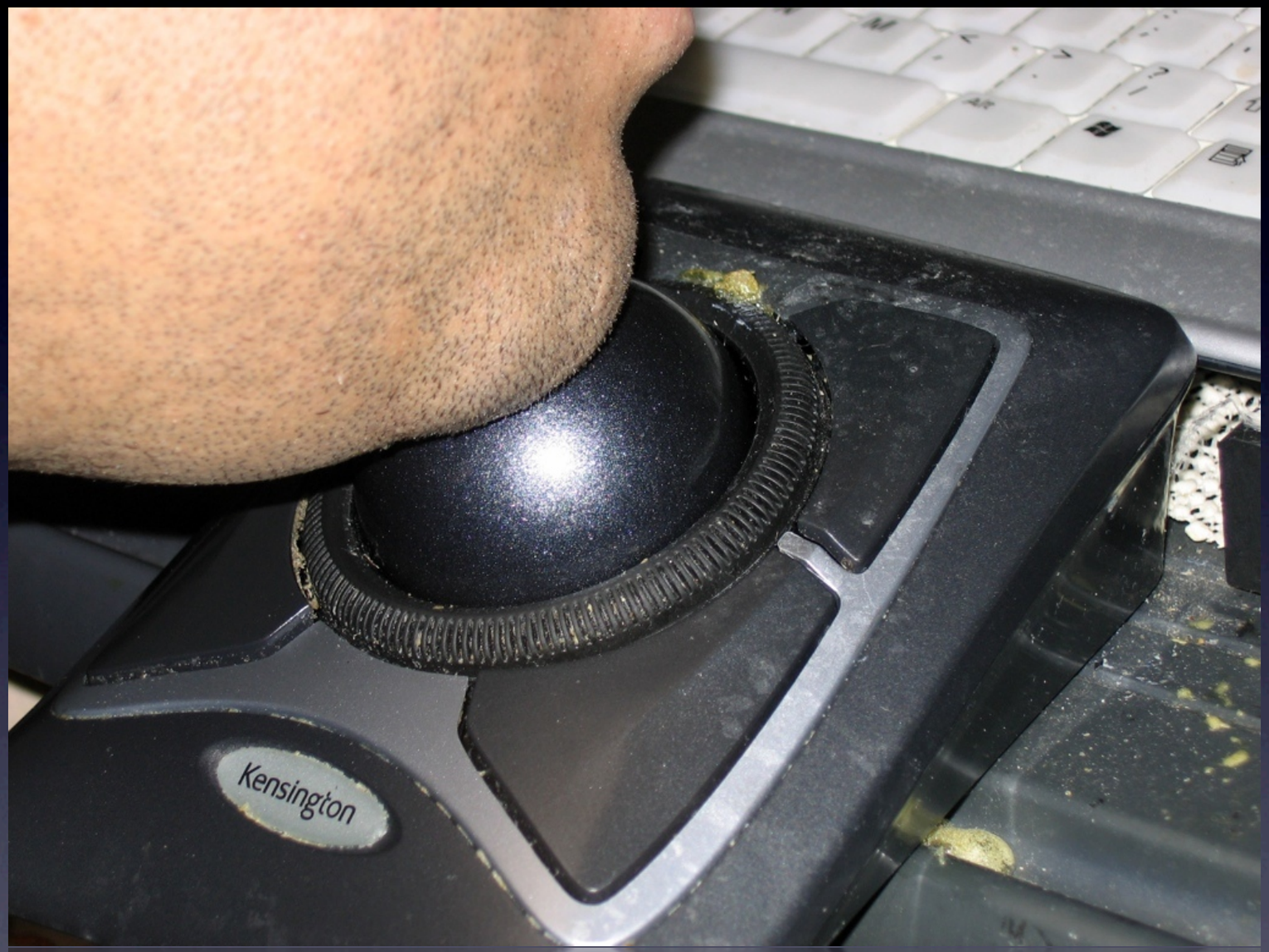
Scalable Personalized Adaptive (Computer) Accessibility

Krzysztof Z. Gajos


Kensington


MIT
+150


AUTOMATIC
CAUTION
DOOR
EXIT


ESTABLISHED FOR ADVANCEMENT
AND
INVENT
DESIGN
ONE COMMUNITY
TOGETHER IN SERVICE
ONE COMMUNITY
TOGETHER IN SERVICE
CAUTION
CONSTRUCTION
WORKERS


MIT
+150


MIT
+150


ACCESSIBLE
ENTRANCE


ACCESSIBLE
ENTRANCE
ACCESSIBLE
ENTRANCE


ACCESSIBLE
ENTRANCE

ACCESSIBLE
PATH

It’s not enough to make access possible

You have to ensure that access is

equitable

Definition of Disability?

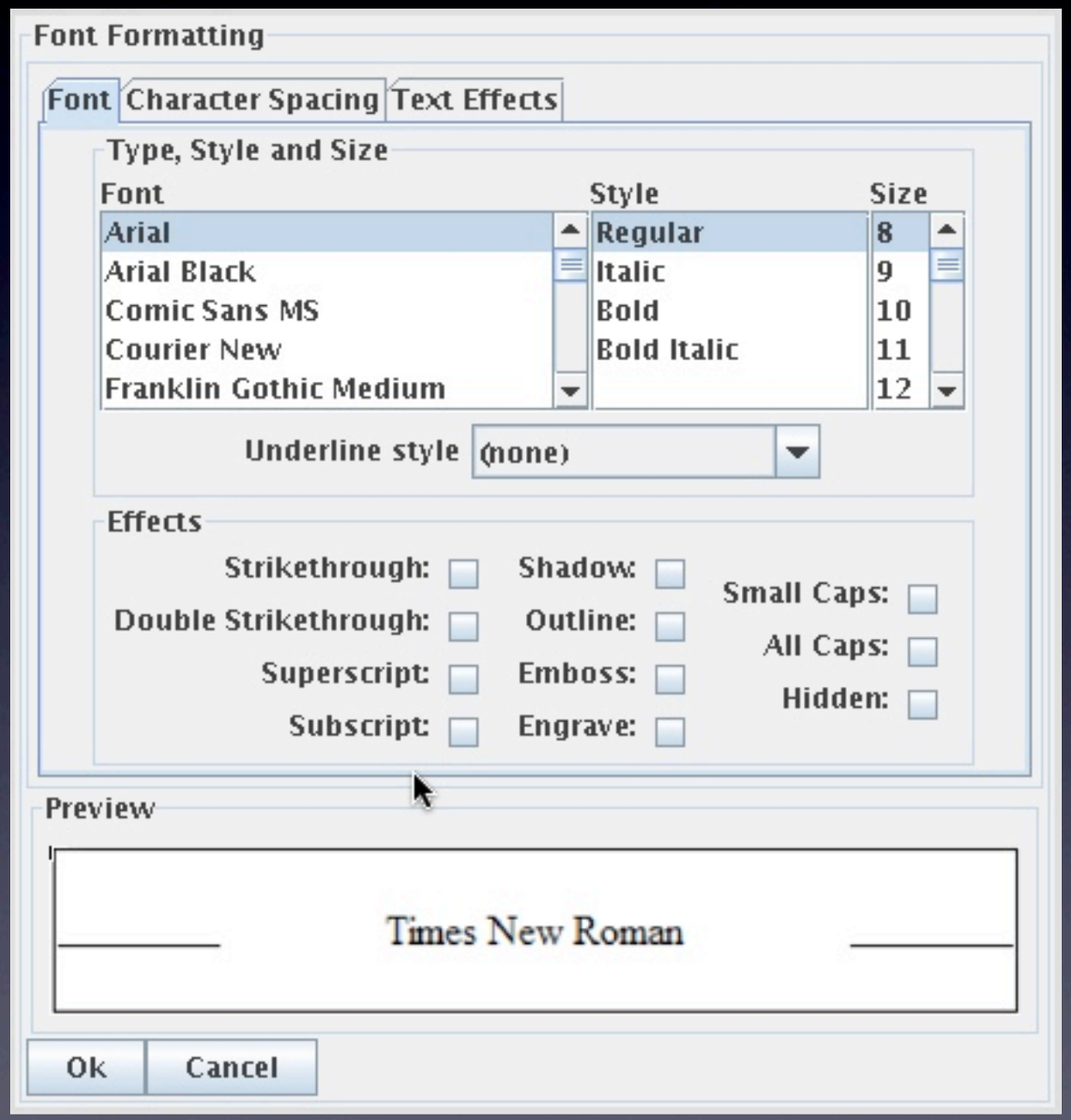
Definition of Disability?

- **Health condition?**
  A disease, disorder, injury, or trauma
- **Impairment?**
  A loss or abnormality of body structure or function
- **Disability?**
  Activity limitations: Difficulties an individual may have in executing a task or action
- **Handicap?**
  Participation restrictions: Problems an individual may experience in involvement in life situations

A Vision for Equitable (Computer) Accessibility

- Interfaces **share** the burden of adaptation
- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive**
- Solutions can **scale** to millions of individuals

Supple Project



Font Formatting

Font | Character Spacing | Text Effects

Type, Style and Size

Font	Style	Size
Arial	Regular	8
Arial Black	Italic	9
Comic Sans MS	Bold	10
Courier New	Bold Italic	11
Franklin Gothic Medium		12
Italic		13
Gautami		14
Georgia		15
Helvetica		16
Latha		17
Lucida Console		18
Lucida Sans Unicode		19
Microsoft Sans Serif		20
Modern MS Sans Serif		21
MS Serif		22
Mv Boli		23
Palatino Linotype		24
Roman		25
Script		26
Small Fonts		27

Underline style

- (none)
- Single solid
- Double solid
- Dotted
- Dashed
- Wavy

Effects

- Strikethrough
- Double Strikethrough
- Superscript
- Subscript
- Shadow
- Outline
- Emboss
- Engrave
- Small Caps
- All Caps
- Hidden

Ok

Cancel

Preview

Times New Roman

Font Formatting

Font | Character Spacing | Text Effects

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Font	Style	Size
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Comic Sans MS	Bold	10
Courier New	Bold Italic	11
Franklin Gothic Medium		12
Italic		13
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Lucida Console		18
Lucida Sans Unicode		19
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- All Caps
- Hidden

Ok

Cancel

Preview

Times New Roman

Font Formatting

Font

Type, Style and Size

Font	Style	Size
Arial	Regular	8
Arial Black	Italic	9
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Franklin Gothic Medium		12
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Modern MS Sans Serif		21
MS Serif		22
Mv Boli		23
Palatino Linotype		24
Roman		25
Script		26
Small Fonts		27
Symbol		28
Tahoma		29

Underline style

- (none)
- Single solid
- Double solid
- Dotted
- Dashed
- Wavy

Effects

- [ ] Strikethrough
- [ ] Double Strikethrough
- [ ] Superscript
- [ ] Subscript
- [ ] Shadow
- [ ] Outline
- [ ] Emboss
- [ ] Engrave
- [ ] Small Caps
- [ ] All Caps
- [ ] Hidden

Character Spacing

Scale

- 200%
- 150%
- 100%
- 90%
- 80%

Spacing

- Normal
- Expanded
- Condensed

By

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Position

- Normal
- Raised
- Lowered

By

- 0
- 1
- 2
- 3
- 4

- [ ] Kerning for fonts

Points and above

- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17

Text Effects

Animations

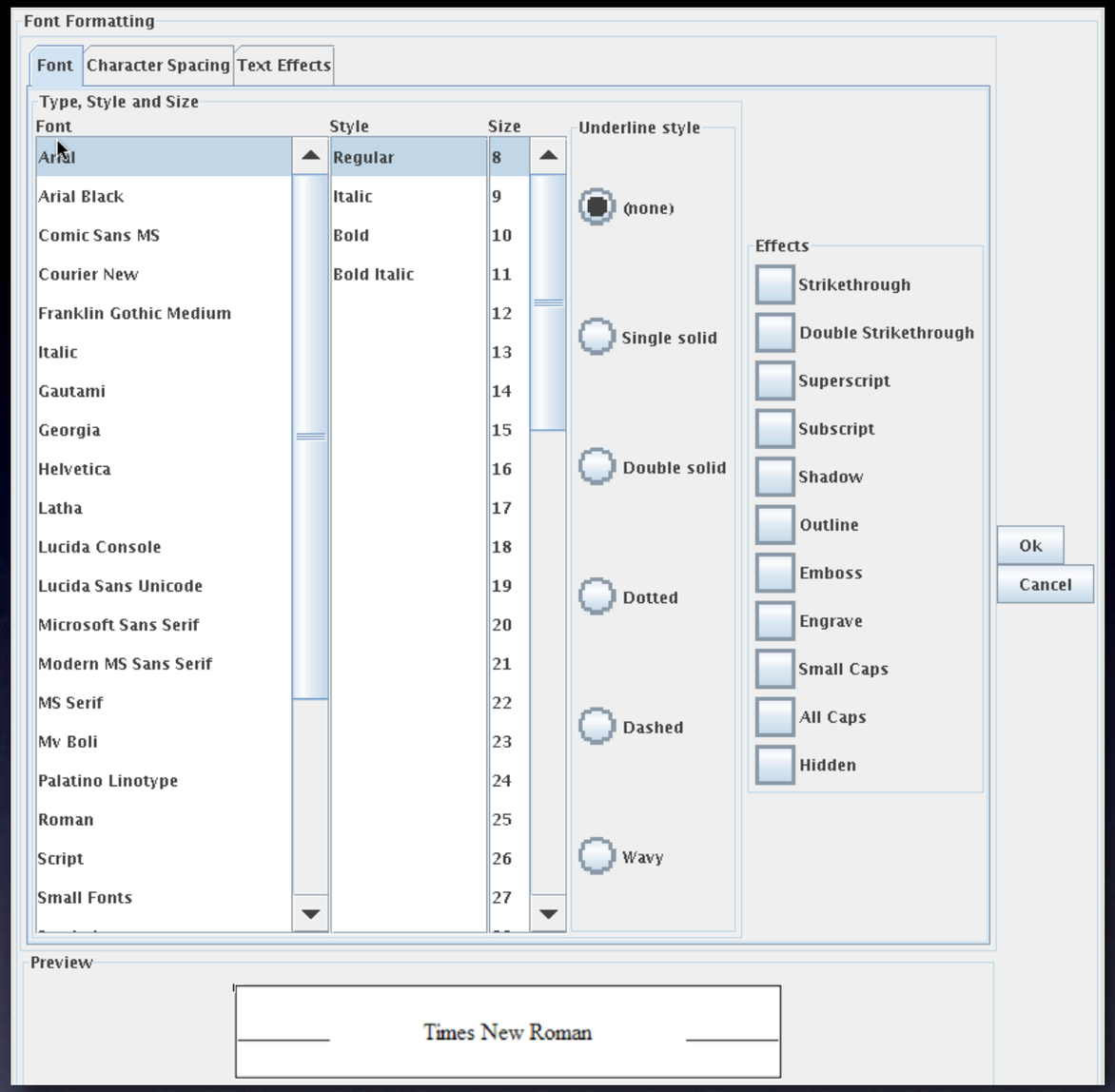
- (none)
- Blinking Background
- Las Vegas Lights
- Marching Black Ants
- Marching Red Ants
- Shimmer
- Sparkle Text

