Universal Usability

• Design for larger and more diverse groups of users

• Technological advances that help deal with:
  - User diversity
    Age, language, disabilities, 1st-time vs. frequent users
  - Variety of technology
    Screen size, network speed, platform, version
  - Gaps in user knowledge
    General or specific
Temporal e.g. LifeLines

www.cs.umd.edu/hcil/lifelines
How to make an interactive map such as this accessible?
• but what about blind users?

• Particularly Important for Public Access
Outline

• Toward Universal Usability
• Focus on Information Visualization
• Two examples:
  - Sonification of geo-referenced statistical data
  - Helping users get started
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State of the art of citizen web access to statistical info on map
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Unemployment Rate (percent) - 2001

Click for: PDF or JPEG version of the current map to print or save
Unemployment Rate (percent) - 2001

Map with 51 items.

AK is 5.2. Value is in the 5.4 - 6.5 range, Label: AK, Alaska: 6.2, Detail for AK.
AL is 5.3. Value is in the 4.8 - 5.3 range, Label: AL, Alabama: 5.3, Detail for AL.
AR is 5.1. Value is in the 4.8 - 5.3 range, Label: AR, Arkansas: 5.1, Detail for AR.
AZ is 4.6. Value is in the 4.4 - 4.7 range, Label: AZ, Arizona: 4.6, Detail for AZ.
CA is 5.3. Value is in the 4.8 - 5.3 range, Label: CA, California: 5.3, Detail for CA.
CO is 3.7. Value is in the 3.7 - 4.3 range, Label: CO, Colorado: 3.7, Detail for CO.
CT is 3.2. Value is in the 2.8 - 3.6 range, Label: CT, Connecticut: 3.2, Detail for CT.
DC is 6.5. Value is in the 5.4 - 6.5 range, Label: DC, District of Columbia: 6.5, Detail for DC.
DE is 3.5. Value is in the 2.8 - 3.6 range, Label: DE, Delaware: 3.5, Detail for DE.
FL is 4.7. Value is in the 4.4 - 4.7 range, Label: FL, Florida: 4.7, Detail for FL.
GA is 3.9. Value is in the 3.7 - 4.3 range, Label: GA, Georgia: 3.9, Detail for GA.
HI is 4.5. Value is in the 4.4 - 4.7 range, Label: HI, Hawaii: 4.6, Detail for HI.
IA is 3.3. Value is in the 2.8 - 3.6 range, Label: IA, Iowa: 3.3, Detail for IA.
ID is 4.9. Value is in the 4.8 - 5.3 range, Label: ID, Idaho: 4.9, Detail for ID.
IL is 5.3. Value is in the 4.8 - 5.3 range, Label: IL, Illinois: 5.3, Detail for IL.
IN is 4.3. Value is in the 3.7 - 4.3 range, Label: IN, Indiana: 4.3, Detail for IN.
KS is 4.2. Value is in the 3.7 - 4.3 range, Label: KS, Kansas: 4.2, Detail for KS.
KY is 5.4. Value is in the 5.4 - 6.5 range, Label: KY, Kentucky: 5.4, Detail for KY.
LA is 5.9. Value is in the 5.4 - 5.5 range, Label: LA, Louisiana: 5.9, Detail for LA.
MA is 3.6. Value is in the 2.0 - 3.5 range, Label: MA, Massachusetts: 3.6, Detail for MA.
MD is 4. Value is in the 3.7 - 4.3 range, Label: MD, Maryland: 4, Detail for MD.
ME is 3.9. Value is in the 3.7 - 4.3 range, Label: ME, Maine: 3.9, Detail for ME.
MI is 5.3. Value is in the 4.8 - 5.3 range, Label: MI, Michigan: 5.3, Detail for MI.
MN is 3.6. Value is in the 2.8 - 3.6 range, Label: MN, Minnesota: 3.6, Detail for MN.
MO is 4.7. Value is in the 4.4 - 4.7 range, Label: MO, Missouri: 4.7, Detail for MO.
MS is 5.5. Value is in the 5.4 - 6.5 range, Label: MS, Mississippi: 5.5, Detail for MS.
MT is 4.5. Value is in the 4.4 - 4.7 range, Label: MT, Montana: 4.5, Detail for MT.
Traditionally, tactile approaches to maps

