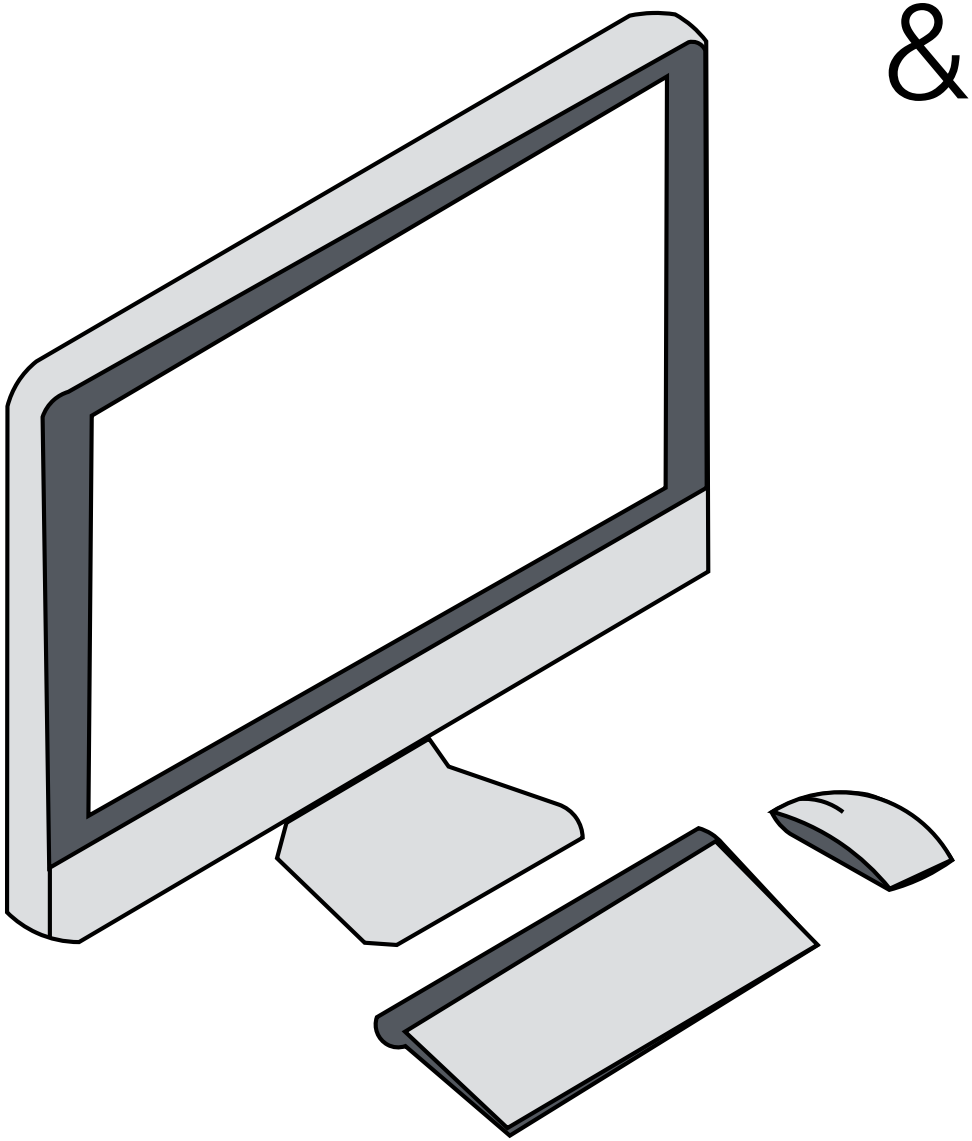
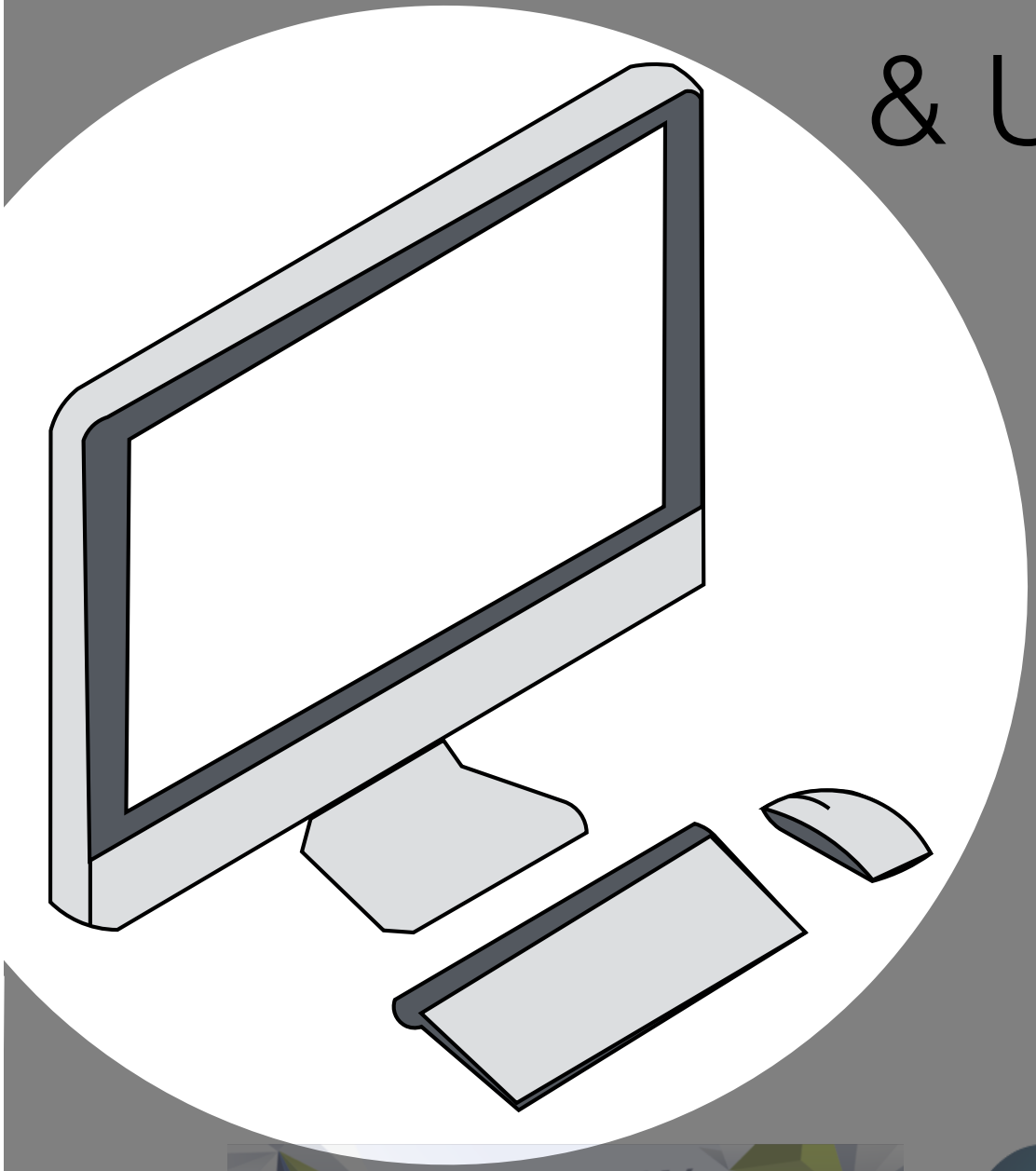
Command Selection & User Expertise



