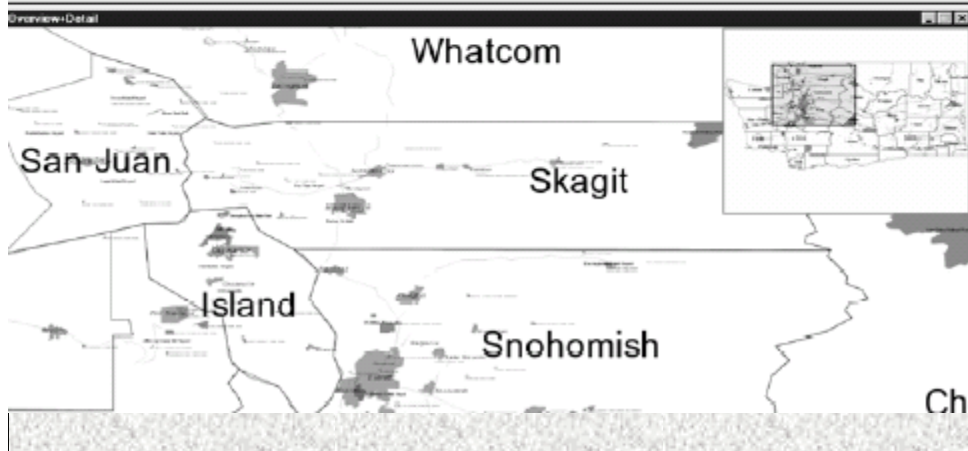
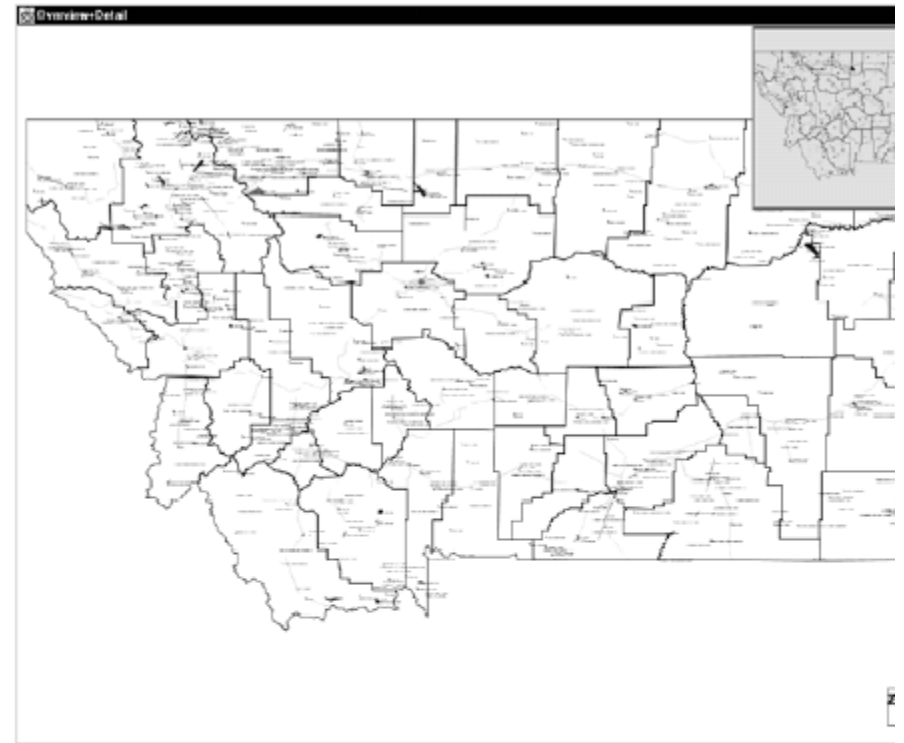
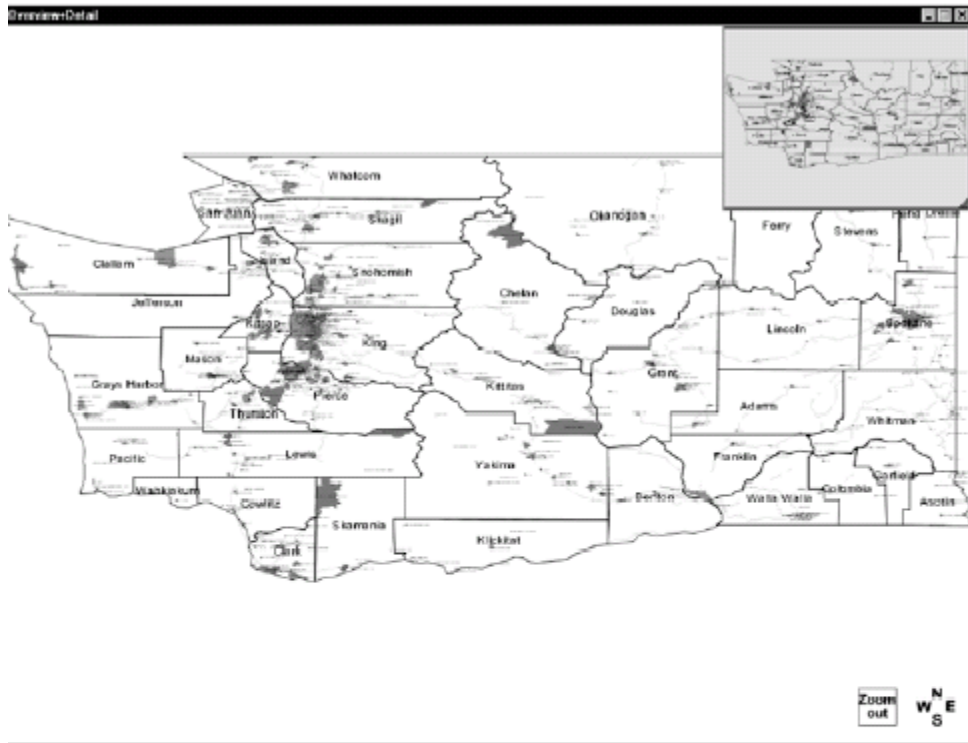
- Is panning and zooming useful?
 - Is it better to show multiple simultaneous views?
 - Is it better to use distortion techniques?
- Would keeping a separate global overview help with navigation?