Learning maps with a printed tactile Braille atlas
Tactile approaches to maps

Braille mouse gives Braille feedback for different regions
Tactile approaches to maps

Embossed map attached to touchscreen  (www.touchgraphics.com)
but

• All require custom input devices or special printed tactile materials

• i.e. not really providing access for all

• Instead, we tried to use audio ONLY
Visualization
↓
Sonification
Use of non-speech audio to represent abstract data
To contrast, example use of “Real world” sounds

BATS project at UNC

Uses open library of spatial sounds as icons

Sonification

• Mono audio
• Stereo audio
• Spatial audio
  Left - Right
  Up - Down
  Front - back
  Distance

head-related transfer function (HRTF)

Perception of spatial effects improves when using “personal” HRTF

Generated using high performance dual performance processor or by saving large files of sound libraries
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Coordinated table and map views, e.g. counties of the state of Maryland
Superimposed on the color coded (choropleth) map is a representation of the
recursive 3x3 keyboard exploration grid.
Darker green indicates a higher value
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www.cs.umd.edu/hcil/audiomap
Study with blind users

- 7 users
  - No residual vision
  - Basic computer skill
  - Rely on screen readers
  - Used govt. statistical data at work
  - Compensated for time

Total of 42 hours of observation

Session 1:
  - Self-paced tutorial + training tasks

Session 2 (another day):
  - 7 tasks
  - Free explore different map
  - Comparison with Excel

For tasks that did NOT require geo-knowledge:
  - Similar results. iSonic preferred (had extra shortcut commands)

For tasks requiring geo-knowledge.
  - 95% success with iSonic
  - with Excel: 67% for those you know geography well and 20% for others (who guessed)
A bivariate scatterplot and its heat map at the resolution of 9x9 grid.
A bivariate scatterplot and its heat map at the resolution of 9x9 grid.

Applets – Papers – Video – Source Code on the web!
Lessons

• Hard but possible!
• Needs a good command language
  - and good help for it
• Coordinate with table view
• Synchronize visual and audio
  - to permit collaboration
• Allow multiple input mechanism
  (including keyboard only)
• Still many questions e.g. choice of sounds
Something easier?
Color Blindness

• ColorBrewer  www.colorbrewer.org
  - Suggests color sets
  - Indicates when it is acceptable for users with color blindness

• VisCheck  www.VisCheck.com
  - Simulates color blindness
  - Suggest enhancements
Addressing Universal Usability
Colorblindness

Check your color choices
(www.VizCheck.com)
Download a PhotoShop filter
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    General or specific
Helping Users get Started

Example of challenge:

Improving 1st access to interactive visualization tools

Map + Table + Dynamic Queries + Scatterplot

Usability tests at Census showed many problems

Need for help

But manuals not read tutorials too long...

What else could we do?

3 approaches investigated

Kang, H., Plaisant, C., Shneiderman, B.
New Approaches to Help Users Get Started with Visual Interfaces: Multi-Layered Interfaces and Integrated Initial Guidance
Proc. of the Digital Government Research Conference, 141-146
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1- Multi-layered interfaces

instead of 1 level

map + table
+ filters
+ scatterplot
1- Multi-layered interfaces

instead of 1 level

3 levels, of growing complexity

map+table +filters +scatterplot

map+table

map+table +filters +scatterplot

map+table +filters +scatterplot
1- Multi-layered interfaces instead of 1 level

3 levels, of growing complexity

map+table +filters +scatterplot

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Benefits:
- easier to get started

Risks:
- user may not visit the higher levels
- confusion about transitions
1- Multi-layered interfaces instead of 1 level

3 levels, of growing complexity

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2- Sticky Notes

• Overlaid on top of working interface
• Locates **main** interface widgets
• “Show me” function
  - Introduces main procedures as series of steps
  - Provides explanation of the effect of actions
• Lists example tasks
• Active at the start
1 level

Very crowded
(even with only a subset of features explained)

OK only for simpler interfaces

3 levels
3) “Show Me” recorded demos

- Demonstrations recorded with Camtasia and saved as flash video
- Full screen (gives impression of being in the interface)
- Audio explanations crucial

Plaisant and Shneiderman,
Show Me! Guidelines for Producing Recorded Demonstrations
VL/HCC'05
Search in medical records