Gilles Bailly

Command Selection & User Expertise



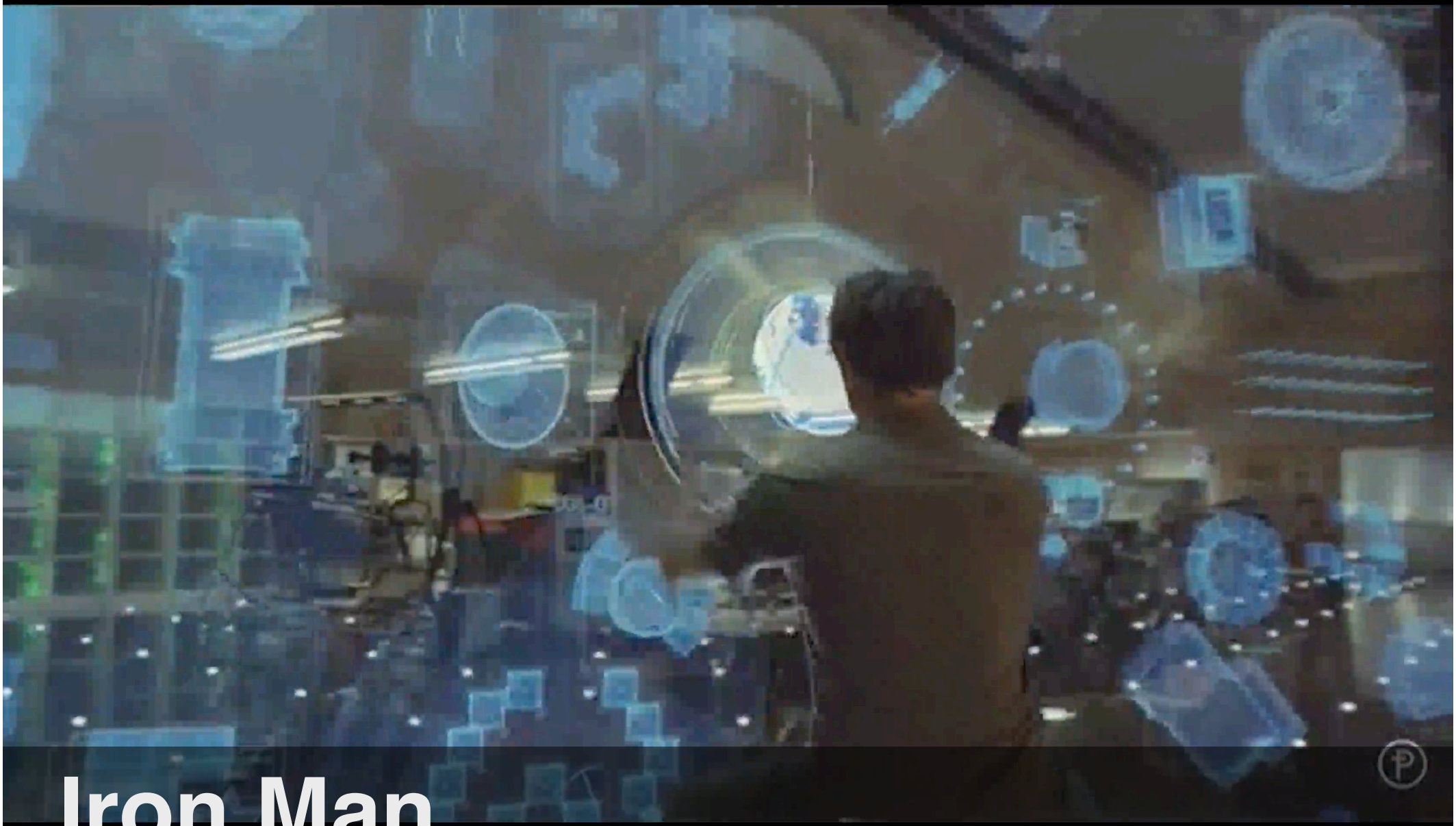
Gilles Bailly

VISIGRAPP 2016
11th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications
Rome, Italy 27 - 29 February, 2016
GRAPP IVAPP VISAPP

cnrs
TELECOM ParisTech
université PARIS-SACLAY

Human-Computer Interaction

Minority Report

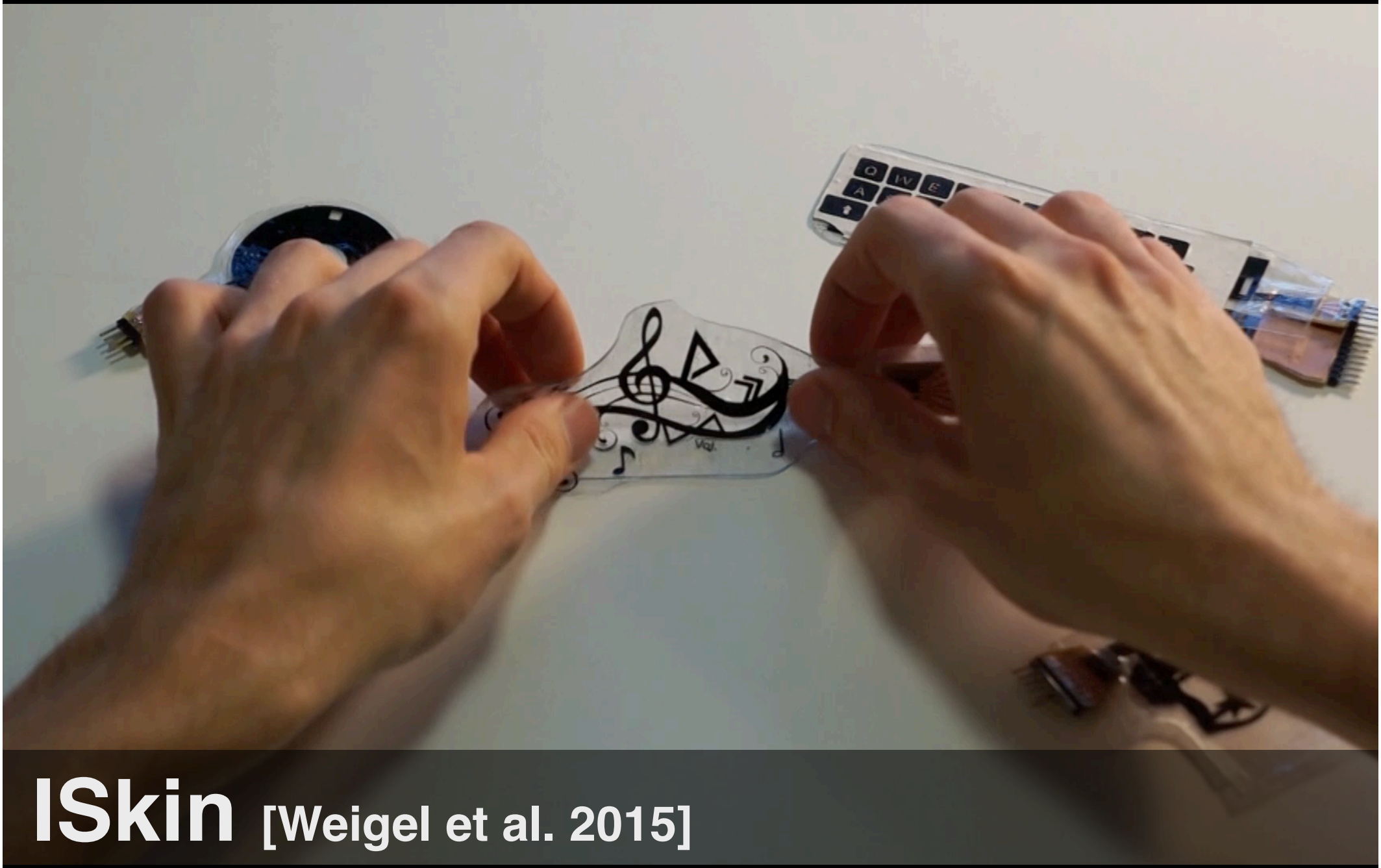


Iron Man

iForm [Leithinger 2013]

