Navigation/Zooming

Lecture 12 CPSC 533C, Fall 2004

Tamara Munzner

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Reading

(from before) Ware, Chap 10 [navigation]

Tufte, Chap 2: Macro/Micro

Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics
Ben Bederson, and James D Hollan, Proc UIST 94.

Space-Scale Diagrams: Understanding Multiscale Interfaces
George Furnas and Ben Bederson, Proc SIGCHI 95.

Speed-Dependent Automatic Zooming for Browsing Large Documents
Takeo Igarashi and Ken Hinckley, Proc. UIST 00, pp. 139-148.

Smooth and Efficient Zooming and Panning.
Jack J. van Wijk and Wim A.A. Nuij, Proc. InfoVis 2003, p. 15-22

Further Reading

Rapid Controlled Movement Through a Virtual 3D Workspace
Jock Mackinlay, Stuart Card, and George Robertson. Proc SIGGRAPH '90, pp 171-176.

Effective View Navigation, George W. Furnas, Proc. SIGCHI 97, pp. 367-374

Critical Zones in Desert Fog: Aids to Multiscale Navigation, Susanne Jul and George W. Furnas, Proc. UIST 98

Design Guidelines for Landmarks to Support Navigation in Virtual Environments
Norman G. Vinson, Proc. SIGCHI 99.

newly added:

Tuning and testing scrolling interfaces that automatically zoom
Andy Cockburn, Joshua Savage, Andrew Wallace. Proc CHI 05.

What Kind of Motion?

rigid
- rotate/pan/zoom
- easy to understand
- object shape static, positions change

morph/change/distort
- object evolves
  beating heart, thunderstorm, walking person
- multiscale/ZUI
  object appearance changes by viewpoint
- focus+context
  carefully chosen distortion

Ware Chapter 10 - Spatial Navigation

world in hand
- good: spinning discrete objects
- bad: large-scale terrain

eye in hand
- explicitly move camera

walking
- real-world walking
- terrain following

flying
- unconstrained 6DOF navigation

other: constrained navigation!

Rapid Controlled Movement

move to selected point of interest
- normal to surface, logarithmic speed

trajectories as first-class objects

[video]

Spatial Navigation

real navigation only partially understood
- compared to low-level perception, JNDs

spatial memory / environmental cognition
- city: landmark/path/whole

implicit logic
- evolved to deal with reality
- so we'll learn from synthetic worlds

- but we can't fly in 3D...

how much applies to synthetic environments?
- even perception not always the same!

Design Guidelines for VE Landmarks

Ware's derived guidelines
- enough so always can see some
- visually distinguishable from others
- visible and recognizeable at all scales
- placed at major paths/junctions

others, only some of of these crossover for infovis!
- need all 5 types of landmarks
  path,edge,district,node,landmark
- concrete not abstract
- asymmetry: different sides looks different
- clumps
- different from "data objects"
- need grid structure, alignment

Macro/Micro

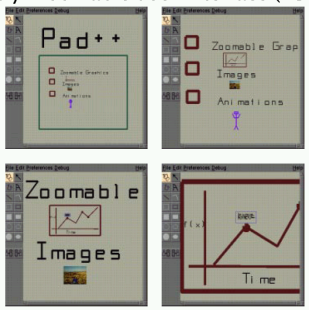
classic example: map
- arms-length vs. up-close

paper vs. computer screen
- 300-600 dpi vs. 72 dpi (legally blind)
- finally changing

possibly available for projects
- 22" 200dpi IBM T221 display
- 9 Mpixels (4000x2000)

Pad++

"infinitely" zoomable user interface (ZUI) [video]



[Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics Bederson and Hollan, Proc UIST 94]

Space-Scale Diagrams

reasoning about navigation and trajectories

Space-Scale Diagrams: Understanding Multiscale Interfaces
George Furnas and Ben Bederson, Proc SIGCHI '95.

www.cs.umd.edu/hcil/pad++/papers/chi-95-spacescale/chi-95-spacescale.pdf

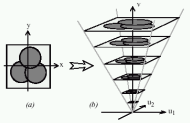
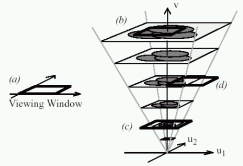
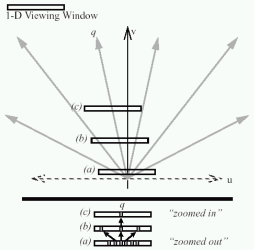