Study of Overview + Detail

- K. Hornbaek et al., Navigation patterns and Usability of Zoomable User Interfaces with and without an Overview, ACM TOCHI, 9(4), December 2002.
- A study on integrating Overview + Detail on a Map search task
 - Incorporating panning & zooming as well.
 - They note that panning & zooming does not do well in most studies.

Overview + Detail

K. Hornbaek et al., Navigation patterns and Usability of Zoomable User Interfaces with and without an Overview, ACM TOCHI, 9(4),



Overview + Detail

- K. Hornbaek et al., Navigation patterns and Usability of Zoomable User Interfaces with and without an Overview, ACM TOCHI, 9(4), December 2002.
- Results seem to be
 - Subjectively, users prefer to have a linked overview
 - But they aren't necessarily faster or more effective using it
 - Well-constructed representation of the underlying data may be more important.
- More research needed as each study seems to turn up different results, sensitive to underlying test set.

Distortion-based Techniques

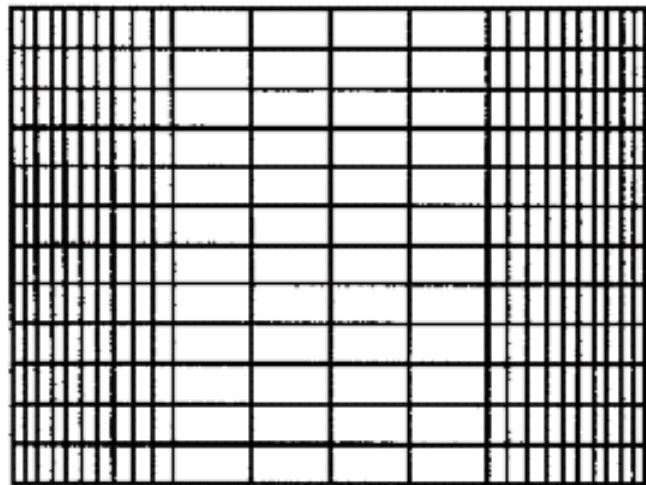
Leung & Apperley:

Unified theory of distortion techniques

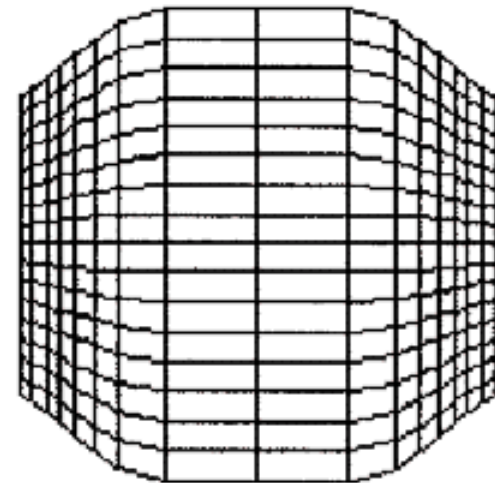
- Techniques aim to solve problems of presenting large amounts of data in a confined space.
- "...stretchable rubber sheet mounted on a rigid frame"
- Stretching = Magnification
- Stretching one part must equal shrinkage in other areas

Piecewise Non-Continuous Magnification Functions

- Bifocal Display, Perspective Wall



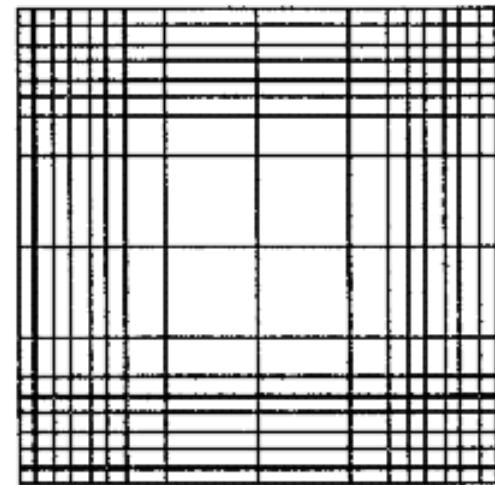
Bifocal Display



Perspective Wall

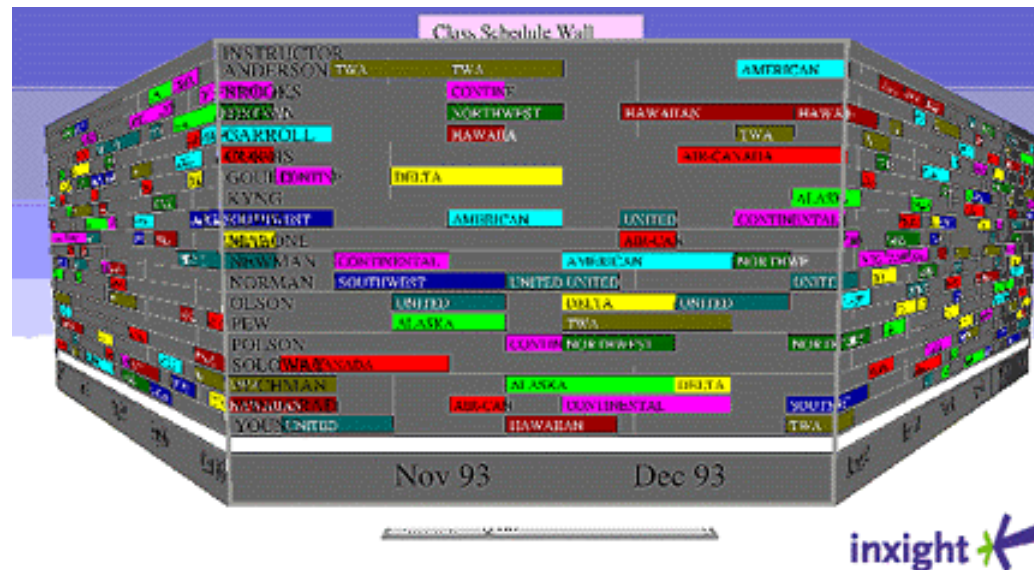
Bifocal Display

- Combination of detail view and two distorted side views
- Can be applied in 2D
 - Since the corners are distorted by the same amount in x and y, it's just scaled, not distorted