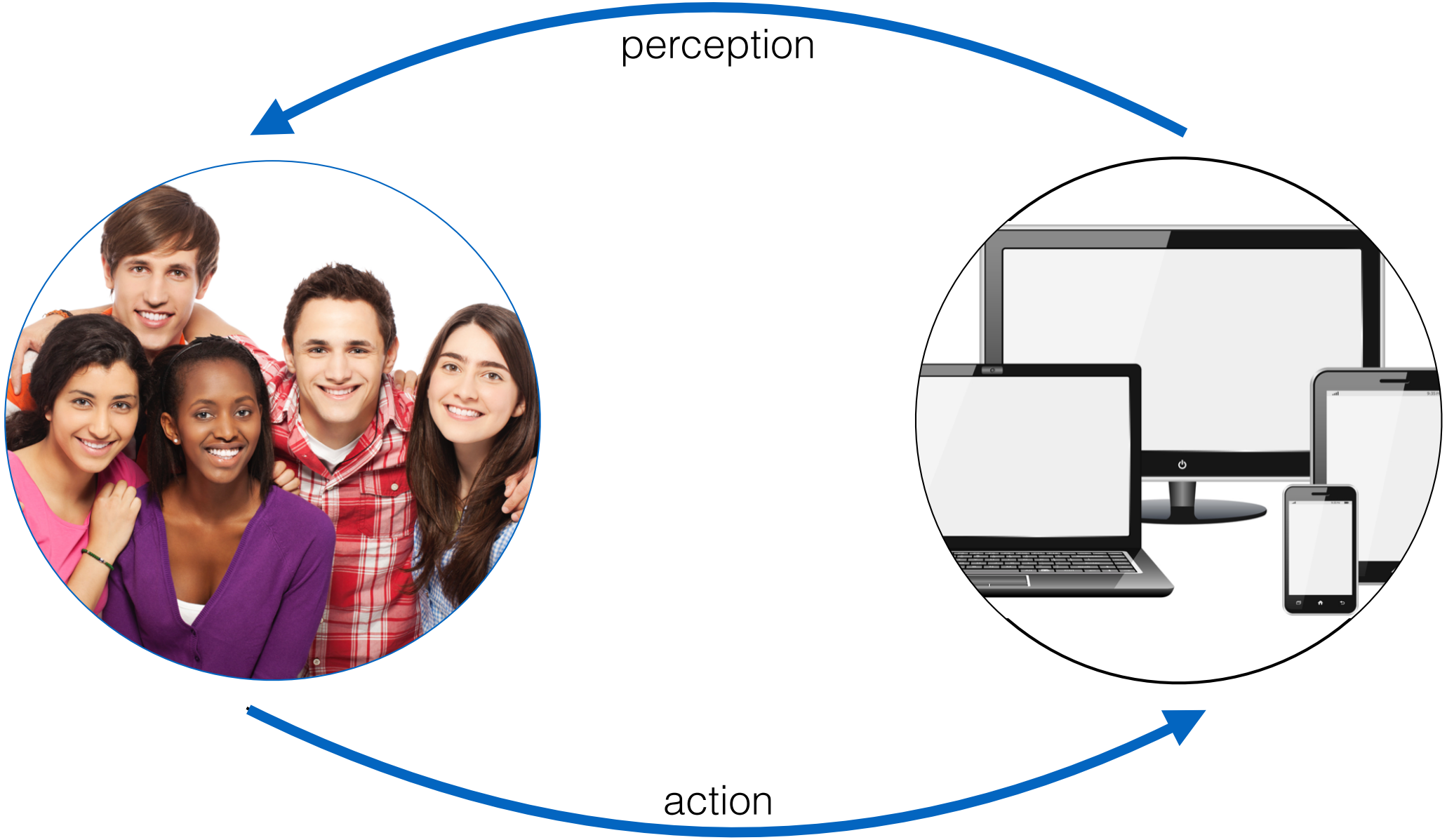
LazyNav [Guy 2015]

ISkin [Weigel et al. 2015]



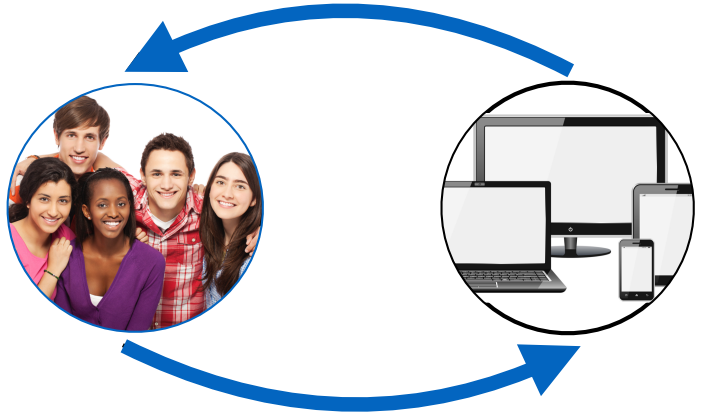
ISkin [Weigel et al. 2015]

1. ”HCI is just designing cool devices"



Human-Computer Interaction

HCI



Improve artefacts

Understand phenomena

Creating Tools

1. ”HCI is more than designing cool devices"

2. ”Desktop workstation is dead"

Mowing along the length of the field
100,75
0,0
Mowing along the width of the field
100,75
0,0
w

Today

SketchPad [Sutherland 1963]

"The world is changing…

…we should design beyond the desktop"

"Microsoft's Kinect: The New Mouse?"

The New York Times

"The mouse dies"

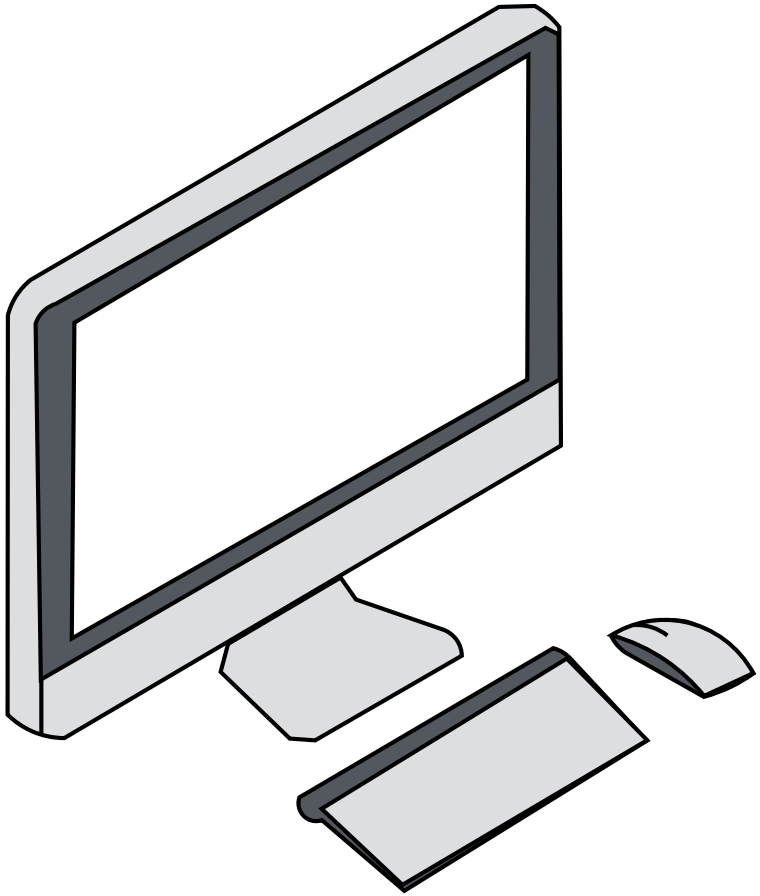
[CIO for the city of Palo Alto]

"Touch is king"

"The mouse is ancient […], the mouse is outhere"

[Al Farsoldt]

Screen



Desktop workstation is a timeless interactive system

High level of comfort during extended computing sessions

"A device is well suited for some tasks, and not for others"

[Buxton]

Mowing along the length of the field
100,75
0,0
Mowing along the width of the field
100,75
0,0
w

Today (and probably tomorrow)

Millions of users

are spending several hours per day

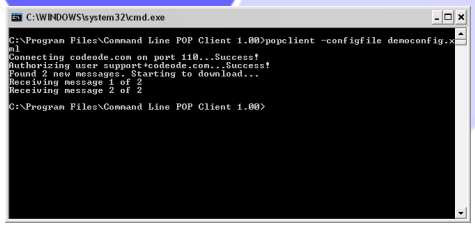
Working on their old good workstation

PC games > 2x console games

The desktop is NOT dead!