Figure 1. *The basic construction of a Space-Scale diagram from a 2D picture.*

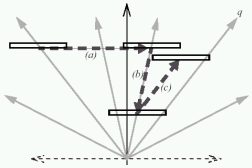
Viewing Window



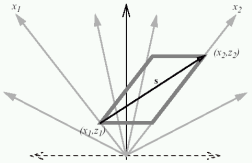
1D Version



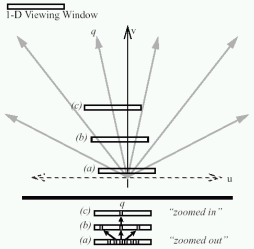
Pan-Zoom Trajectories



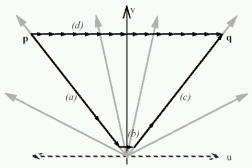
Joint Pan-Zoom Problem



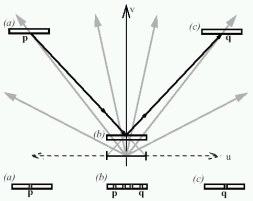
Shortest Path?



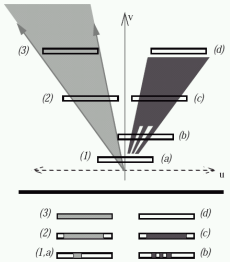
Shortest Path



Shortest Path, Details



Semantic Zooming



Speed-Dependent Automatic Zooming

Speed-Dependent Automatic Zooming for
Browsing Large Documents
Takeo Igarashi and Ken Hinckley,
Proc. UIST'00, pp. 139-148.

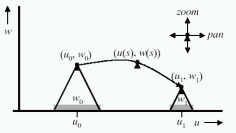
[demo www-ui.is.s.u-tokyo.ac.jp/~takeo/java/autozoom/autozoom.htm]

[video www-ui.is.s.u-tokyo.ac.jp/~takeo/video/autozoom.mov]

automatic zoom
- amount depends on how far to pan

Smooth and Efficient Zooming

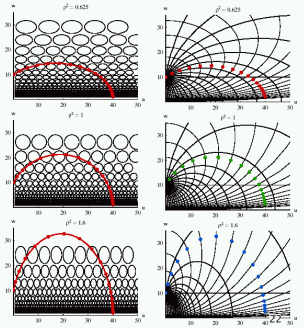
uw space: u = pan, w = zoom
- horiz axis: cross-section through objects
- point = camera at height w above object
- path = camera path



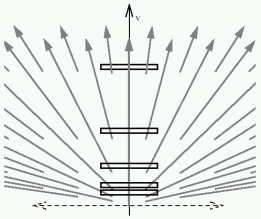
Optimal Paths Through Space

at each step, cross same number of ellipses

cross minimal number of ellipses total



Multiscale Display



Multiscale Desert Fog

Critical Zones in Desert Fog: Aids to Multiscale Navigation
Susanne Jul, George W. Furnas UIST 98

environment devoid of navigational cues
- not just Pad: 6DOF navigation where object fills view

designer strategies
- explicit world creation - fog not made on purpose
  games - partial counter example
- island of information surrounded by desert fog

Pad: min/max visibility distances

View-Navigation Theory

Effective View Navigation, CHI 97
George Furnas

characterizing navigability: viewing graph
- nodes: views
- links: traversible connections

1. short paths between all nodes
   - true in ZUIs (e.g. speed-dependent zooming)

2. all views have small number outlinks
   - not overwhelmed by choices

Critical Zones

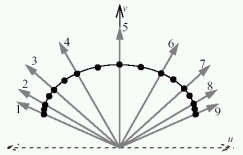
region where zoom-in brings interesting views
- show with navigation "residue"

unambiguous action choice
- visible critical zone "residue" of stuff beneath
- zoom out if see nothing

extension to VN theory
- 3. all views contain good residue of all nodes
- 4. all links must have small outlink-info
- must build support for these into ZUIs

do not have "minsize", always use a few pixels
- they don't address clutter/scalability

What's This?



Fisheye Focus+Context View!