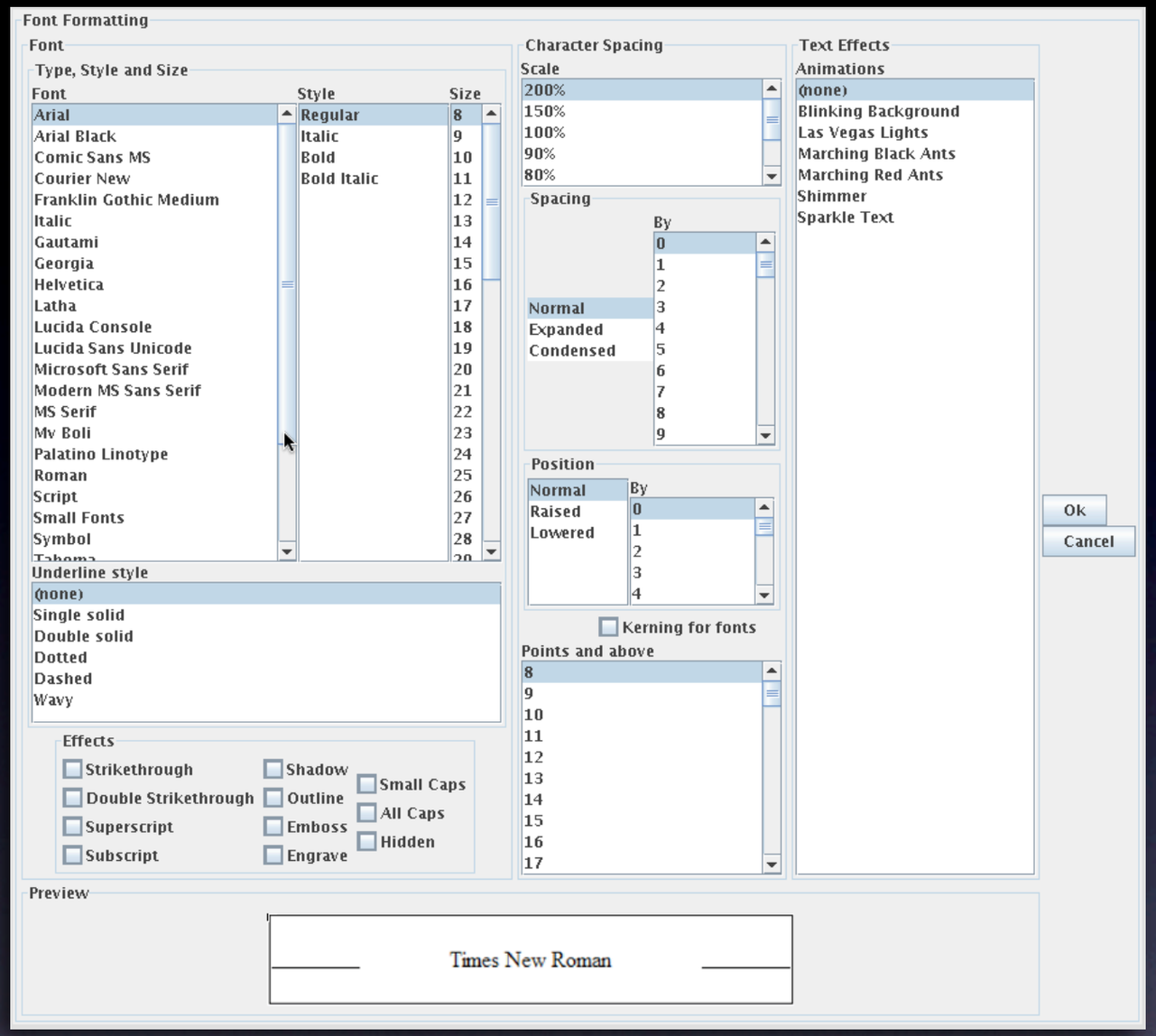
Ok

Cancel

Preview

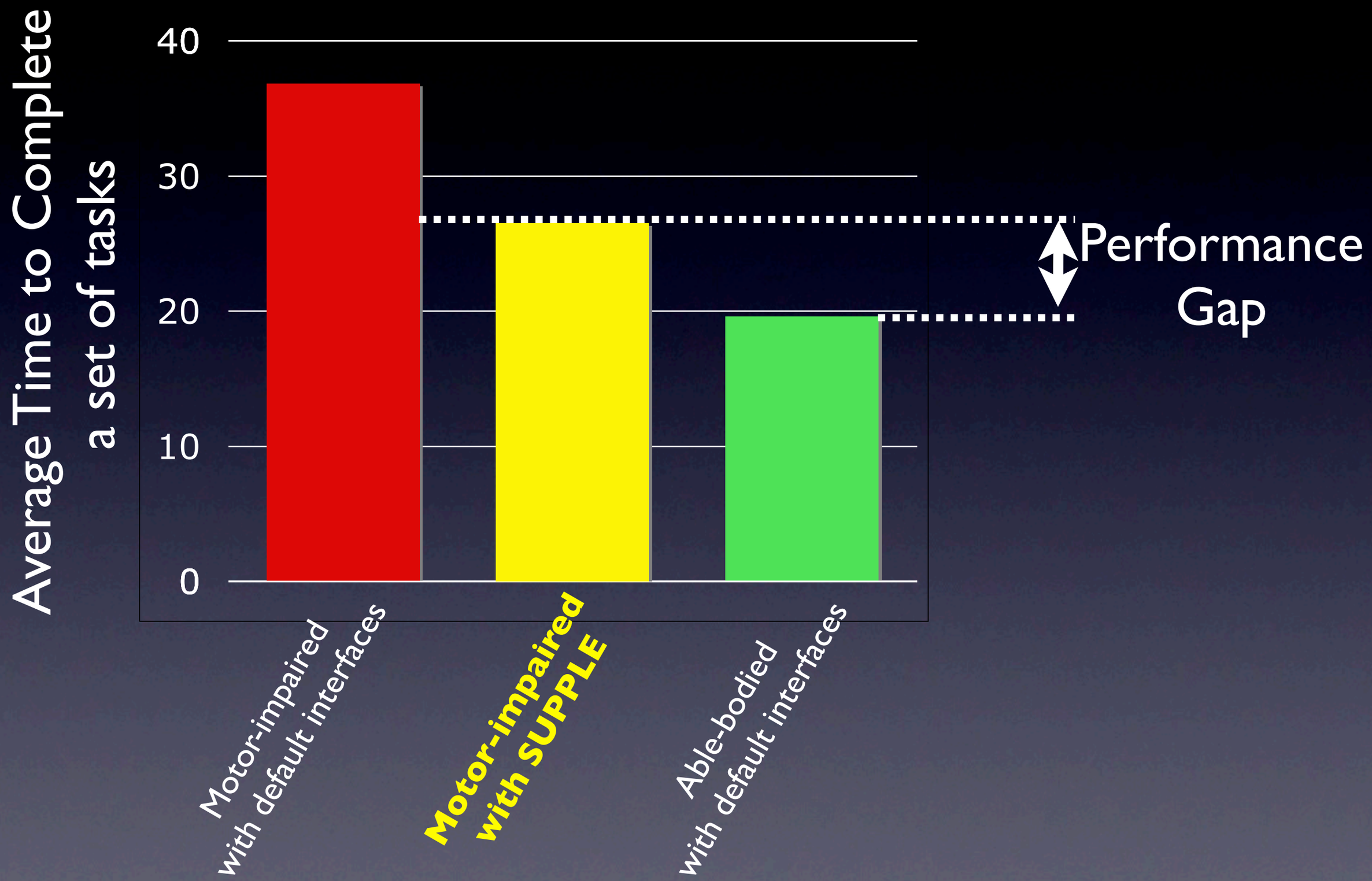
Times New Roman



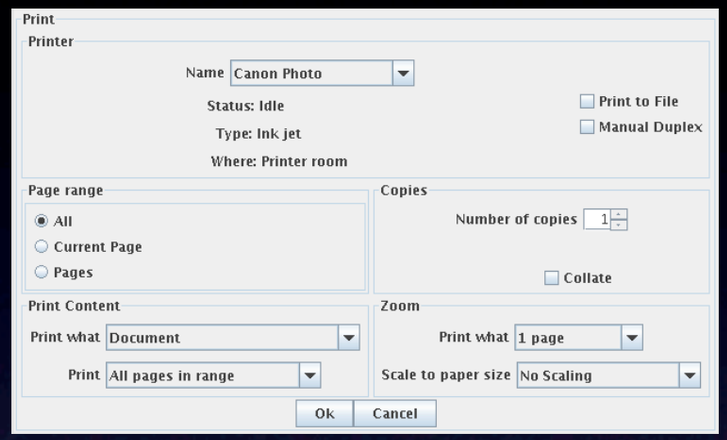


Impaired dexterity

Low strength


Average Time to Complete a set of tasks
40
30
20
10
0
Performance Gap
Motor-impaired with default interfaces
Motor-impaired with SUPPLE
Able-bodied with default interfaces

Interfaces **share** the burden of adaptation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Printer
Name
Canon Photo
Status: Idle
Type: Ink jet
Where: Printer room
Print to File
Manual Duplex
Page range
All
Current Page
Pages
Copies
Number of copies
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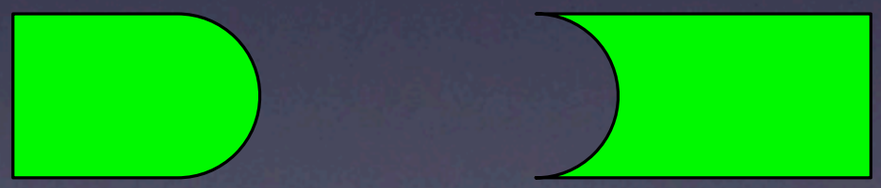
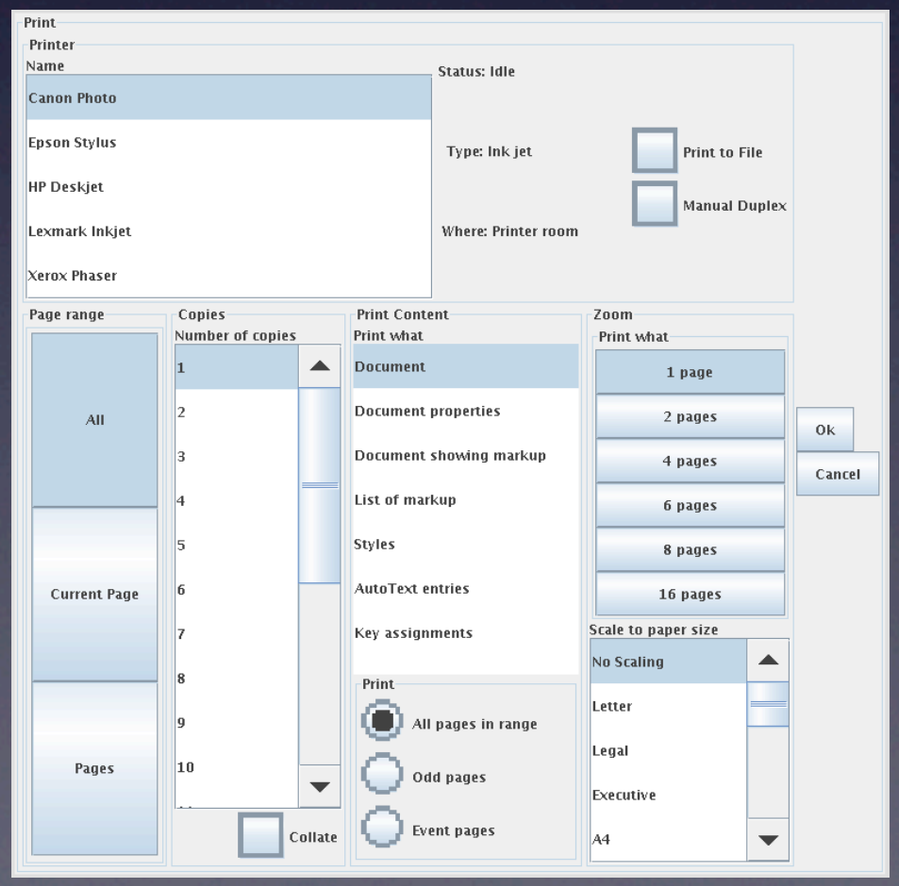
Collate
Print Content
Print what
Document
Print
All pages in range
Zoom
Print what
1 page
Scale to paper size
No Scaling
Ok
Cancel

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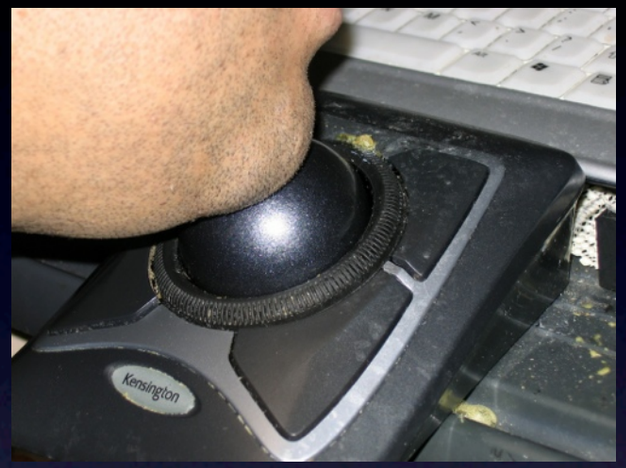
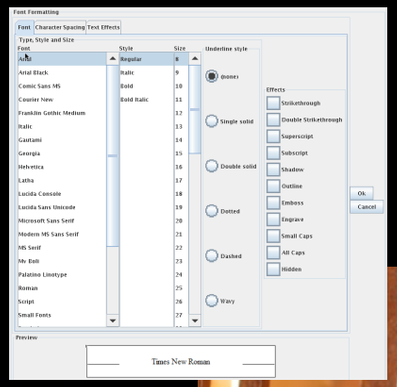
Printer
Name
Canon Photo
Epson Stylus
HP Deskjet
Lexmark Inkjet
Xerox Phaser
Status: Idle
Type: Ink jet
Where: Printer room
Print to File
Manual Duplex
Page range
All
Current Page
Pages
Copies
Number of copies
1
2
3
4
5
6
7
8
9
10
Collate
Print Content
Print what
Document
Document properties
Document showing markup
List of markup
Styles
AutoText entries
Key assignments
Print
All pages in range
Odd pages
Event pages
Zoom
Print what
1 page
2 pages
4 pages
6 pages
8 pages
16 pages
Scale to paper size
No Scaling
Letter
Legal
Executive
A4
Ok
Cancel