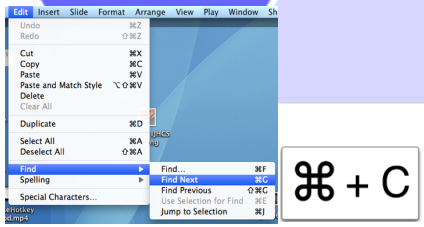
3. ”The GUI model (or WIMP) is dead"

CLI
- Codified
- Strict



Command line Interface

GUI
- Metaphor
- Exploratory



⌘ + C

Graphical User Interface

NUI
- Direct
- Intuitive

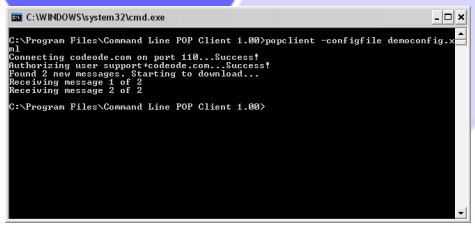
Natural User Interface

[wikipedia]

Command Line Interface

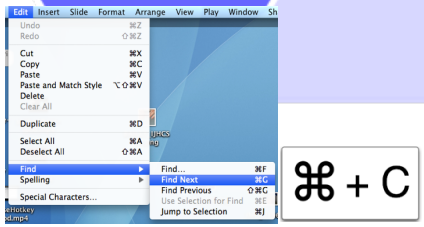
```
[root@localhost ~]# ping -q fa.wikipedia.org
PING text.pmtpa.wikimedia.org (208.80.152.2) 56(84) bytes of data.
^C
--- text.pmtpa.wikimedia.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 540.528/540.528/540.528/0.000 ms
[root@localhost ~]# pwd
/root
[root@localhost ~]# cd /var
[root@localhost var]# ls -la
total 72
drwxr-xr-x. 18 root root 4096 Jul 30 22:43 .
drwxr-xr-x. 23 root root 4096 Sep 14 20:42 ..
drwxr-xr-x.  2 root root 4096 May 14 00:15 account
drwxr-xr-x. 11 root root 4096 Jul 31 22:26 cache
drwxr-xr-x.  3 root root 4096 May 18 16:03 db
drwxr-xr-x.  3 root root 4096 May 18 16:03 empty
drwxr-xr-x.  2 root root 4096 May 18 16:03 games
drwxrwx--T.  2 root gdm  4096 Jun  2 18:39 gdm
drwxr-xr-x. 38 root root 4096 May 18 16:03 lib
drwxr-xr-x.  2 root root 4096 May 18 16:03 local
lrwxrwxrwx.  1 root root   11 May 14 00:12 lock -> ../run/lock
drwxr-xr-x. 14 root root 4096 Sep 14 20:42 log
lrwxrwxrwx.  1 root root   10 Jul 30 22:43 mail -> spool/mail
drwxr-xr-x.  2 root root 4096 May 18 16:03 nis
drwxr-xr-x.  2 root root 4096 May 18 16:03 opt
drwxr-xr-x.  2 root root 4096 May 18 16:03 preserve
drwxr-xr-x.  2 root root 4096 Jul  1 22:11 report
lrwxrwxrwx.  1 root root    6 May 14 00:12 run -> ../run
drwxr-xr-x. 14 root root 4096 May 18 16:03 spool
drwxrwxrwt.  4 root root 4096 Sep 12 23:50 tmp
drwxr-xr-x.  2 root root 4096 May 18 16:03 yp
[root@localhost var]# yum search wiki
Loaded plugins: langpacks, presto, refresh-packagekit, remove-with-leaves
rpmfusion-free-updates                                   | 2.7 kB     00:00
rpmfusion-free-updates/primary_db                        | 206 kB     00:04
rpmfusion-nonfree-updates                                | 2.7 kB     00:00
updates/metalink                                         | 5.9 kB     00:00
updates                                                  | 4.7 kB     00:00
updates/primary_db                 73% [=====================        ]  62 kB/s | 2.6 MB     00:15 ETA
```

CLI
- Codified
- Strict



Command line Interface

GUI
- Metaphor
- Exploratory



⌘ + C

Graphical User Interface

NUI
- Direct
- Intuitive

Natural User Interface

[wikipedia]

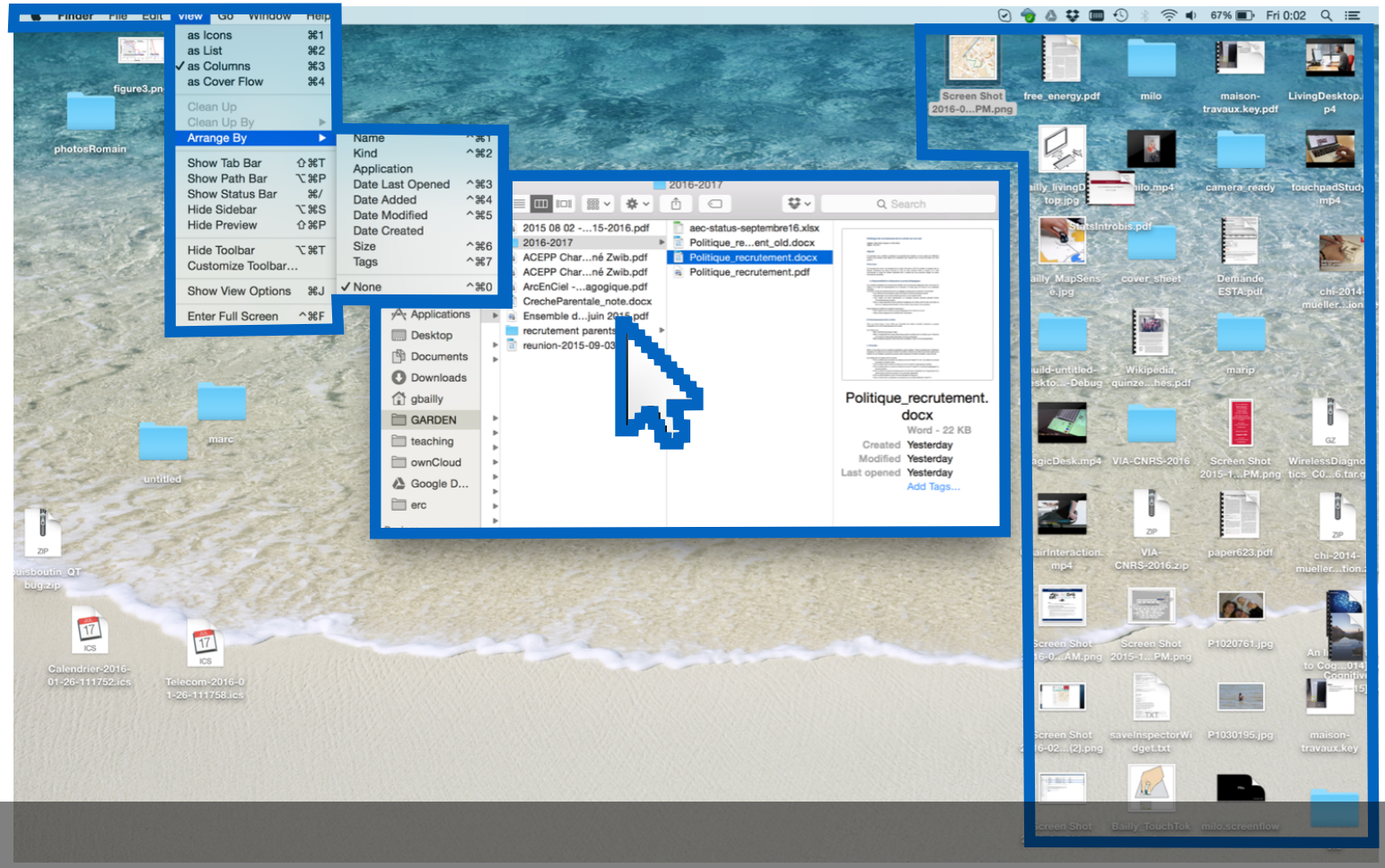
GUI = WIMP

Windows

Icon

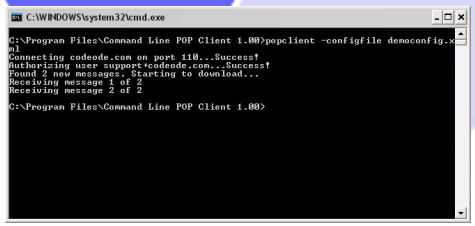
Menu

Pointer



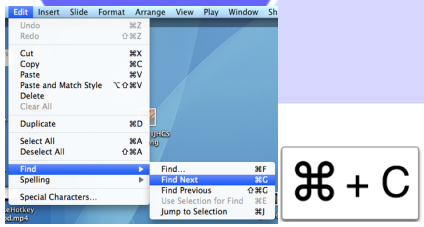
WIMP [merzouga 1980]

CLI
- Codified
- Strict



Command line Interface

GUI
- Metaphor
- Exploratory



⌘ + C

Graphical User Interface

NUI
- Direct
- Intuitive

Natural User Interface

[wikipedia]

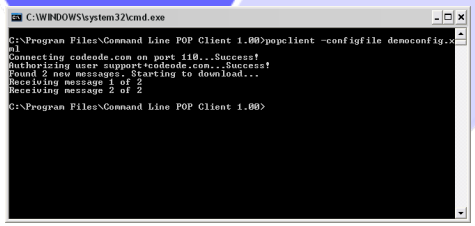
KINECT
for XBOX 360

XBOX360
KINECT

KINECT

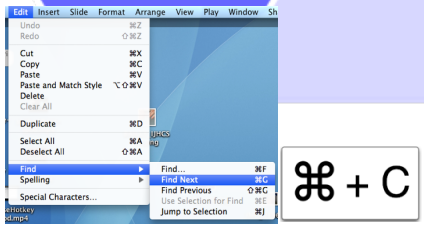
1:43
Thursday, January 16
Press any key to unlock

CLI
- Codified
- Strict



Command line Interface

GUI
- Metaphor
- Exploratory



⌘ + C

Graphical User Interface

NUI
- Direct
- Intuitive

Natural User Interface

[wikipedia]

Is it a WIMP Interface?