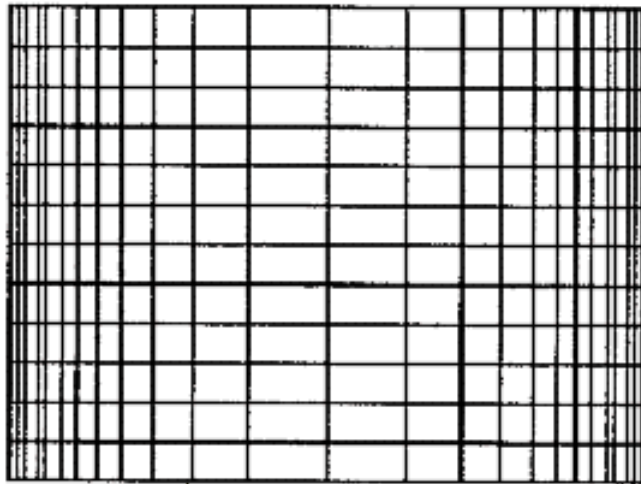
Perspective Wall

- Similar to Bifocal, except demagnifies at increasing rate, while Bifocal is constant
- Visualizes linear information such as timeline
- Adds 3D but uses excess real estate on screen

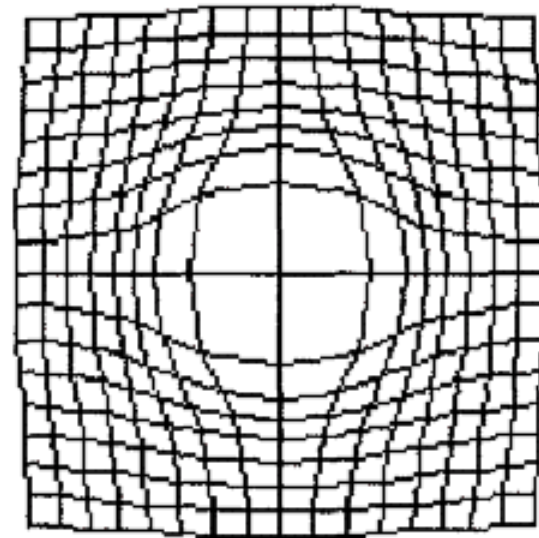


Continuous Magnification Functions

- **Fisheye View, Polyfocal Display**
 - Can distort boundaries because applied radially rather than x y



1D Fisheye



2D Polyfocal

Fisheye Menu

Fisheye Menus, B. Bederson, in the Proceedings of ACM UIST 2000, pp. 217-226.

- Dynamically change the size of a menu item to provide a focus area around the mouse pointer, while allowing all menu items to remain on screen
- All elements are visible but items near cursor are full-size, further away are smaller
- “Bubble” of readable items move with cursor

Fisheye

- A**
 - Advanced Shopping
 - Expedia Travel
 - Fashion Mall
 - FreeAgent
 - Free Merchant Business
 - Free Shop
 - Furniture
- B**
 - Garden
 - Gateway 2000
- C**
 - Georgia Tech
- D**
 - Google Search
- E**
 - Guru Net
- F**
 - HiFi
- G**
 - HotBot Search
- I**
 - HotJobs
- M**
 - Hot Office
- N**
 - ICQ Online Communication
- P**
 - Info Space
- S**
 - Internet Movie Database
- T**
 - iQVC Shopping
- U**
 - Land's End
 - Lonely Planet
- W**
 - Lycos
 - Massachusetts Institute of Technology
 - McAfee Anti-Virus
 - Mercola Shopping
 - WindSpring ISP
 - Windows Ad Search
- X**
 -
- Y**
 -
- Z**
 -

Fisheye Menu

<http://www.cs.umd.edu/hcil/fisheyemenu/fisheyemenu-demo.shtml>

Fisheye Menu

- Distortion Function
 - Maximum font size
 - Focus length (number of items at full size)
 - Together these control the trade-off between the number of items at full size and the size of the smallest item
 - Focus length ↑ small items ↓ distortion ↑
- Alphabetic Index
 - Indexes can decrease search time
 - Index is positioned so that if cursor is aligned with it, the item will be the first one for that letter
 - Initial design had current position, but this was confusing because it moved