Kensington


DELL


Font Formatting
Font
Character Spacing
Text Effects
Type, Style and Size
Font
Style
Size
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Courier New
Franklin Gothic Medium
Italic
Gautami
Georgia
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MS Serif
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Palatino Linotype
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Script
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Regular
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Bold
Bold Italic
Underline style
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Single solid
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Subscript
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Engrave
Small Caps
All Caps
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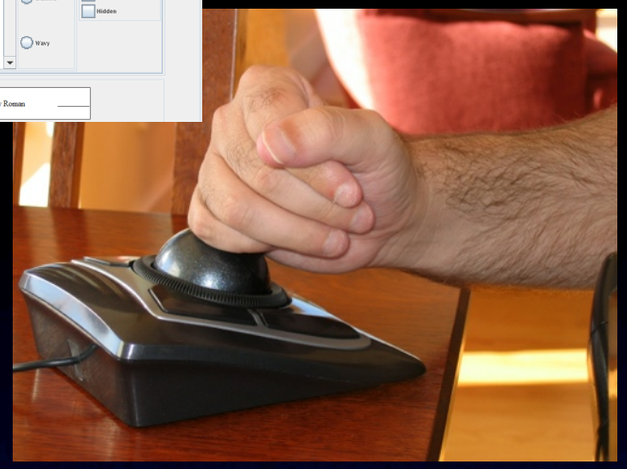
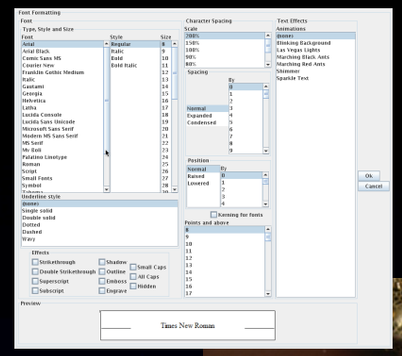
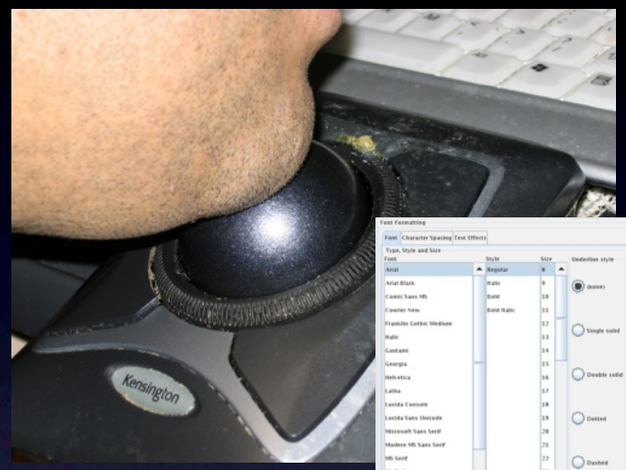
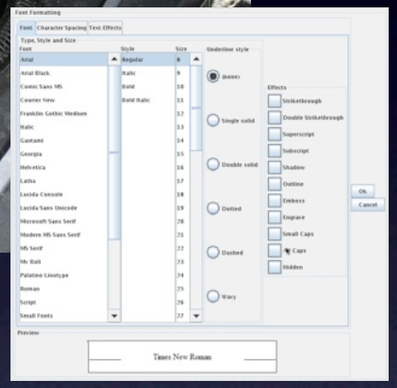
Ok
Cancel
Preview
Times New Roman




Font Formatting
Font
Character Spacing
Text Effects
Ok
Cancel
Preview
Times New Roman


Kensington


Font Formatting
Font
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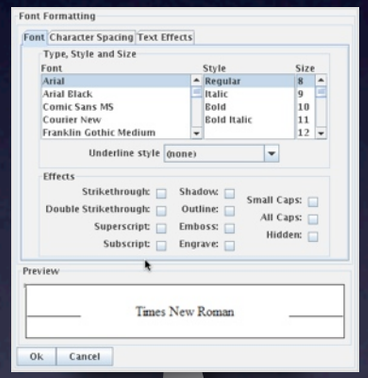
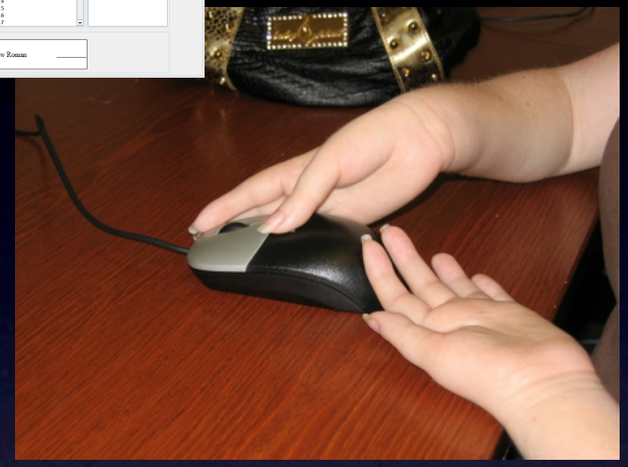
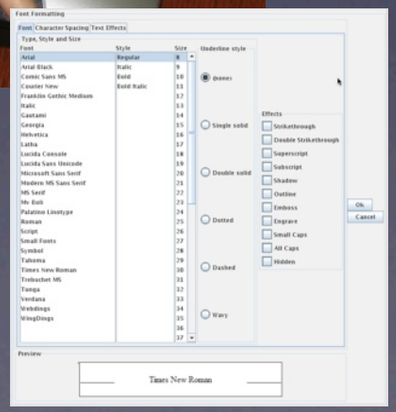
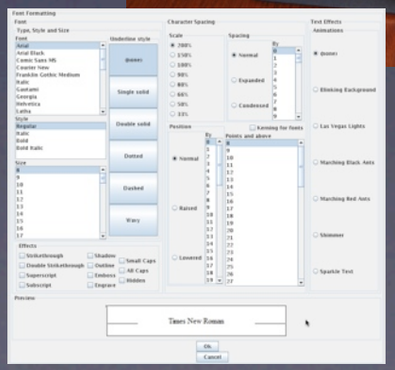
Text Effects
Ok
Cancel
Preview
Times New Roman


Font Formatting
Font
Character Spacing
Text Effects
Type, Style and Size
Font
Style
Size
Arial
Arial Black
Comic Sans MS
Courier New
Franklin Gothic Medium
Regular
Italic
Bold
Bold Italic
8
9
10
11
12
Underline style
(none)
Effects
Strikethrough:
Double Strikethrough:
Superscript:
Subscript:
Shadow:
Outline:
Emboss:
Engrave:
Small Caps:
All Caps:
Hidden:
Preview
Times New Roman
Ok
Cancel




DELL


Font Formatting
Font
Character Spacing
Text Effects
Ok
Cancel
Preview
Times New Roman

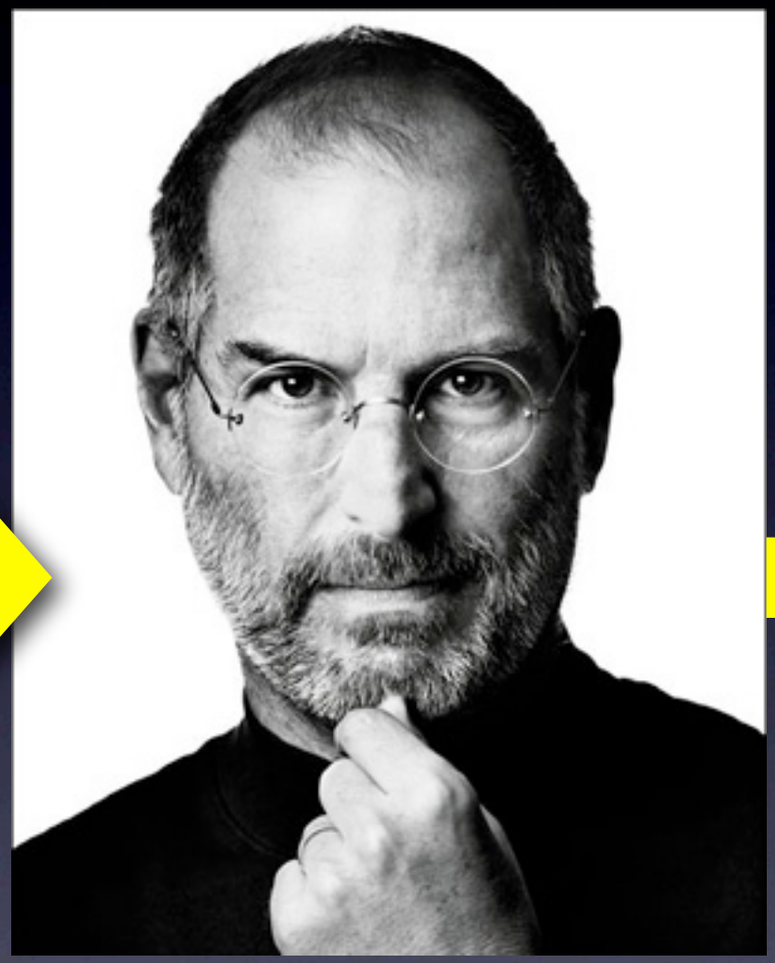

Font Formatting
Font
Character Spacing
Text Effects
Ok
Cancel
Preview
Times New Roman

Solutions can **scale** to millions of individuals

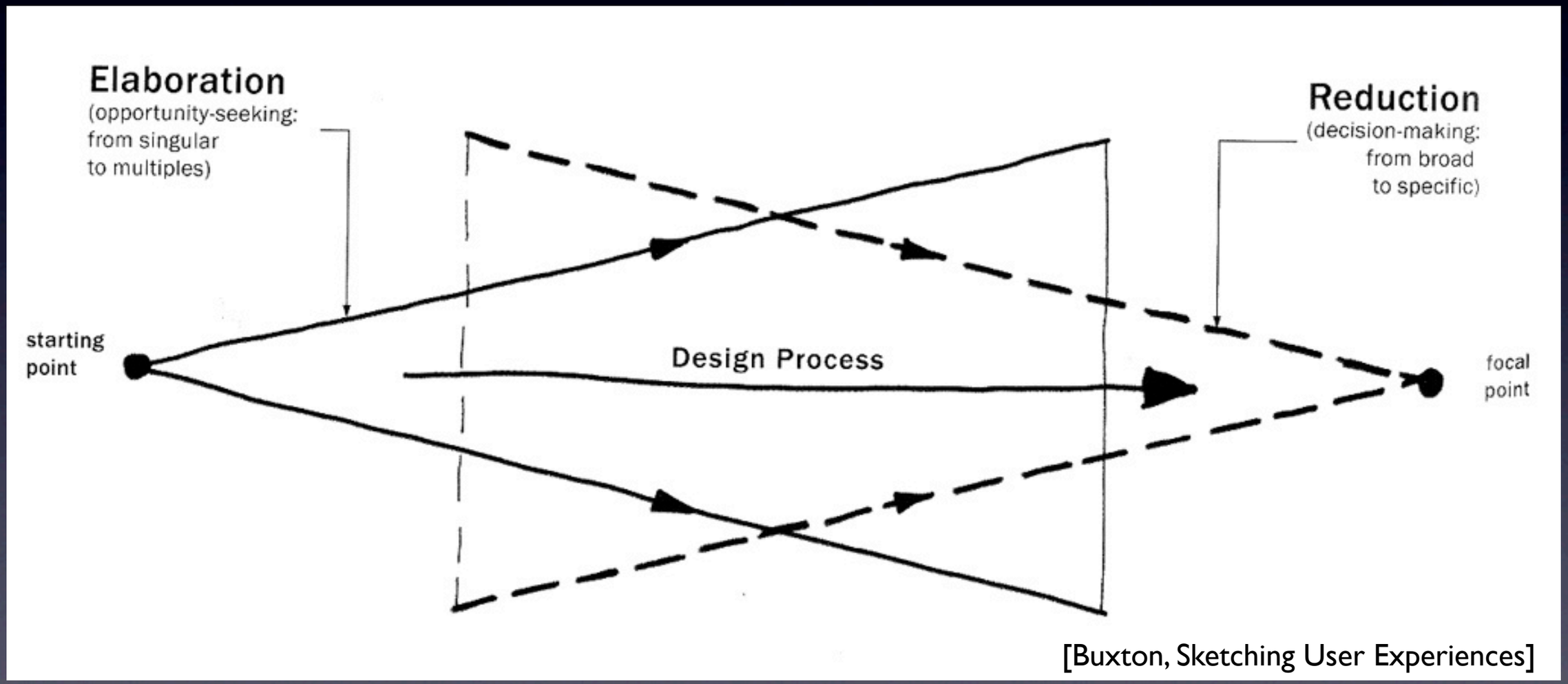
DESIGN

Design by Genius

Specification



Design by Exploration



[Buxton, Sketching User Experiences]

Supple: Stereo Example

Properties

Stereo

Power:

Volume

0 5 10

X-Bass:

Tape

Mode: Tape 1

Tape 2

Reverse:

Dolby Noise Reduction:

< Play

Play >

Stop

Pause

Rewnd

FFwd

CD

Disc: 1

Track: 1

Play

Stop

Pause

Repeat:

Random:

Tuner

<< Seek

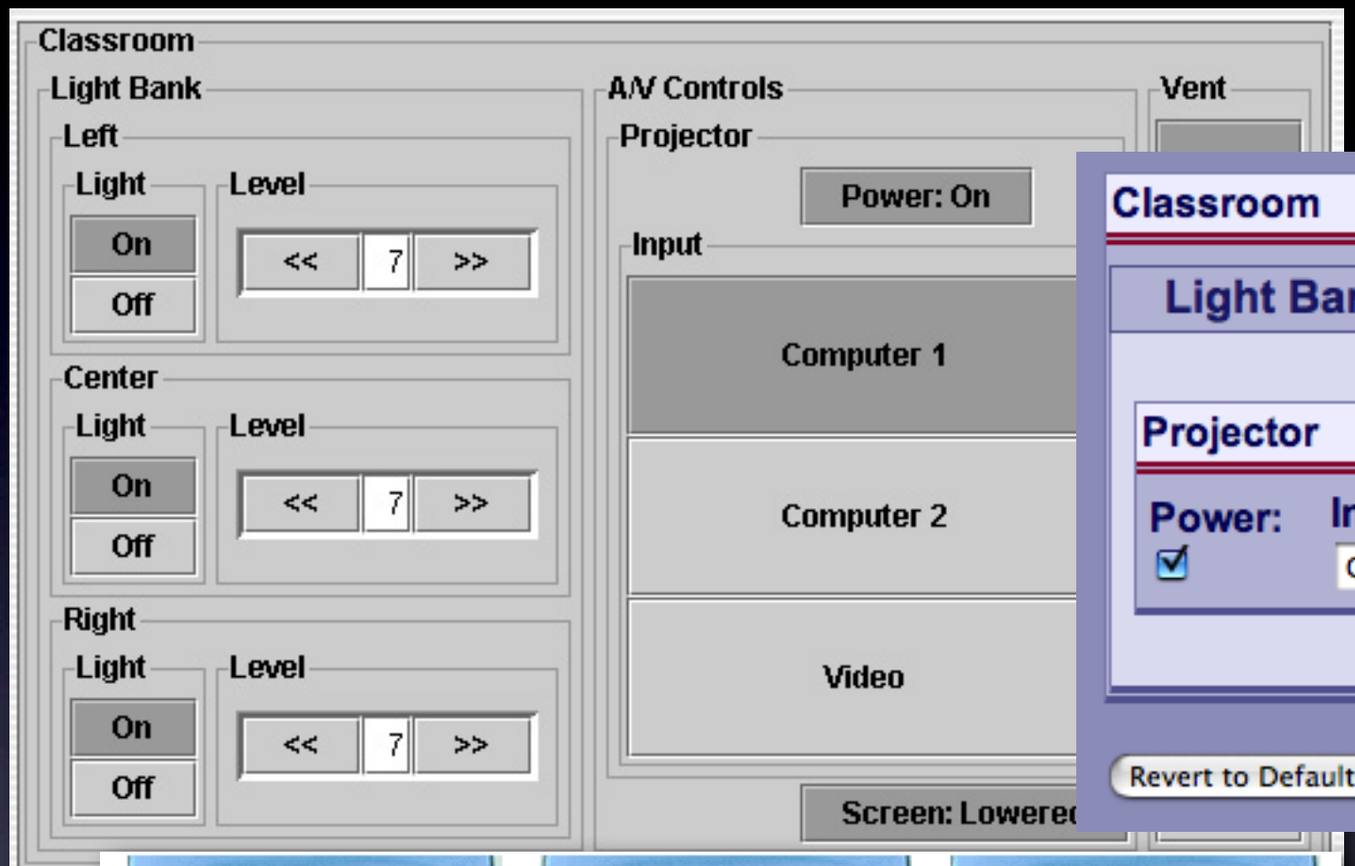
Frequency: 89

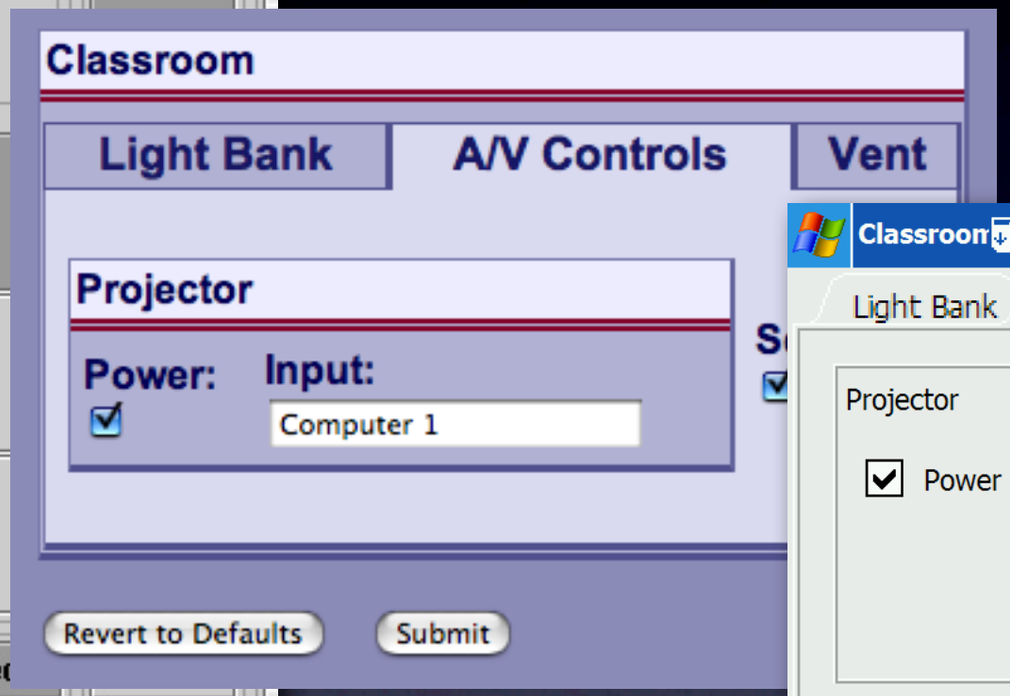
Seek >>

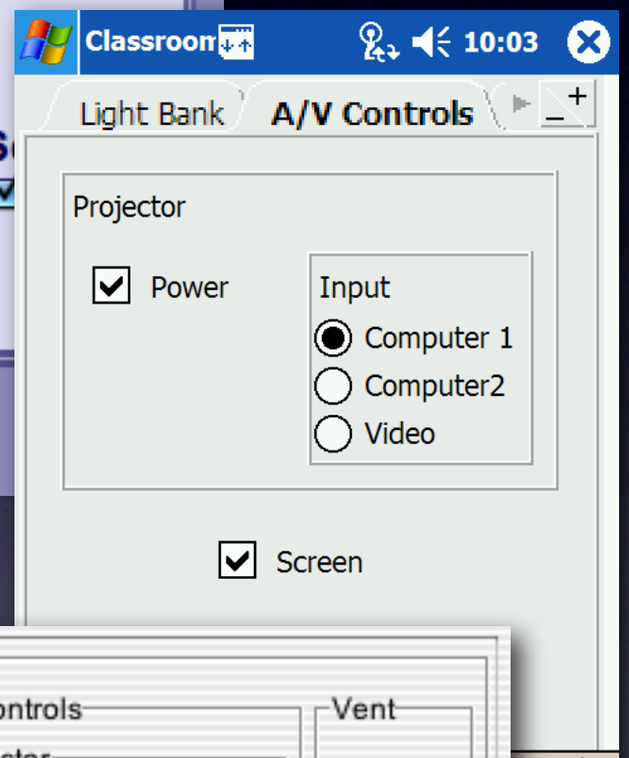
Band: FM

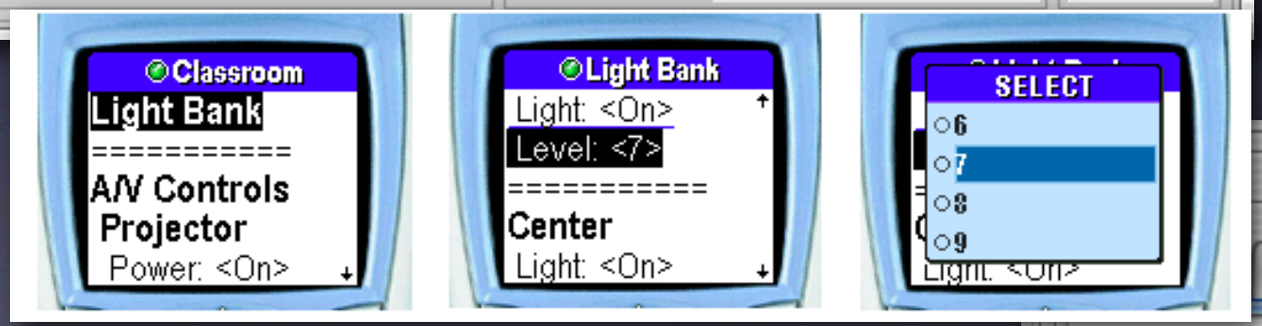
AM

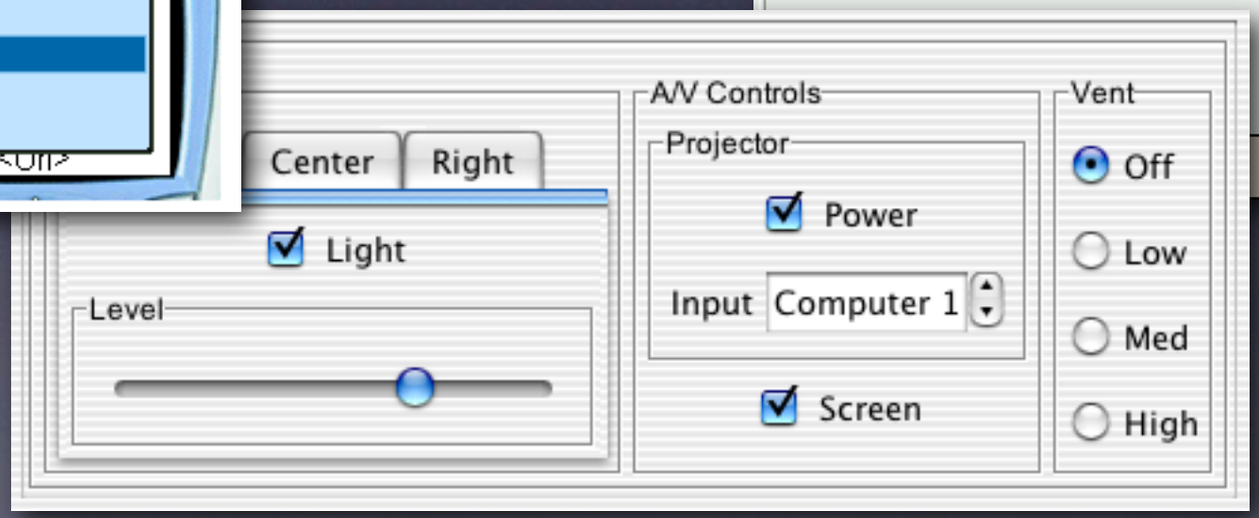
Adaptation to Devices











Folders

New | Rename | Delete | Expunge

- Junk-E-Mail
- Unerwünscht
- Unbekannt2
- Deleted Messages
- Events

Messages

New | Reply | Forward | Delete | Move

05.02 12:53 PM Lucy Dunne <lucy.dunne@gmail.com> [Announcements] ISWC 2008: Ca
01.02 08:30 AM uwgradevents@u.washington.edu [UWgradevents] Career Events for Gra
31.01 05:20 PM Varshavsky Alex <walex@cs.toronto.edu> Pervasive 2008 Late Breakin
31.01 05:02 PM Varshavsky Alex <walex@cs.toronto.edu> Pervasive 2008 Late Breakin
26.10.07:50 AM avi2008@cib.na.cnr.it AVI2008:CALL FOR PAPERS

AS merged to form new full c
ernational Conference on Inte
nts] CFP: Special Issue on Per
Diagrams: CFP: Smart Graphi
/ASIVE 2005: Extended Work

orkshop Deadlines, Ad...

*****

*****

W2:International Workshop on Software Techniques for Embedded and Pervasive Systems (STEPS), 2005
(deadline extended to March 1st)
http://www.pervasive.ifi.lmu.de/workshop.html#W2

Configuration

Status: Messages expunged.

Configuration

Rendering

Configuration

Accounts

- Web.de IMAP
- UW IMAP
- Web.de POP3
- .Mac (kgajos)
- Fastmail

Details

Details

Account Details

Account Name: Web.de IMAP
Reply Address: supple@web.de
From Address: supple@web.de

Incoming Server

Protocol: (•) imap ( ) pop3
Encrypted: [ ]
Server: imap.web.de
User: supple
Password: ••••••••

Outgoing Server

Authentication: [x]
Encrypted: [ ]
Server: [#text: smtp.web.d
User: supple
Password: ••••••••

Add Account | Remove Account | Save | Switch to Account

Folders

New | Rename | Delete | Expunge

- Junk-E-Mail
- Unerwünscht
- Unbekannt2
- Deleted Messages
- Events
- INBOX
- Entwurf
- Papierkorb
- Gesendet
- Postausgang

Configurati

Messages

New | Reply | Forward | Delete | Move

05.02 12:53 PM	Lucy Dunne <lucy.dunne@gmail.com>	[Announcements] ISWC 2008: Ca
01.02 08:30 AM	uwgradevents@u.washington.edu	[UWgradevents] Career Events for Gra
31.01 05:20 PM	Varshavsky Alex <walex@cs.toronto.edu>	Pervasive 2008 Late Breakin
31.01 05:02 PM	Varshavsky Alex <walex@cs.toronto.edu>	Pervasive 2008 Late Breakin
26.10 07:50 AM	avi2008@cib.na.cnr.it	AVI2008:CALL FOR PAPERS
29.01 07:22 PM	Paul Robertson <paulr@csail.mit.edu>	IWSAS merged to form new full c
07.06 08:50 PM	Fang Chen <Fang.Chen@nicta.com.au>	International Conference on Inte
04.04 08:29 AM	Gulden Uchyigit <gu1@doc.ic.ac.uk>	[agents] CFP: Special Issue on Per
04.01 06:47 AM	P L Olivier <P.L.Olivier@newcastle.ac.uk>	Diagrams: CFP: Smart Graphi
21.02 12:07 PM	khai@cc.gatech.edu	[Announcements] PERVASIVE 2005: Extended Work

Details

Details

Rendering

Details

Senders: khai@cc.gatech.edu
Date: Mon Feb 21 12:07:11 PST 2005
Recipients: announcements@ubicomp.org
Subject: [Announcements] PERVASIVE 2005: Extended Workshop Deadlines, Ad...

Content

<TEXT/PLAIN; charset=us-ascii>

**********ADVANCE PROGRAM / REGISTRATION**********
The advance program of PERVASIVE 2005 is now online
http://www.pervasive.ifi.lmu.de/program.html

The early registration deadline is March, 14th 2005
http://www.pervasive.ifi.lmu.de/registration.html
Registration for a workshop only is available.