Windows

Icon

Menu

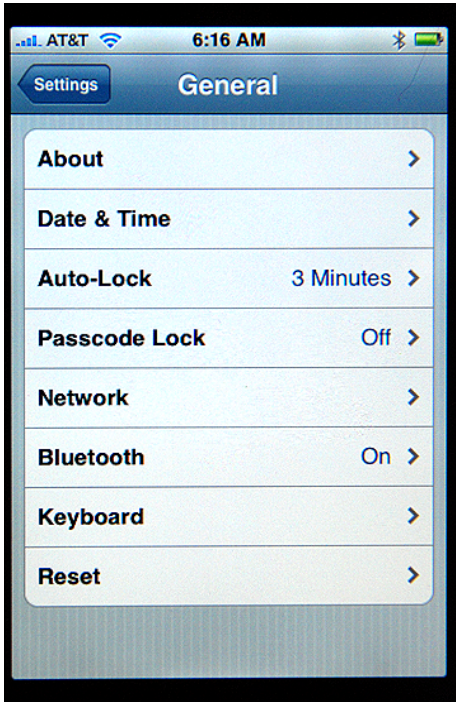
Pointer

Windows

Icon

Menu

Pointer



Windows

Icon

Menu

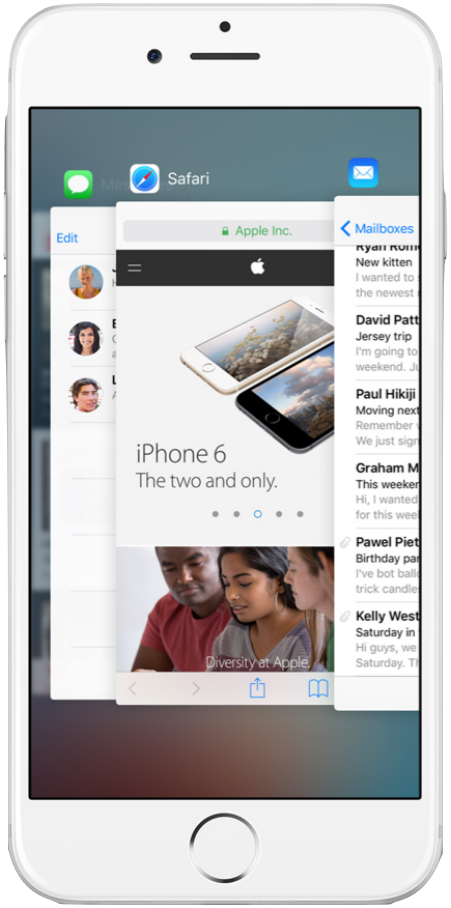
Pointer

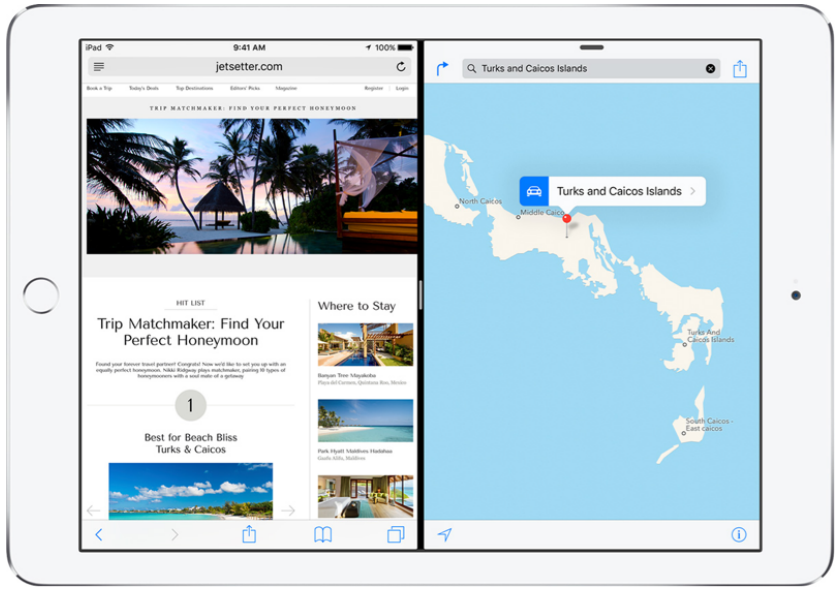
Windows

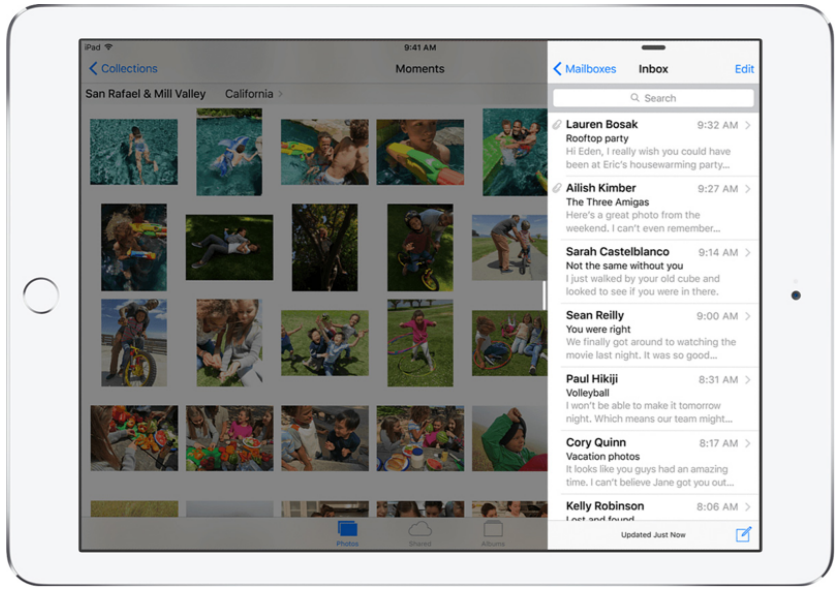
Icon

Menu

Pointer





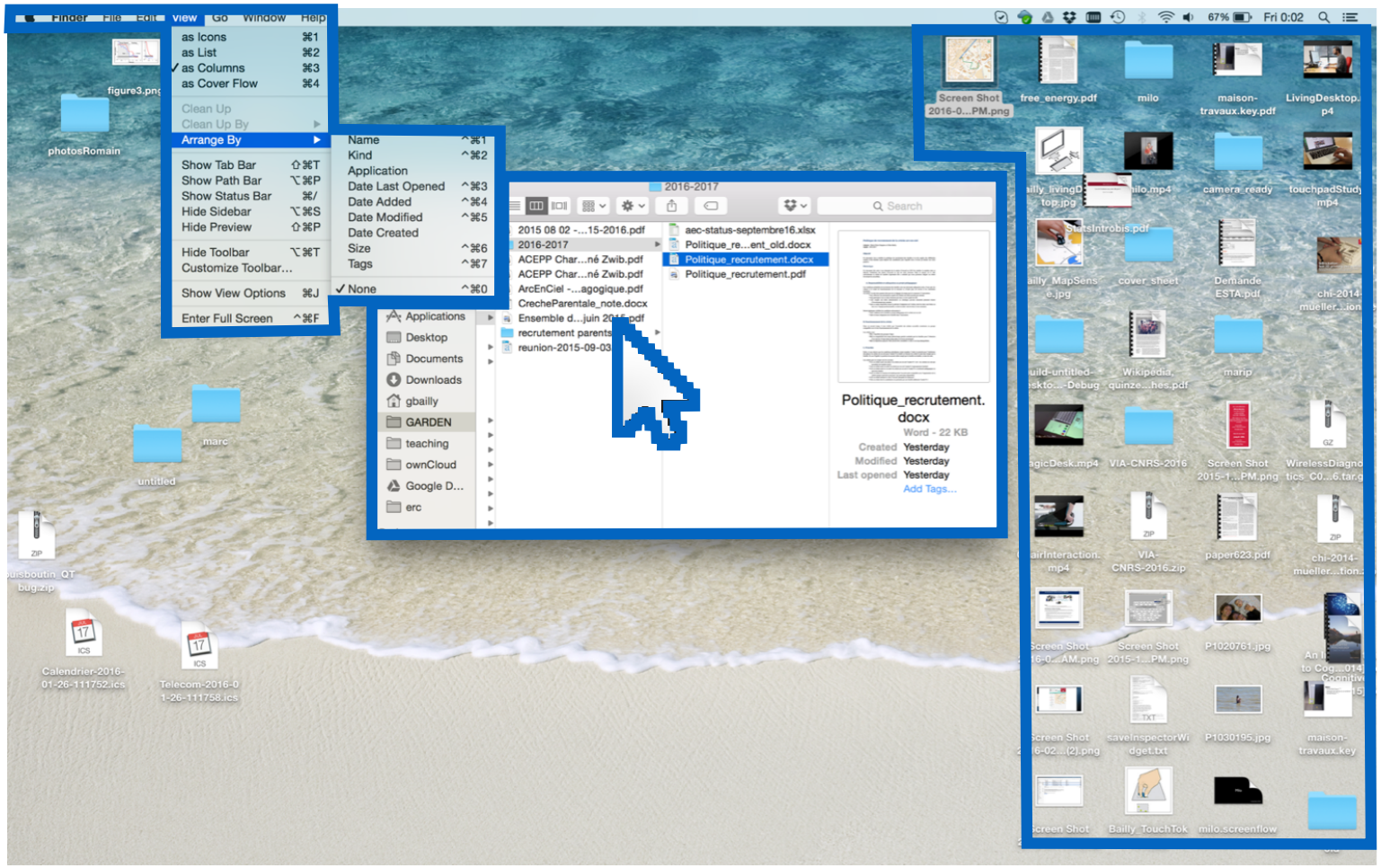


Windows

Icon

Menu

Pointer



GUI (WIMP) is NOT dead

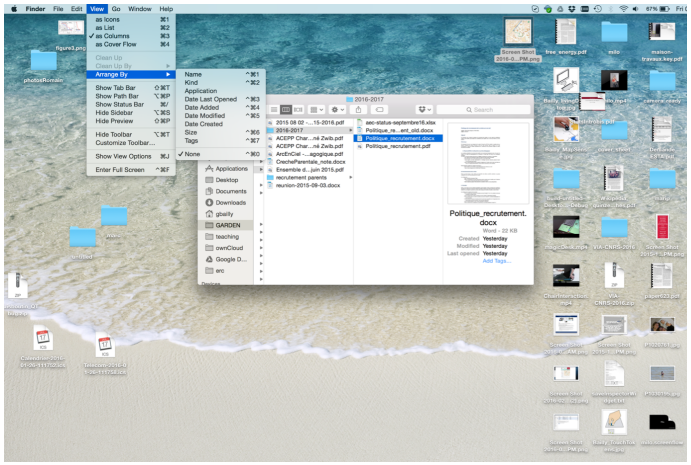
Outline