Focus Lock

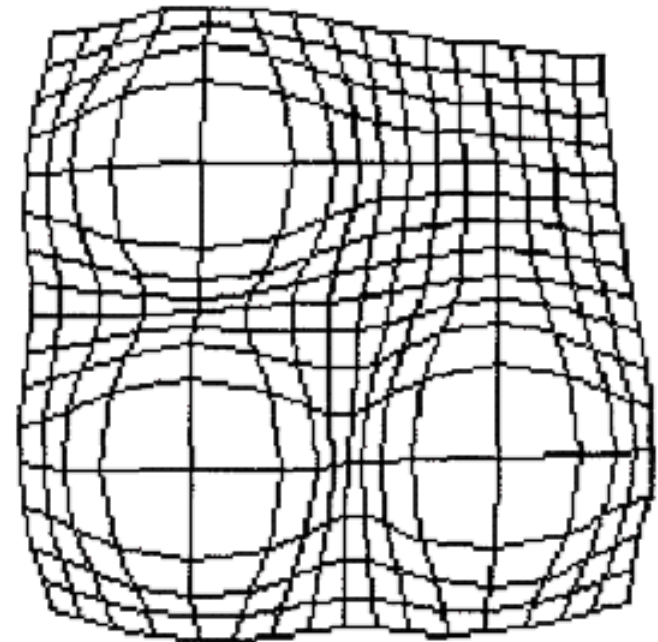
- Item are difficult to select because small mouse movements result in change of focus
- “Focus Lock” allows user to freeze focused area and move mouse freely
 - If cursor moves outside focus area, the area will expand, and perhaps push ends off the screen