**********WORKSHOP DEADLINES EXTENDED**********
Some Pervasive 2005 workshops have extended their
deadlines for another week. Please take advantage of the
opportunity to present your research results in one of
the following workshops:

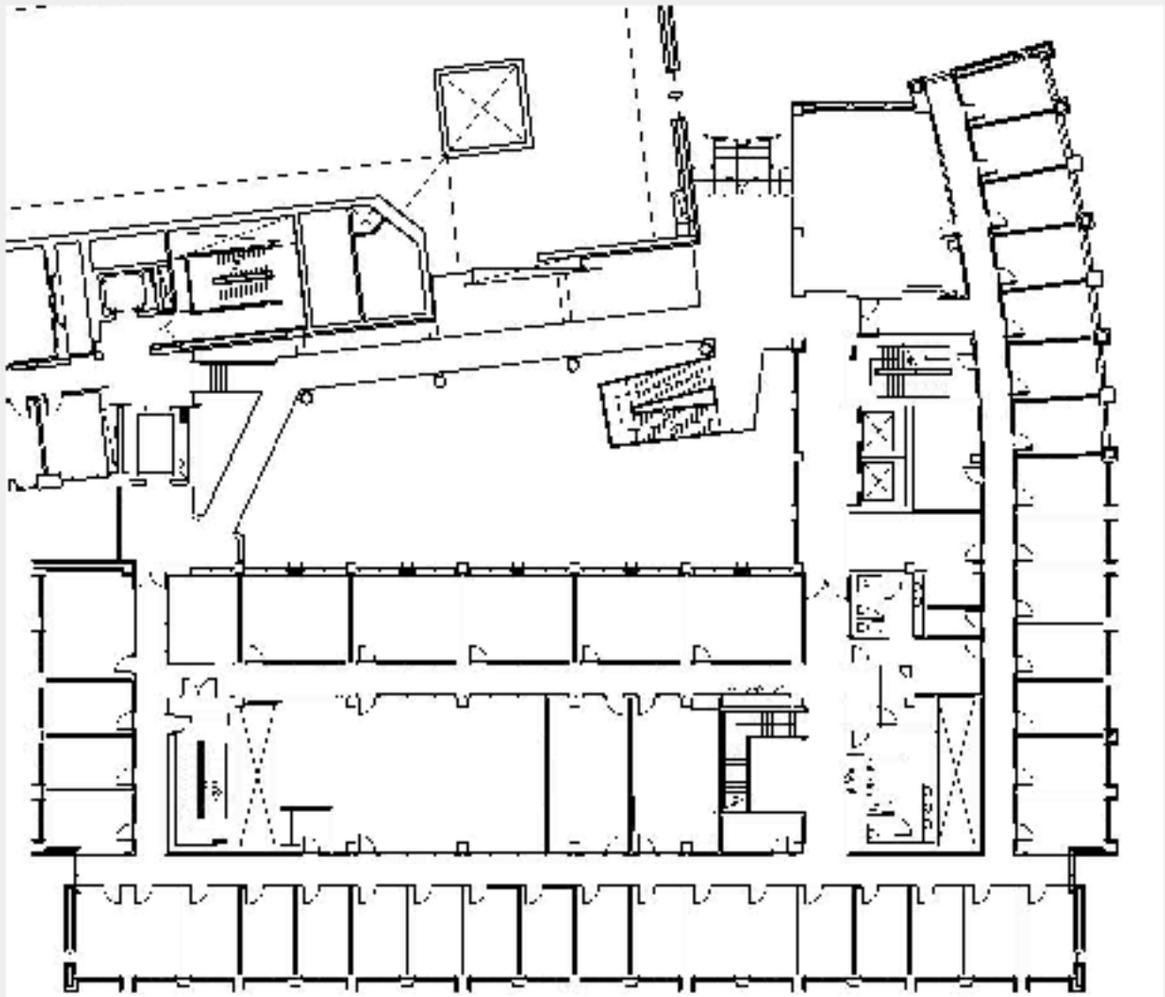
W2:International Workshop on Software Techniques for Embedded
and Pervasive Systems (STEPS), 2005
(deadline extended to March 1st)
http://www.pervasive.ifi.lmu.de/workshop.html#W2

W3:PerGames 2005: Second International Workshop on Pervasive

Map Demo

Pick a location

The Map



Location: (824.0,240.0)

Info

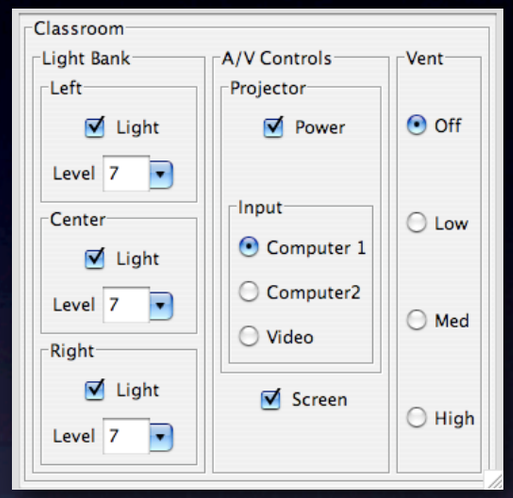
Photo

Name: Dan

Office: 588

Accessibility solutions
are **personalized**

Evaluating Success

cost(

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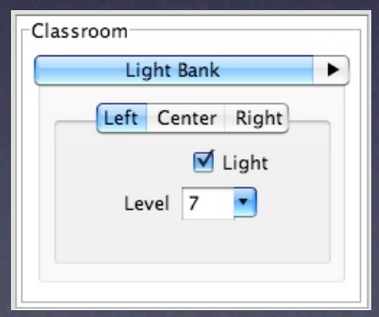
cost(

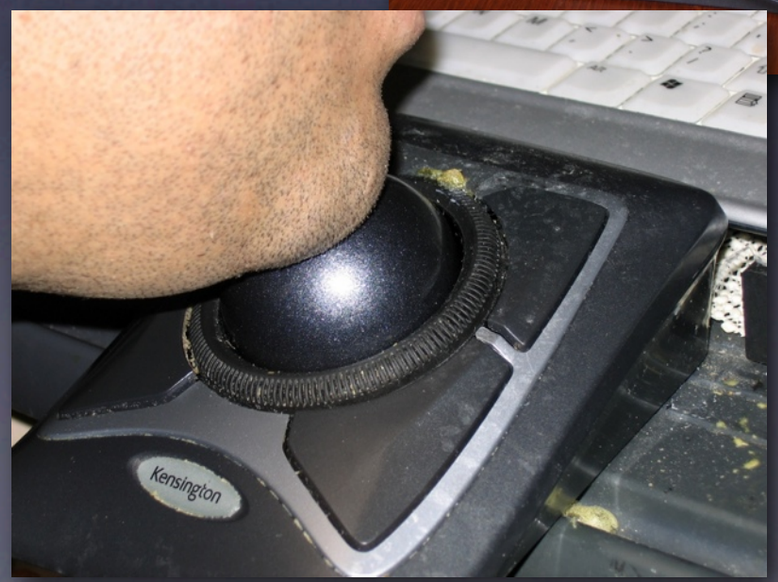
) = 12

Concerns in UI Design

- Perceptual effort
- Cognitive effort
- Motor effort
- Aesthetics

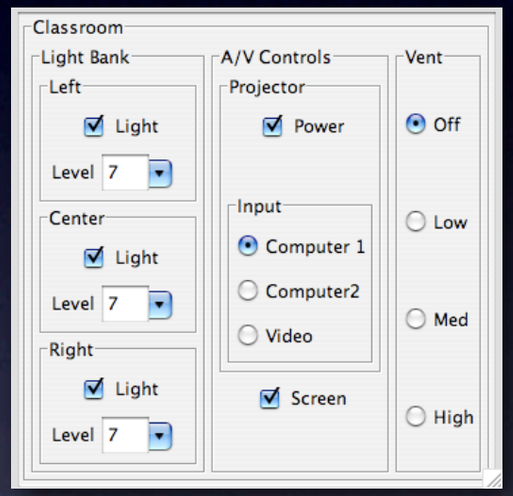
Concerns in UI Design

- Perceptual effort
- Cognitive effort
- **Motor effort**
- Aesthetics



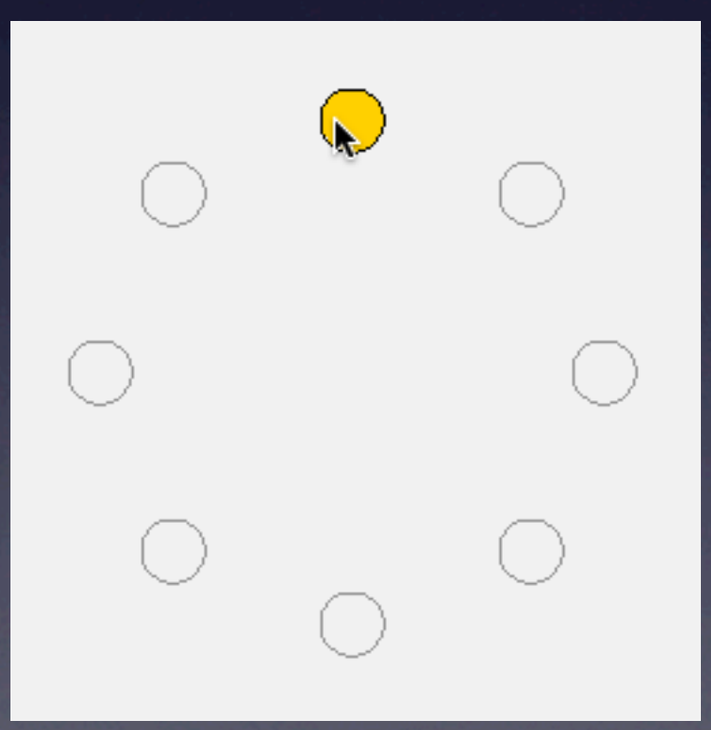
Adapting to Motor Abilities

$$\text{cost}\left(\quad\right) = \text{time}$$

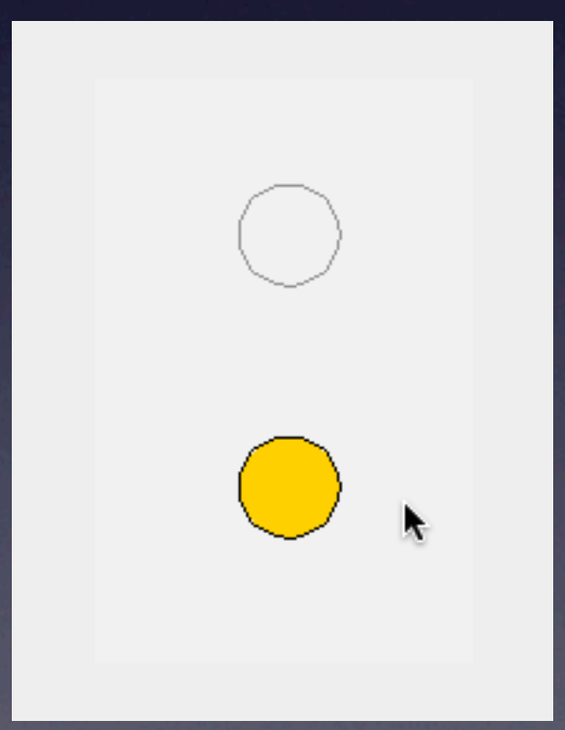


Collect Motor Performance Data

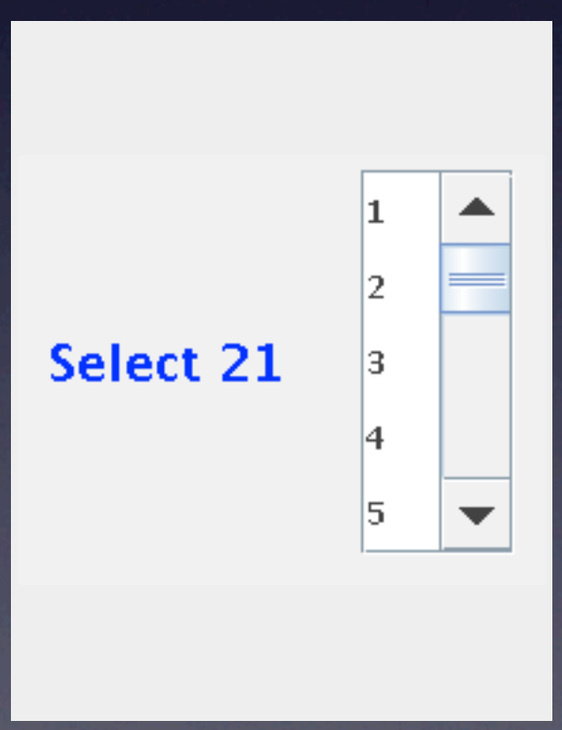
Pointing



Dragging



List Selection

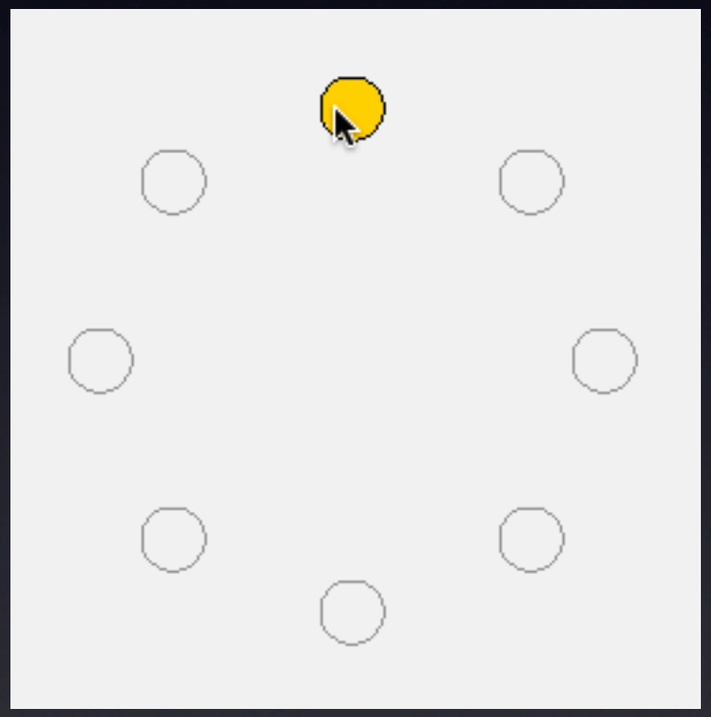


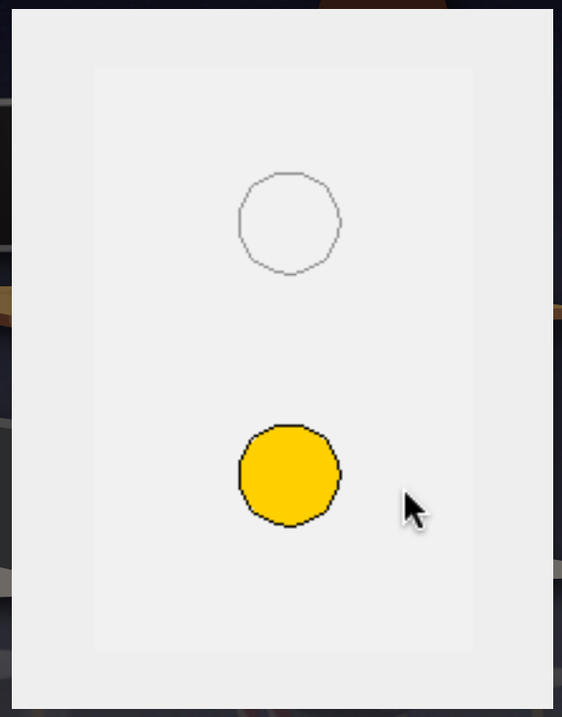
Accessibility solutions
are **adaptive**