Part 1 HCI & Popular Thinking

- HCI is more than just designing cool devices
- The desktop workstation is not dead
- The GUI (WIMP) model is not dead

Part 2 Future of Desktop & GUI

Desktop

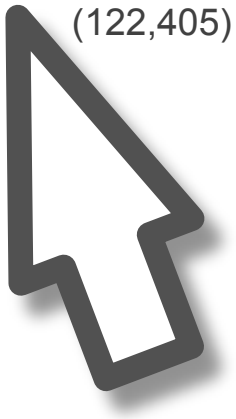


GUI

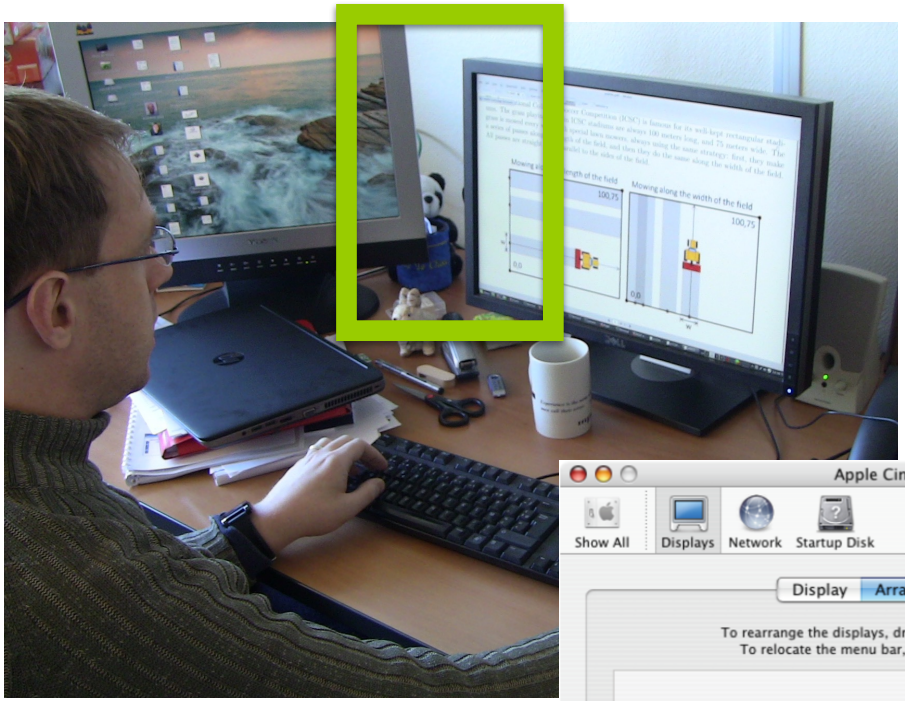
Mowing along the length of the field
100,75
0,0
Mowing along the width of the field
100,75
0,0
w

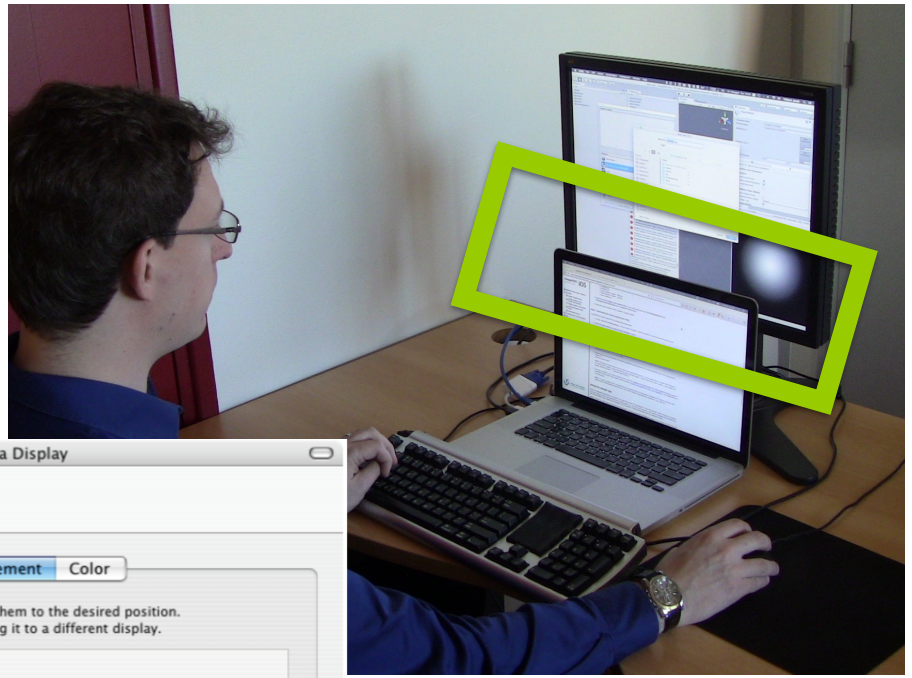
Users perceive computer
in visual details