Evaluation

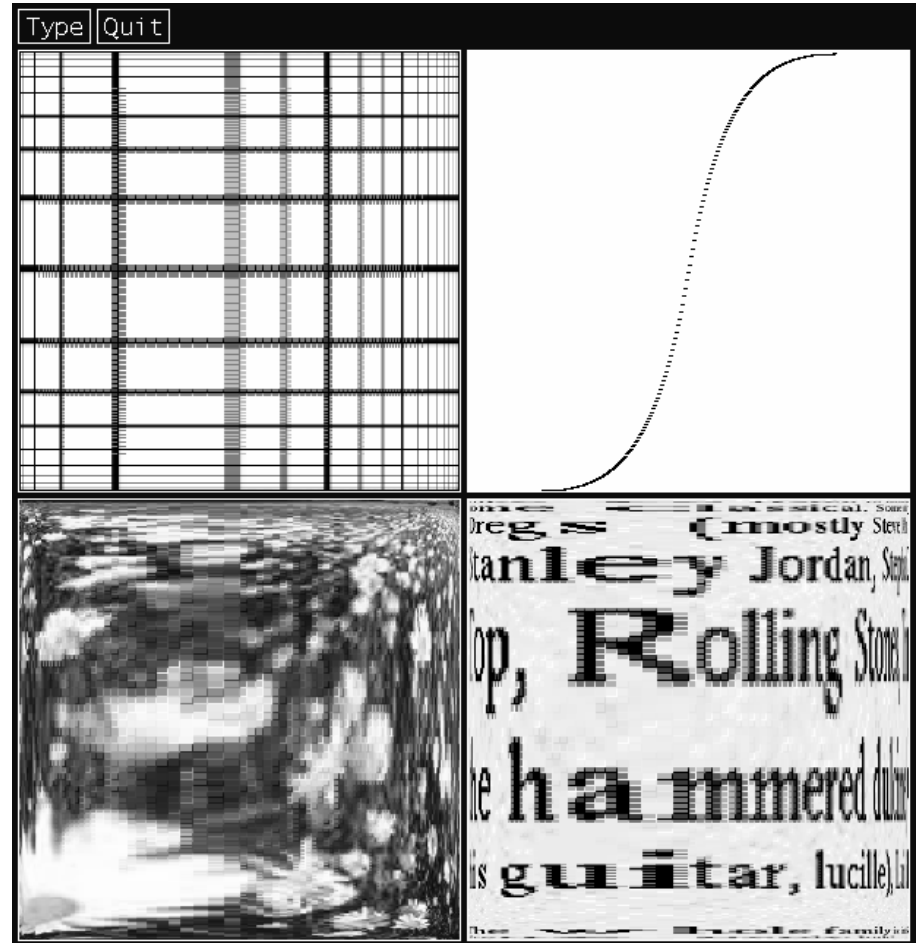
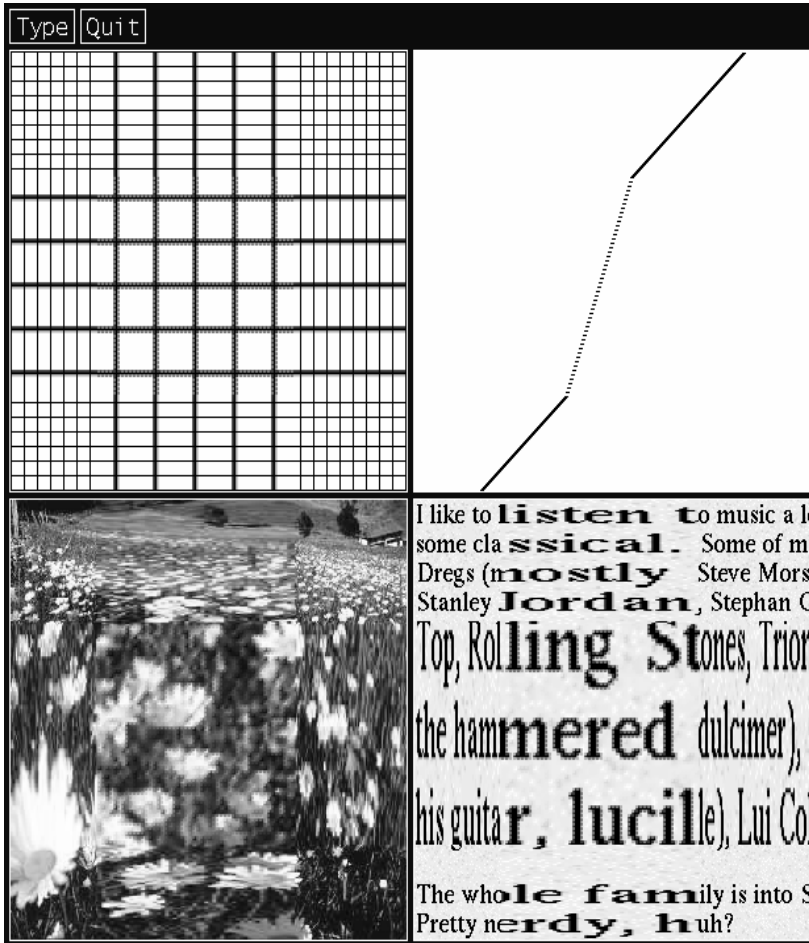
- Small 10 person test, ½ programmers
 - Compared hierarchy, fisheye, scrollbar, and arrow bar (scrolling arrows)
 - Looking for trends
- Results
 - Hierarchy was best for goal-directed task
 - Fisheye preferred for browsing
 - Not significantly though
 - Non-programmers rated it much lower than programmers
 - Only one person discovered Focus Lock
 - Index was thought to be interactive

Polyfocal Display

- Highest peak is focus of display
- Distorts shape of boundaries
- Troughs surrounding peaks are highly distorted and can effectively be shrunk to nothing



Comparisons



Bifocal View

Slide adapted from Hornung & Zagreus

Polyfocal View

Focus + Context

- Can go hand-in-hand with distortion – like fisheye
- Works with zooming if animated – Photomesa
- “Allows dynamic interactive positioning of the local detail without severely compromising spatial relationships.”
 - *Leung & Apperley*
- “One challenge in navigating through any large dataspace is maintaining a sense of relationship between what you are looking at and where it is with respect to the rest of the data.”
 - *Bederson & Hollan*