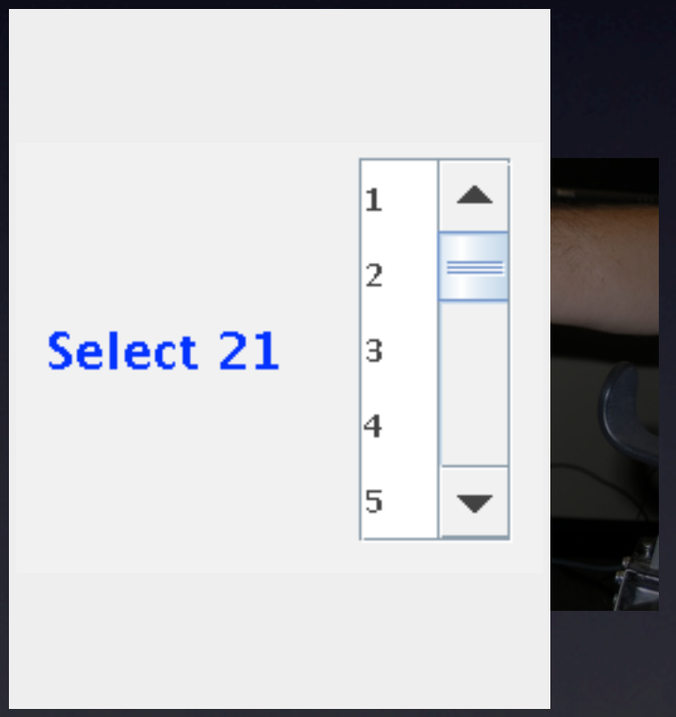
Pointing

Dragging

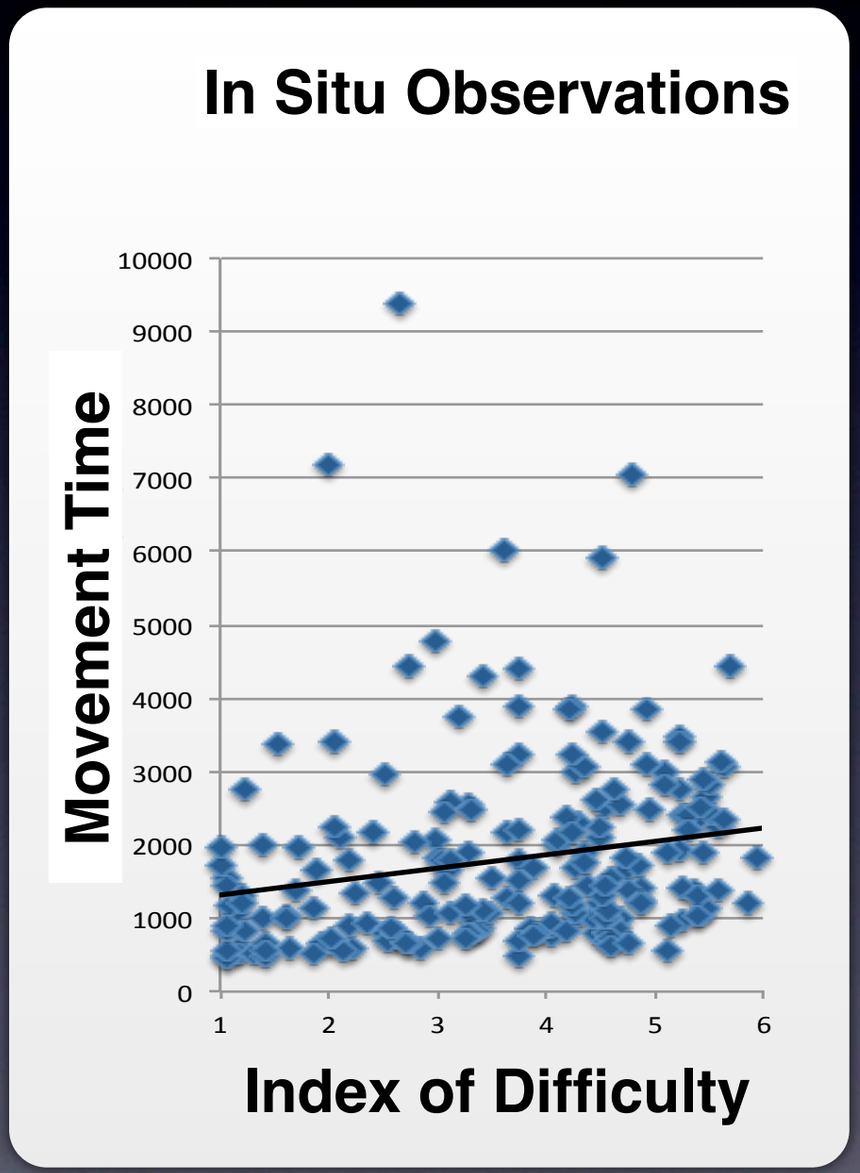
List Selection







What we get in the wild



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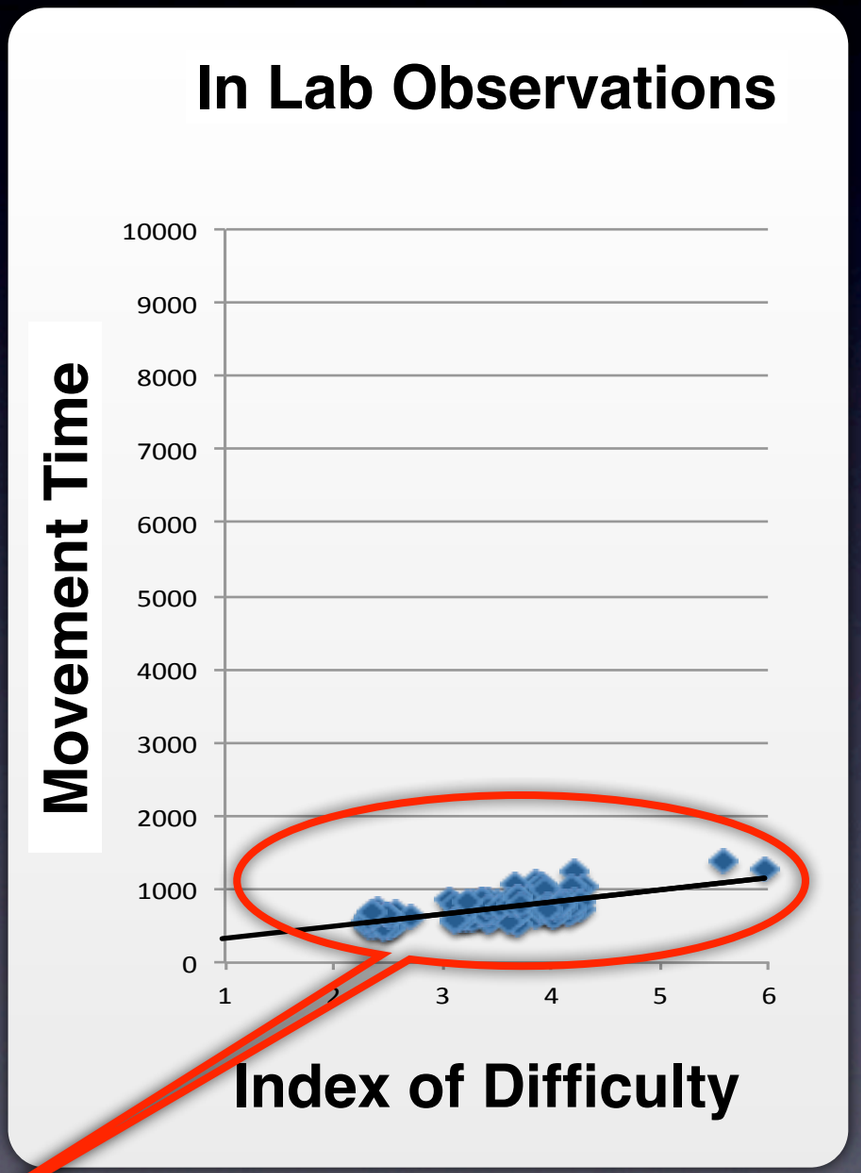
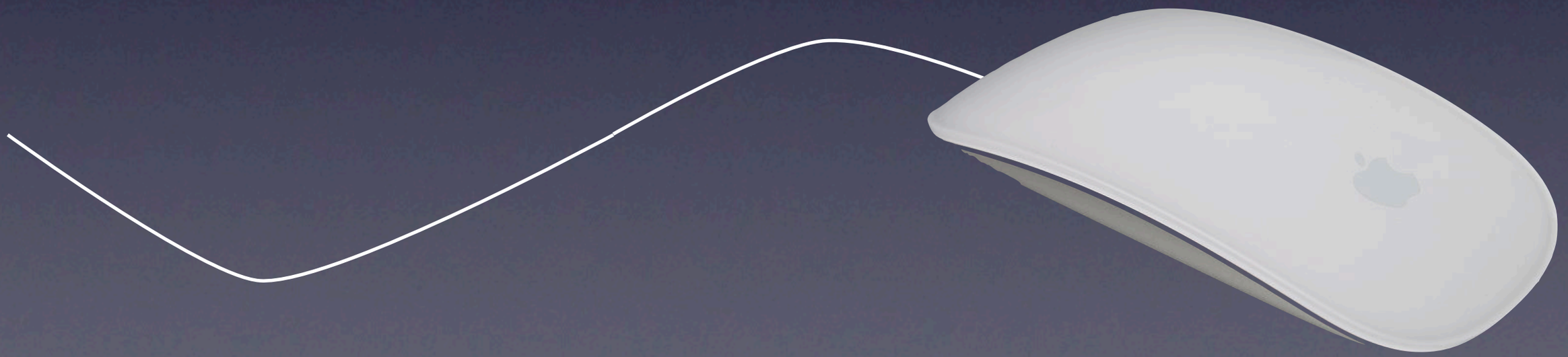
What we want



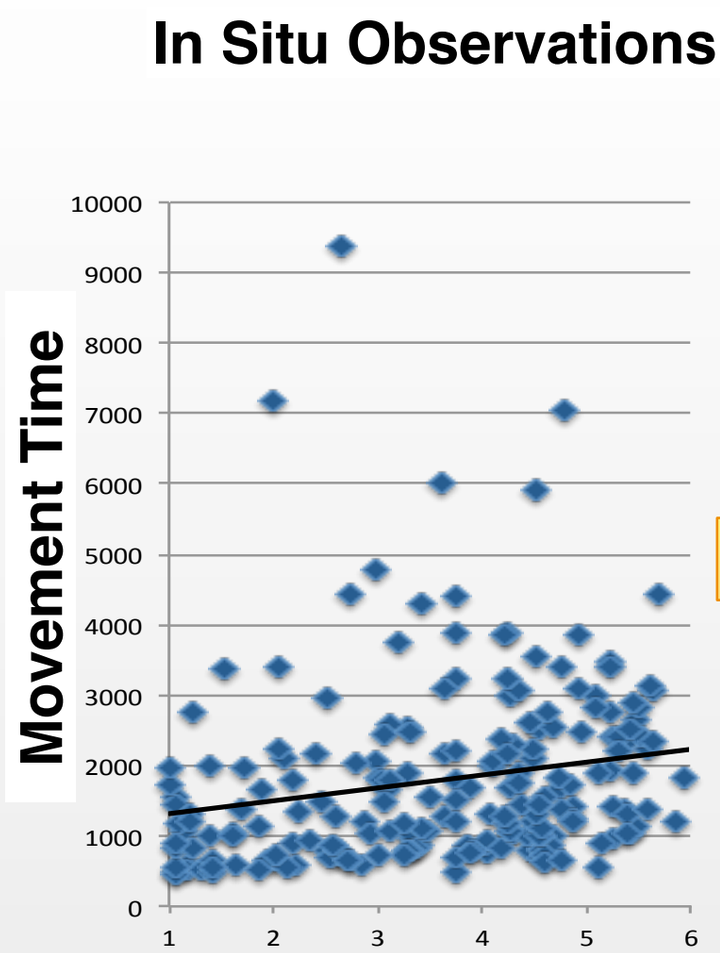
Deliberate, targeted movements

Deliberate, targeted movement?

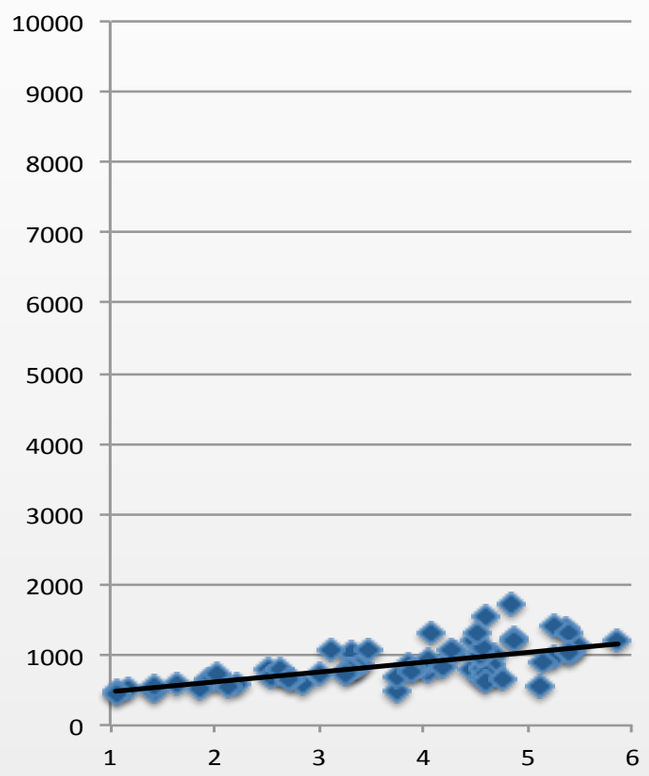


A Data-Driven Approach

Results



filter



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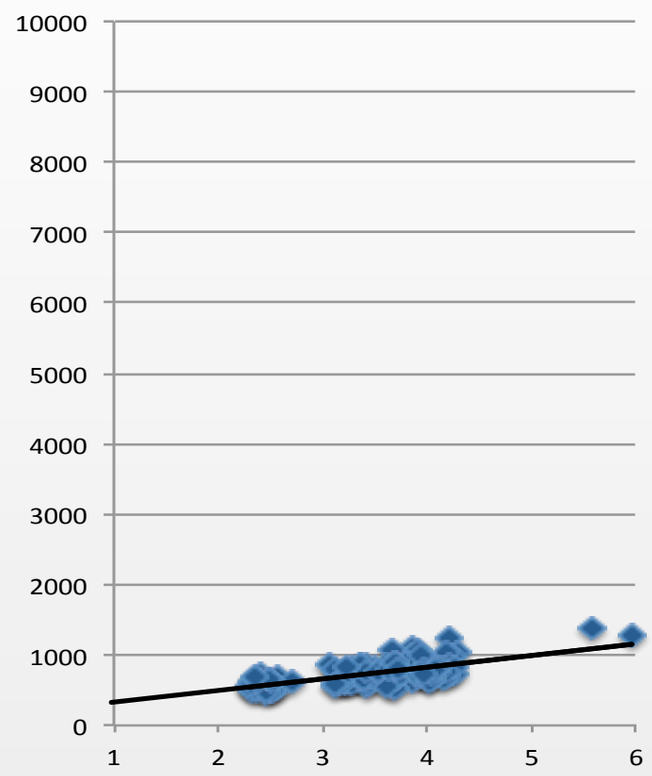


SPR Web Project

SPR*Web*:

Preserving Subjective Responses to Website Colour Schemes through Automatic Recolouring

http://iis.seas.harvard.edu/papers/images/flatla13sprweb.mp4

SPR Web

- Interfaces **share** the burden of adaptation
- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive** (not yet)
- Solutions can **scale** to millions of individuals

Age-related differences in computer input performance?

LabInTheWild

4860
participants last week

Trust us; you will love this test!

Take this test to see how well you can spot (un)trustworthy websites. This experiment takes around 12 minutes.

Participate now!

How do you predict future change?

Plot some points to see whether your way of predicting event trends is more American or Chinese. This experiment takes around 10 minutes.

Participate now!

What is your website aesthetic?

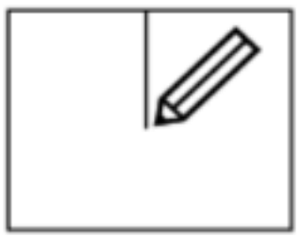
Compare your visual preferences to people around the world. This experiment takes around 10 minutes.