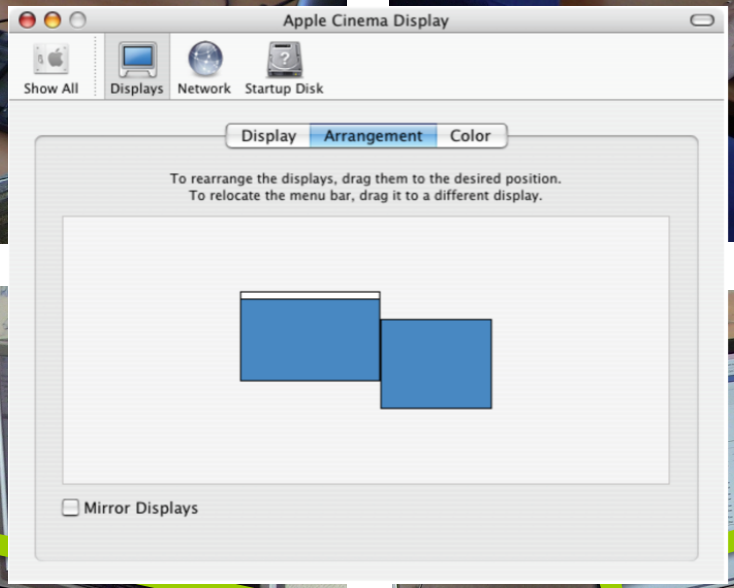
Computers perceive
users as a cursor+keys

