Using Models of Human Performance to Inform Design

Krzysztof Gajos
6.813, Spring 2014
Hall of Fame?

Hall of Shame?
Hall of Fame?  

Hall of Shame?
Hall of Fame? Hall of Shame?

from the Buxton Collection http://research.microsoft.com/en-us/um/people/bibuxton/buxtoncollection/
Hall of Fame?

Hall of Shame?
Hall of Fame?  Hall of Shame?

Wenger 16999 Swiss Army Knife Giant
by Wenger

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List Price: $1,400.00
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Only 15 left in stock.
Width

Distance

movement time = \( a + b \times \log_2 \left( \frac{D}{W} \right) \)
Fitts’ Law in 2D?

movement time = ???

D
Vista versus Windows 95
Vista versus Windows 95
A Brief History of MS Word
Word for Windows 1.0 (1989)

Common screen resolution: 640x480

Number of toolbars: 2
Word for Windows 2.0 (1992)
Common screen resolution: 640x480
Number of toolbars: 2

User Interface Additions:
Nested Dialog Boxes
Microsoft Word 6.0 (1994)

Common screen resolution: 800x600
Number of toolbars: 8

User Interface Additions:
Right-click contextual menus
  Tooltips
Tabbed dialog boxes
  Toolbars on bottom of screen
  Wizards
Microsoft Word 95 (1995)
Common screen resolution: 800x600
Number of toolbars: 9

User Interface Additions:
Red-squiggle spell checking
IntelliSense ("Auto" features)
Microsoft Word 97 (1996)

Common screen resolution: 1024x768
Number of toolbars: 18

User Interface Additions:
Toolbars on every side of the screen and floating
Menu bar can be docked on any side of the screen or floating
Drag and drop any command anywhere
Office Assistant ("Clippit")
Hierarchical, multi-level menus
Hierarchical, multi-level context menus
Icons on menus and context menus
Green-squiggle grammar checking
Increased IntelliSense (including on-the-fly spell correction)
EXPERIENCE

1990–1994 Arbor Shoe Southridge, SC
National Sales Manager
• Increased sales from $50 million to $100 million.
• Doubled sales per representative from $5 million to $10 million.
• Suggested new products that increased earnings by 23%.

1985–1990 Ferguson and Bardell Southridge, SC
District Sales Manager
• Increased regional sales from $25 million to $350 million.
• Managed 250 sales representatives in 10 Western states.
• Implemented training course for new recruits — speeding profitability.

1980–1984 Duffy Vineyards Southridge, SC
Senior Sales Representative
Common screen resolution: 1024x768
Number of toolbars: 23

User Interface Additions:
Personalized Menus (short -> long expanding menus)
Default toolbars "rafted" onto a single row
Toolbars buttons show/hide based on frequency of use
SDI: One window on taskbar per document
Free-Roaming Office Assistant
Help Pane
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**CHAPTER 3**

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Microsoft Word 2002 (2001)
Common screen resolution: 1024x768
Number of toolbars: 30

User Interface Additions:
Task Panes (8)
On-Object UI: Paste Options
On-Object UI: Undo unwanted "Auto" actions
Smart Tags: Pink-squiggle recognized words
"Type a question for help" box

Common screen resolution: 1024x768
Number of toolbars: 31

User Interface Additions:
Task Panes (11 new + 8 existing = 19 total)
Person Name Smart Tag Menu
ALT+click words to perform lookup actions
| Value1 | Value2 | Value3 | Value4 |

Change the appearance of a table of contents, index, table of authorities, or table of figures:

1. On the Insert menu, point to Reference, click Index and Tables, and then click the tab you want.
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Notes:
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Remaining characters: 650
Menu Items in Microsoft Word

[From Jensen Harris' MIX'08 talk]
Toolbars and Task Panes in Microsoft Word

[From Jensen Harris' MIX'08 talk]
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Frequency-based Reordering

Hick-Hyman Law

Given $n$ equally probable choices, the average reaction time $T$ required to choose among them is approximately

$$T = a + b \log_2(n)$$
So How Well Do People Perform with UIs?

- Novel interface, no apparent organization
  - full visual search
  - \( \Rightarrow \) time = \( O(n) \)

- Familiar interface
  - only decision time
  - \( \Rightarrow \) time = \( O(\log n) \)
Frequency-based Reordering

Frequency-based Reordering

Static ordering based on frequency

Time (s)

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Morphing Menus

Static size based on frequency

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size based on frequency
Split Interfaces

A
B
C
D
E
F

static

D
F
A
B
C
D
E
F

split
Split Interfaces
Ken
Claire
Design by Genius

Specification
Design by Exploration

Elaboration
(opportunity-seeking: from singular to multiples)

Design Process

Reduction
(decision-making: from broad to specific)

starting point

focal point

[Buxton, Sketching User Experiences]
Design as Optimization

- Consider all possible designs
- Use a quantitative metric of quality to pick the best
- Do it quickly!
Use a quantitative metric of quality to pick the best

cost() = time
Learn What A Person Can Do

Pointing

Dragging

List Selection

Select 21
### Font Formatting

#### Type, Style and Size

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#### Effects

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- Superscript: [ ]
- Subscript: [ ]
- Shadow: [ ]
- Outline: [ ]
- Emboss: [ ]
- Engrave: [ ]
- Small Caps: [ ]
- All Caps: [ ]
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#### Preview

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- Outline
- Emboss
- Engrave
- Small Caps
- All Caps
- Hidden

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- Double solid
- Dotted
- Dashed
- Wavy

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**Preview**

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Impaired dexterity

Low strength
Average Time to Complete a set of tasks

- Motor-impaired with default interfaces
- Motor-impaired with automatically generated UIs
- Able-bodied with default interfaces

Performance Gap
ONE SIZE FITS ALL
Take Aways

• Models of human performance exist

\[
\text{movement time} = a + b \times \log_2 \left( \frac{D}{W} \right)
\]

\[
\text{decision time} = a + b \times \log_2 (n)
\]
Take Aways

- Models of human performance exit
- They can predict relative success of different designs
Take Aways

- Models of human performance exit
- They can predict relative success of different designs
- Models that refer to different aspects of performance may produce contradictory recommendations
Take Aways

• Models of human performance exist
• They can predict relative success of different designs
• Models that refer to different aspects of performance may produce contradictory recommendations
• Models can be used to drive automatic design
Take Aways

- Models of human performance exist
- They can predict relative success of different designs
- Models that refer to different aspects of performance may produce contradictory recommendations
- Models can be used to drive automatic design

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