Participate now!

Test your social intelligence!

Test how well you can read emotions of others just by looking at their eyes. This experiment takes around 10 minutes.

Participate now!



Are you more Eastern or Western?

In this test, you will learn whether you are more sensitive to a focal object (as most Americans) or more attuned to the context (as many Japanese). This experiment takes around 8 minutes.

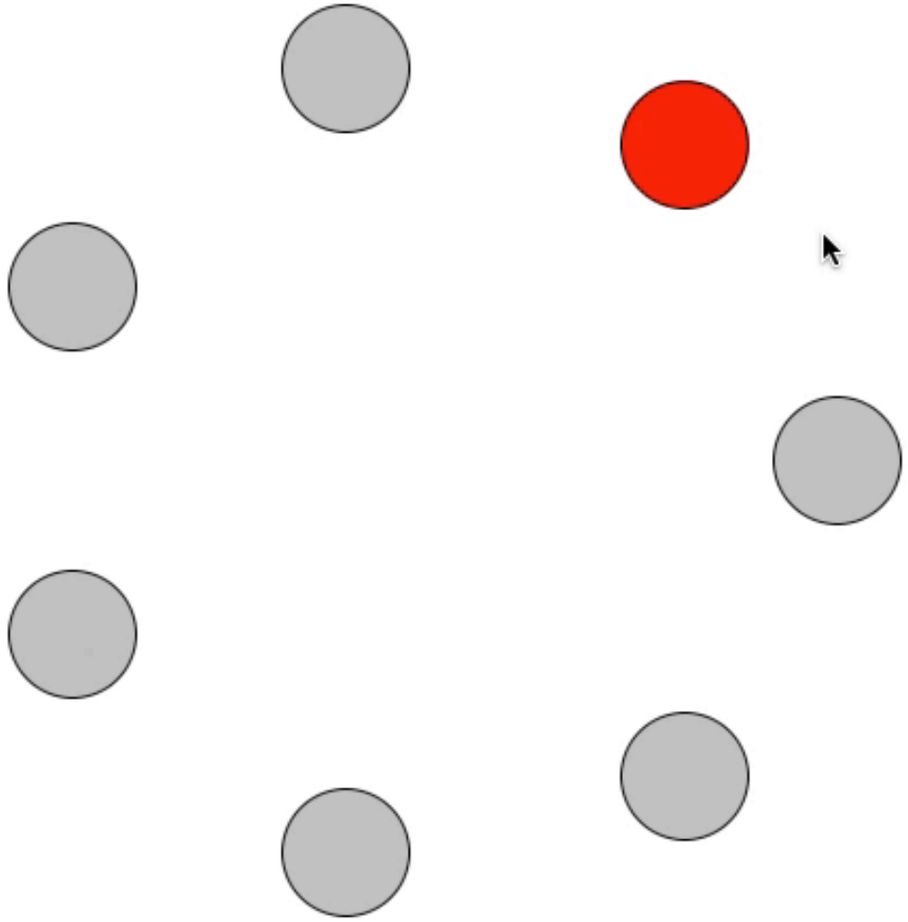
Participate now!

Looking for more studies?

Learn about your brain and contribute to brain research on TestMyBrain, or test your language sense on Games With Words!

Age Guessing Game

Progress: Set 1 out of 10



Results

Our best guess is that you are 30. Is it close?

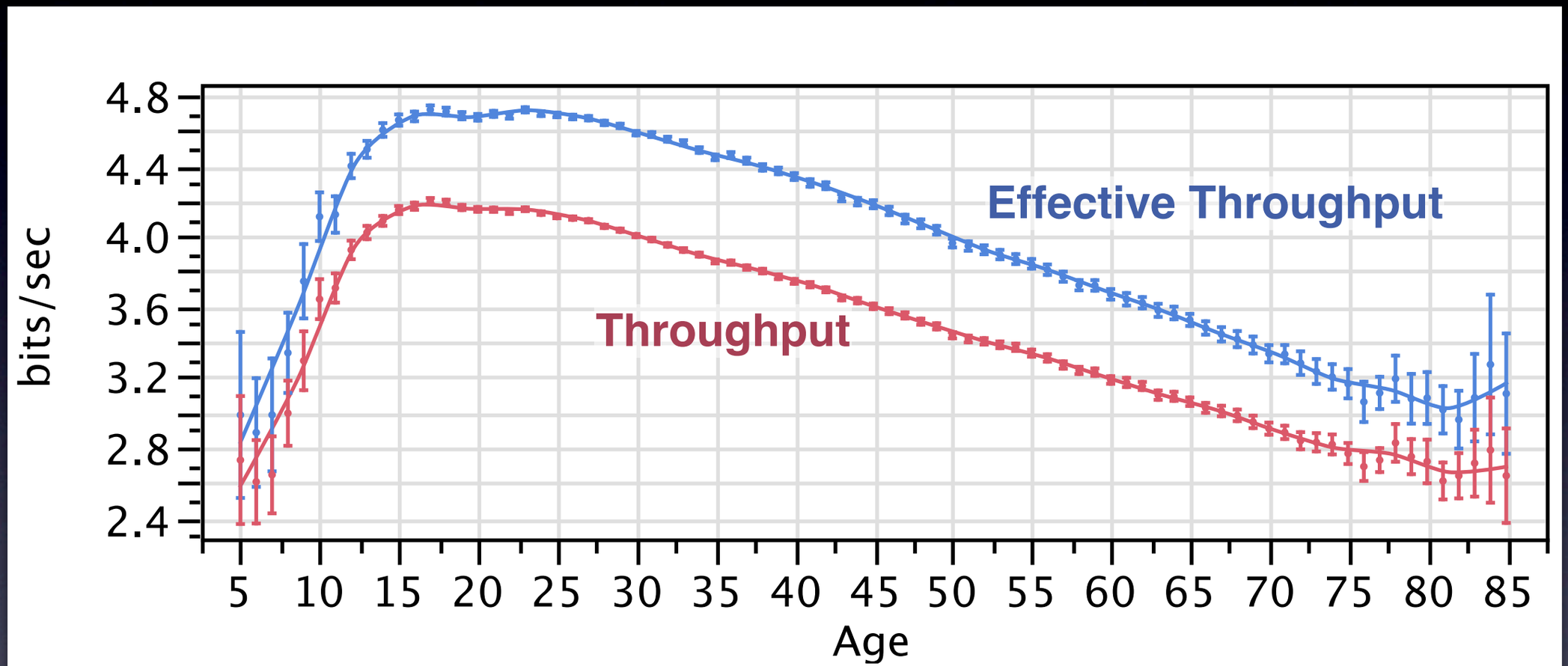
To help us improve the system, please tell us your actual age

Any final comments?

Finish!

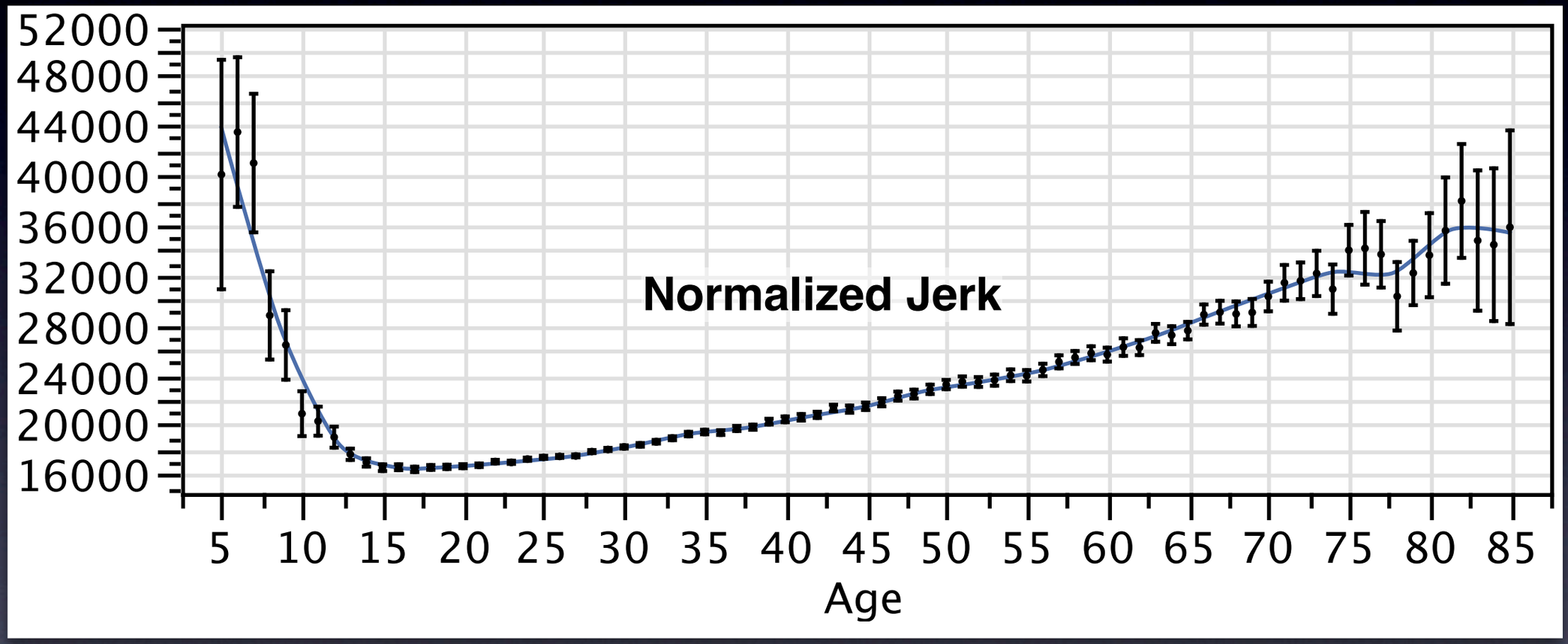
- > 1,000,000 visitors
- > 500,000 participants
- ~350,000 usable participants aged 5-85
- 212,212 mouse users on Windows and Mac OS X

Input Performance by Age

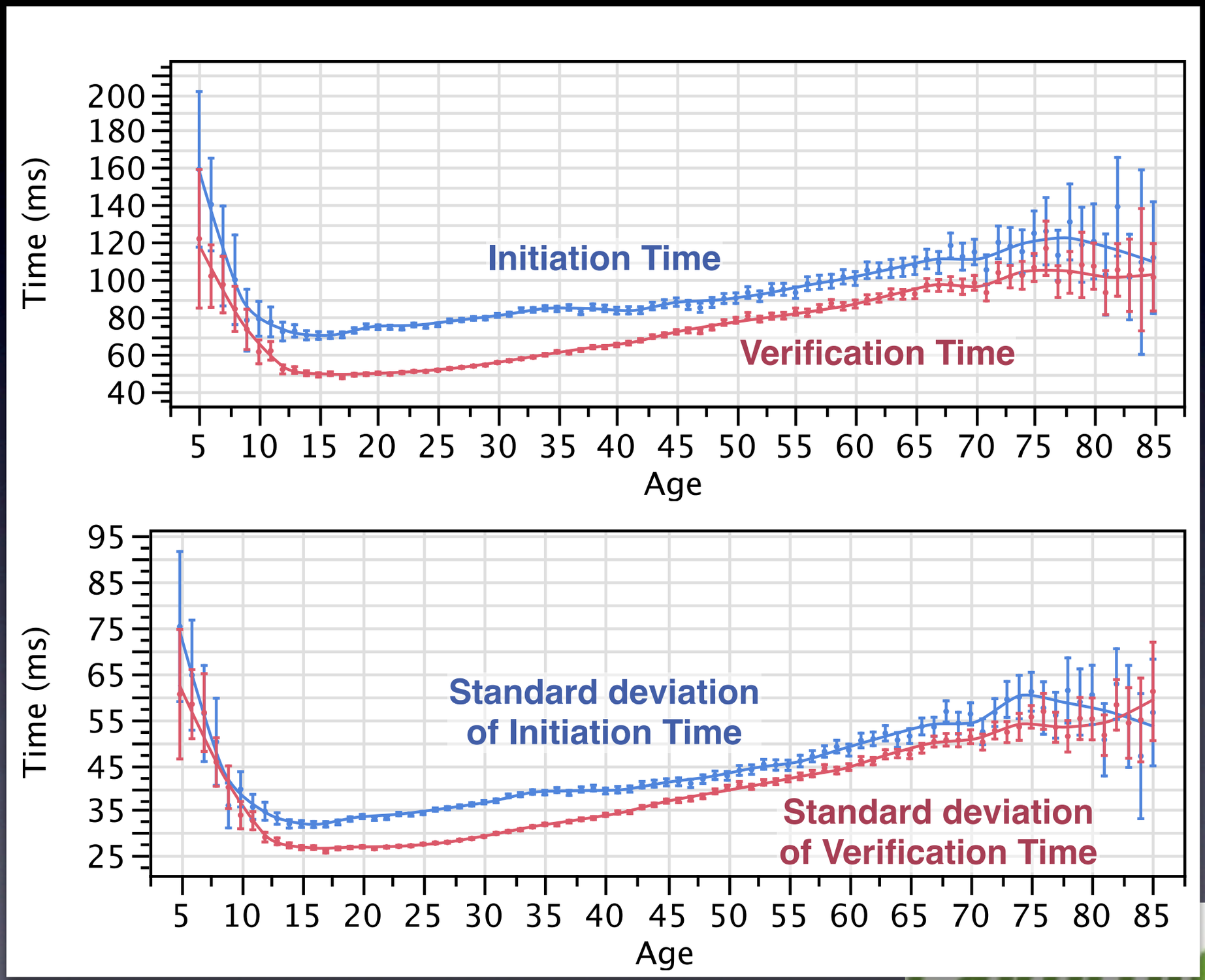


Lab in the Wild

Fine Motor Control by Age



Cognitive Processing Speed by Age



Matthew Effect and Computer Access

For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken even that which he hath.

—Matthew 25:29

Malcolm Gladwell

Photo by Kris Krüg at PopTech 2008

Biases Against Older Workers

Productivity of Older Workers: Perceptions of Employers and Employees

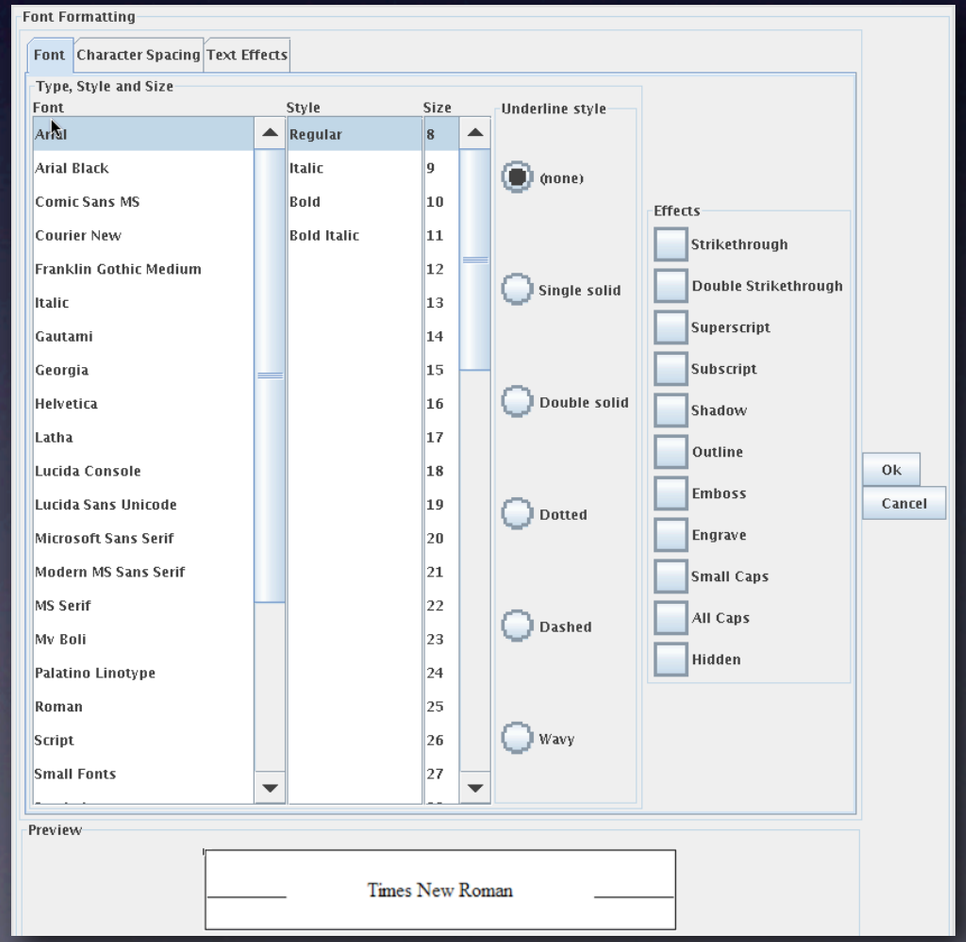
HENDRIK P. VAN DALEN
KÈNE HENKENS
JOOP SCHIPPERS

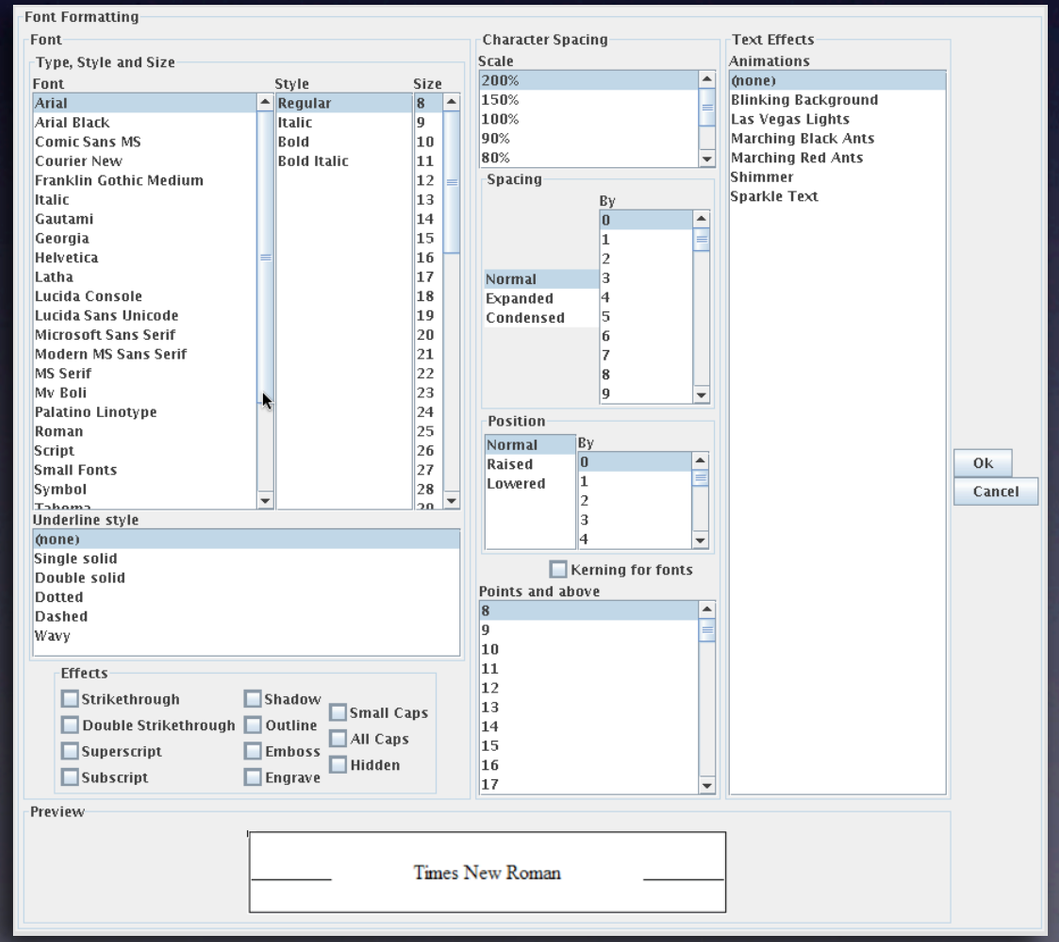
...we tested whether soft qualities and abilities-e.g., reliability and commitment-are just as important as hard qualities-cognitive and physically based skills-in the eyes of both employers and employees. It appears that both employers and employees, young and old, view hard skills as far more important than soft skills.

Reprise

A Vision for Equitable (Computer) Accessibility

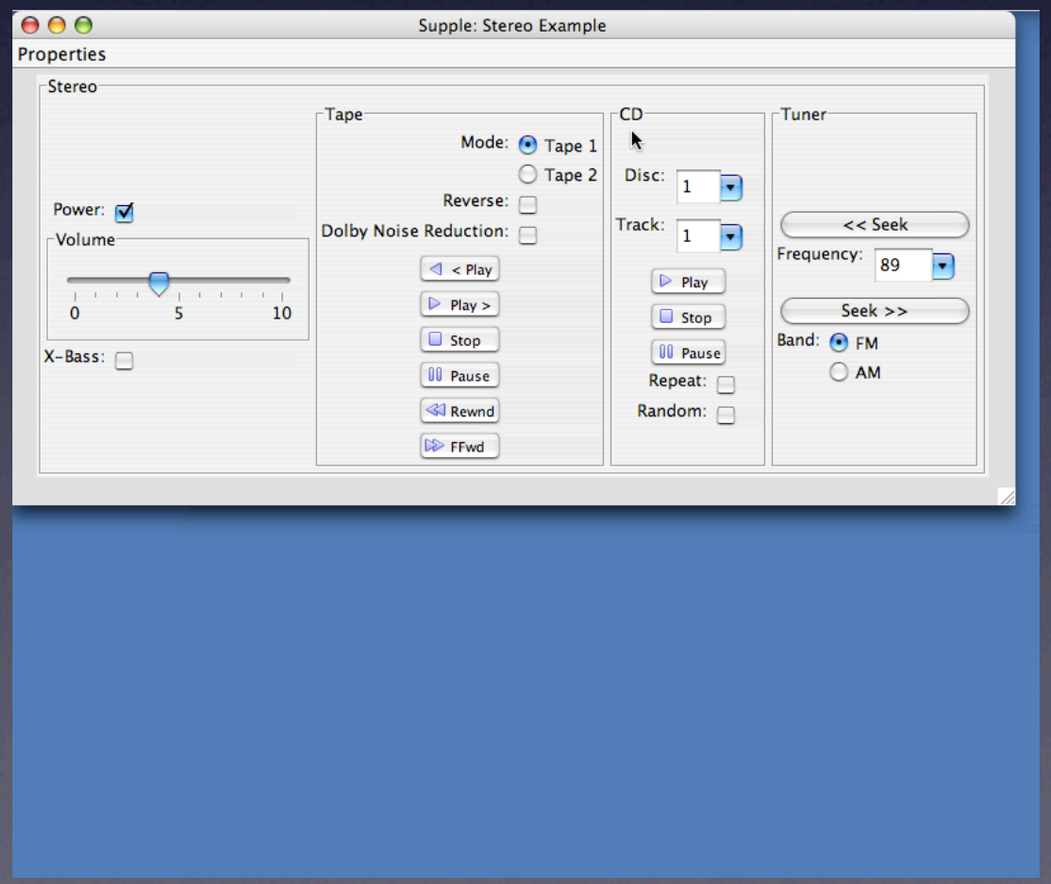
- Interfaces **share** the burden of adaptation





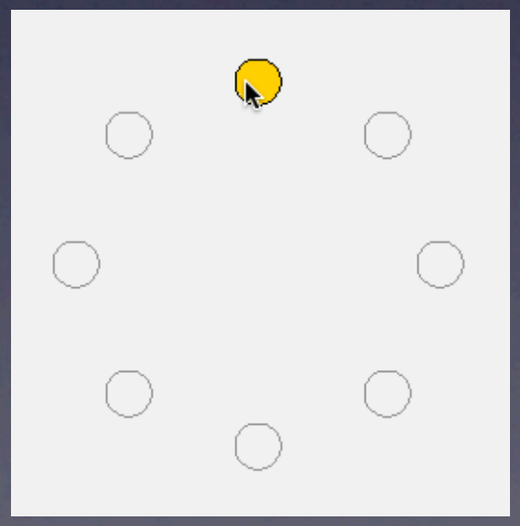
A Vision for Equitable (Computer) Accessibility

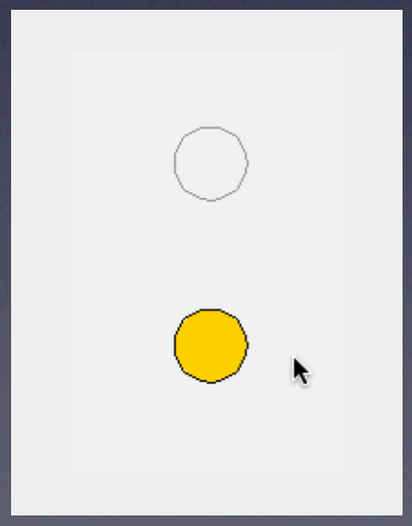
- Interfaces **share** the burden of adaptation
- Solutions can **scale** to millions of individuals

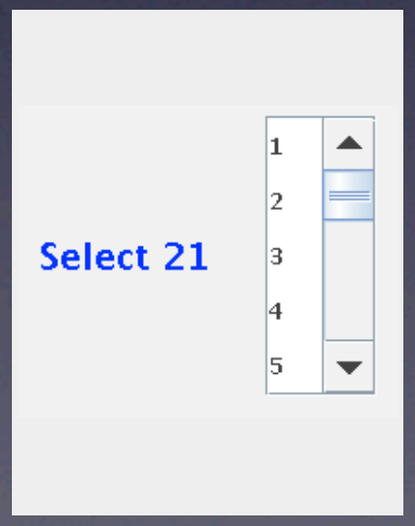


A Vision for Equitable (Computer) Accessibility

- Interfaces **share** the burden of adaptation
- Solutions can **scale** to millions of individuals
- Accessibility solutions are **personalized**

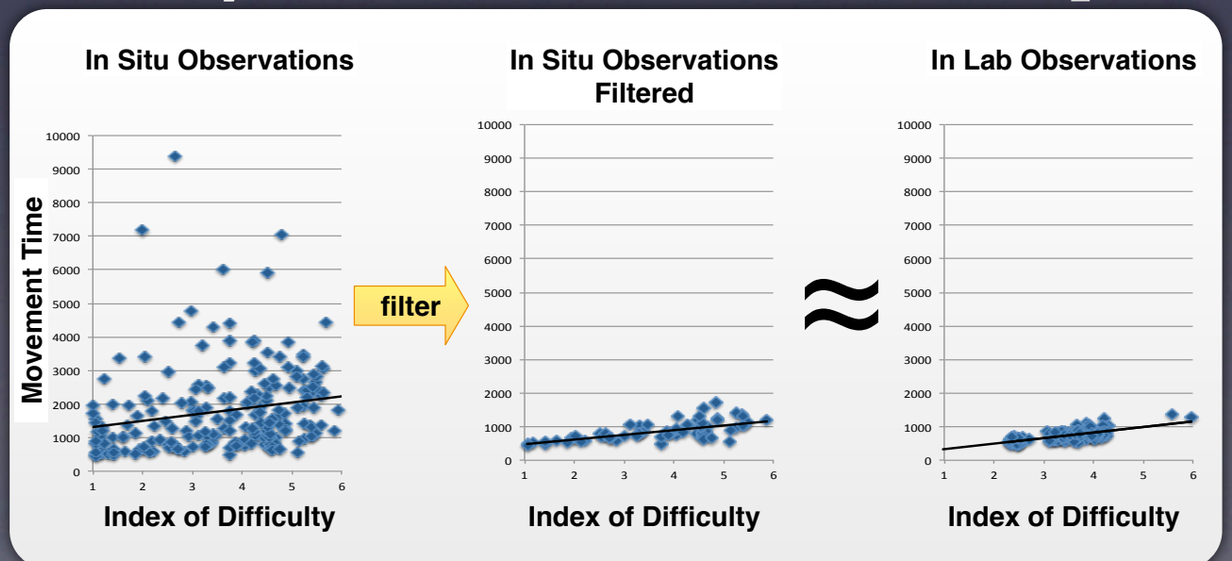






A Vision for Equitable (Computer) Accessibility

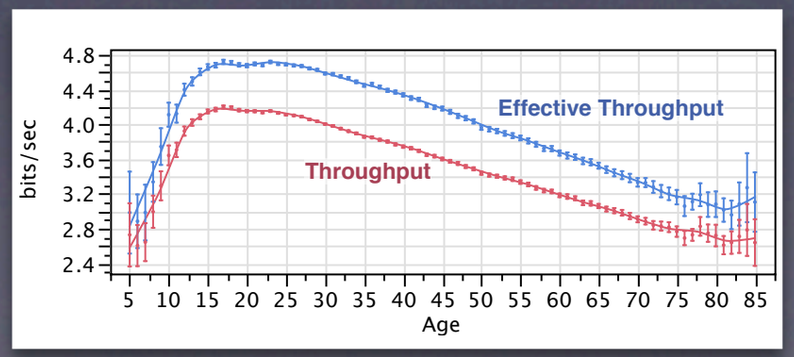
- Interfaces **share** the burden of adaptation
- Solutions can **scale** to millions of individuals
- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive**



A Vision for Equitable (Computer) Accessibility

- Interfaces **share** the burden of adaptation
- Solutions can **scale** to millions of individuals

- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive**
- (Profound differences in abilities are **pervasive**)



A Vision for Equitable (Computer) Accessibility

- Interfaces **share** the burden of adaptation
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- Accessibility solutions are **personalized**
- Accessibility solutions are **adaptive**
- (Profound differences in abilities are **pervasive**)

Krzysztof Gajos
iis.seas.harvard.edu

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School of Engineering
and Applied Sciences