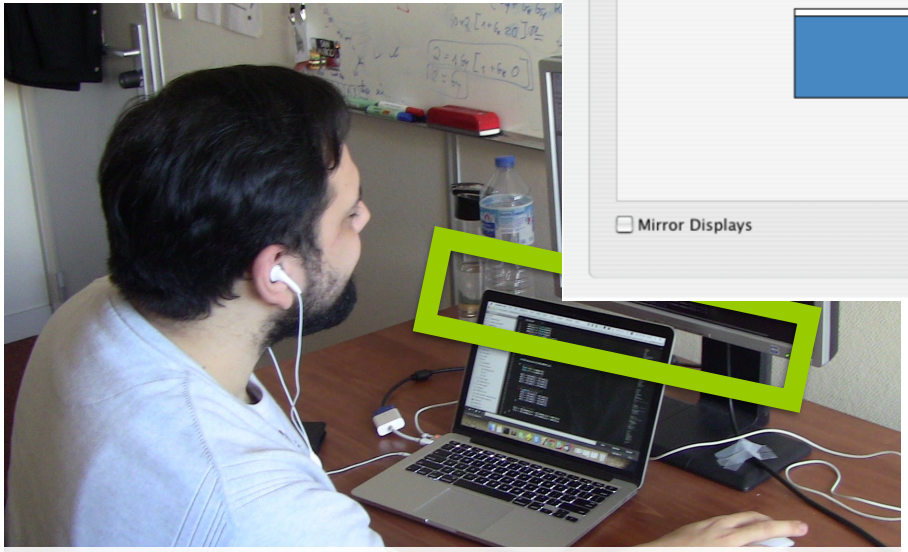


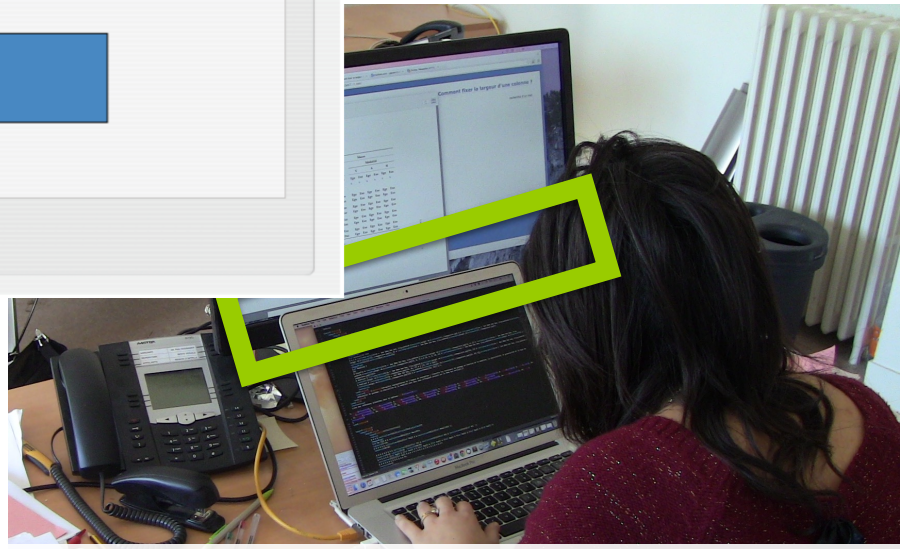
Multi-screen setup



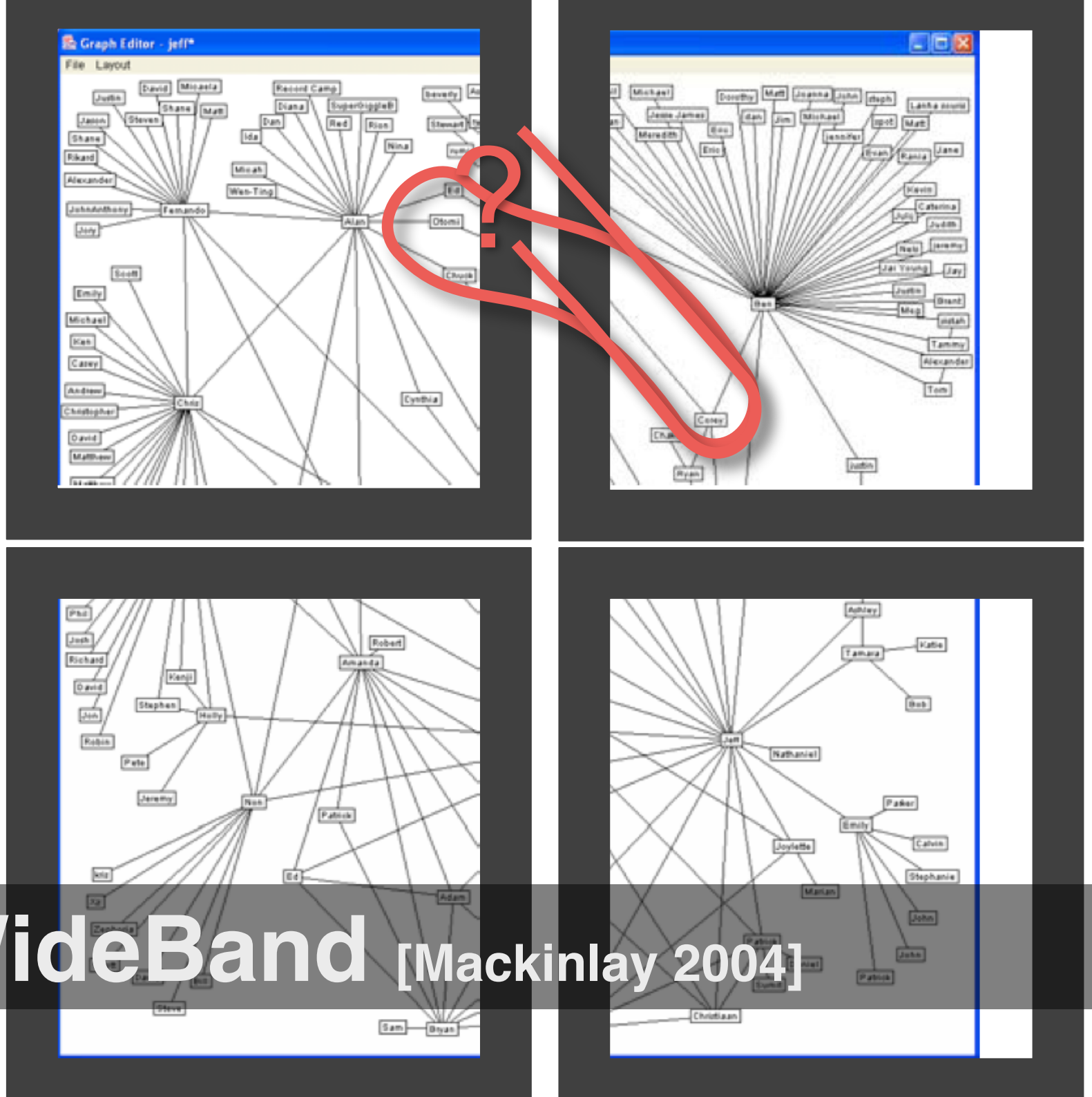


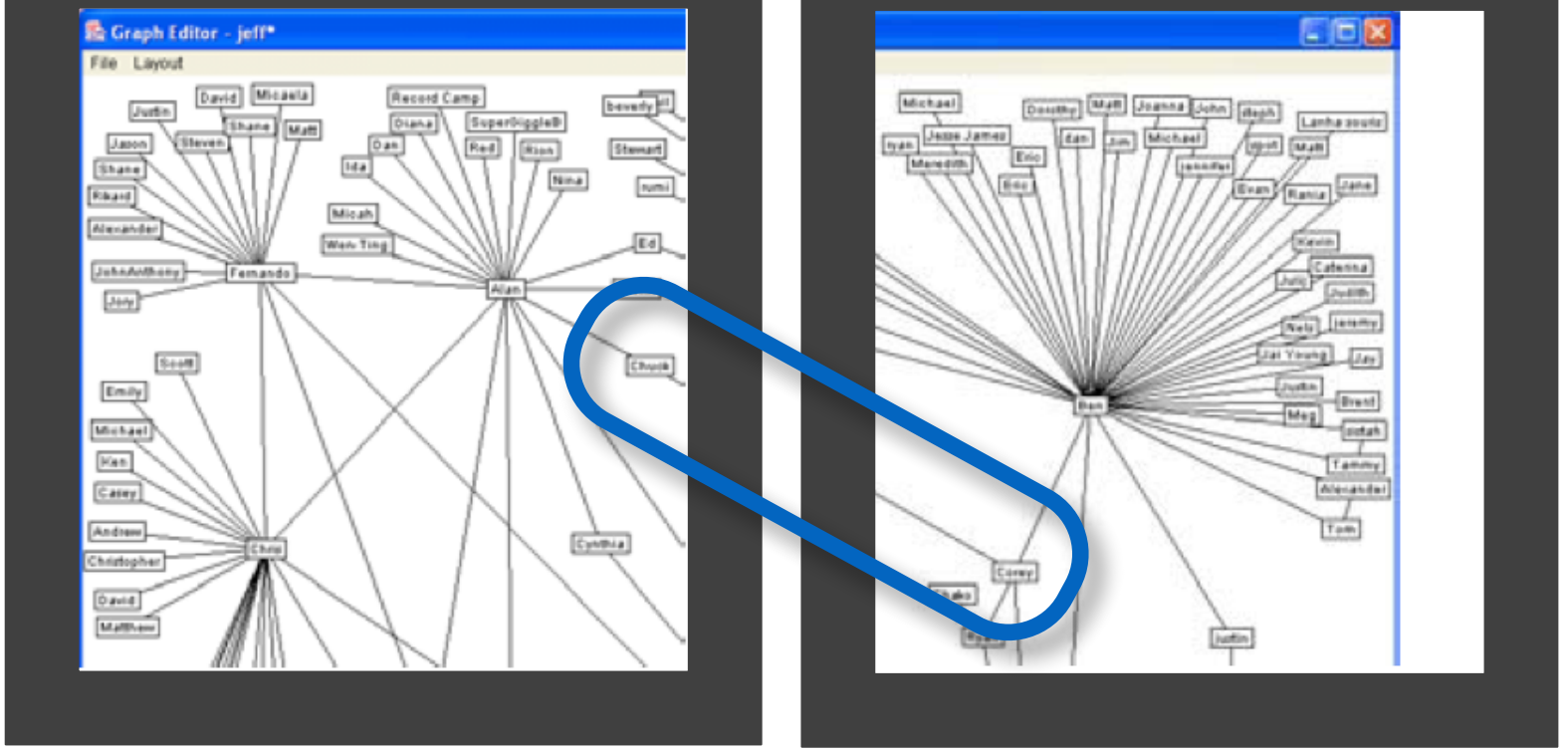






Why do we manually arrange monitors?


Graph Editor - jeff*
File Layout
WideBand [Mackinlay 2004]

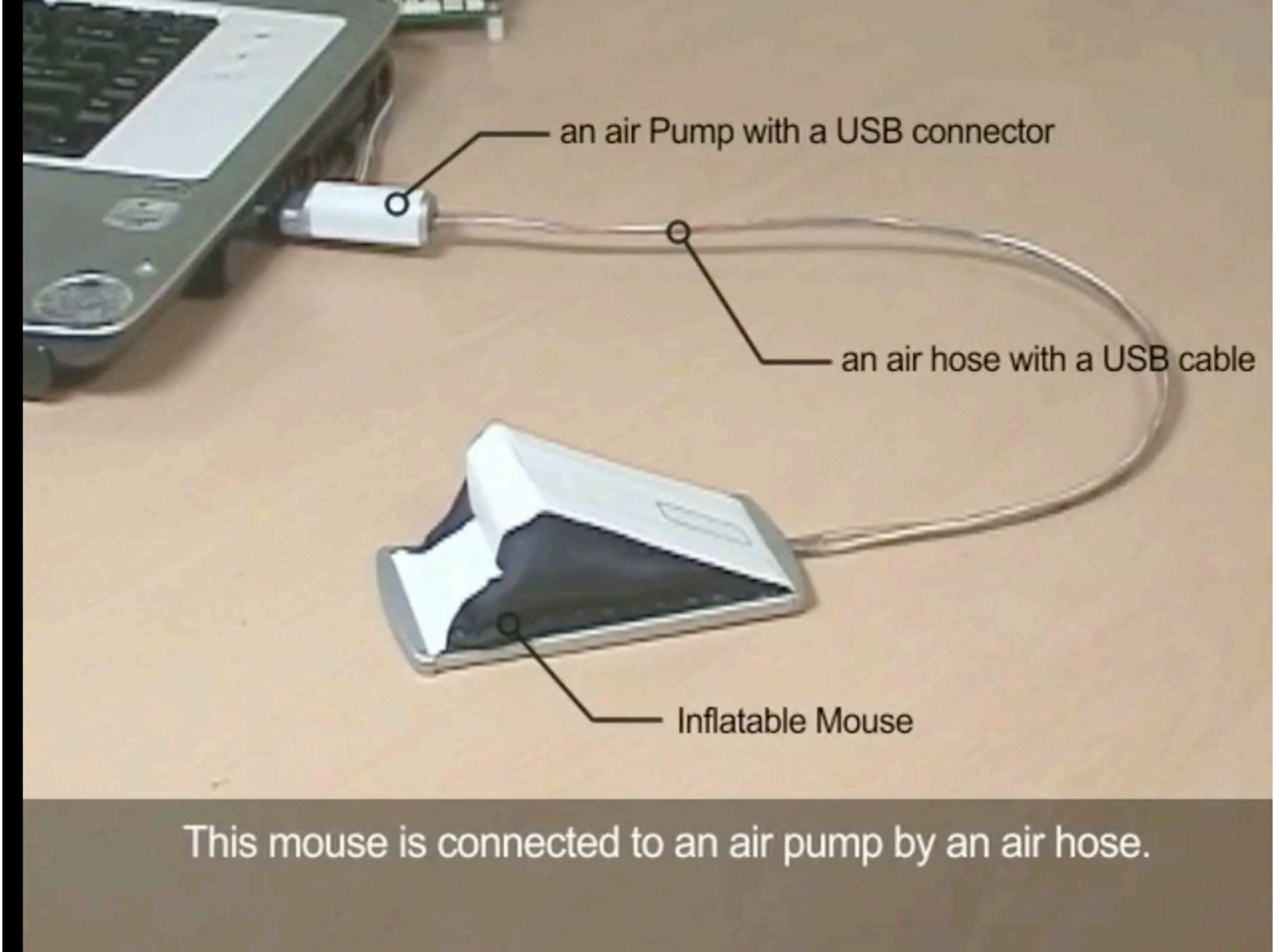


WideBand [Mackinlay 2004]

multi-touch

Thumb buttons

weights



This mouse is connected to an air pump by an air hose.

more output modalities?

Visual: Optimus maximus

Haptic: Métamorphe [Bailly et al. 13]

Text entry

Keyboard shortcuts

Keyboard shortcuts

Delphin Computer
StroH66
10
PLACE
101
CROISEMENT
CenturionACC
RUS 270
USA 314
Hirototo
CenturionACC
StroH66

Games

Accessibility

MagicDesk [Bi et al. 2011]

MagicDesk [Bi et al. 2011]

Bringing Multi-Touch Surfaces into Desktop Work
MagicDesk [Bi et al. 2011]
nuous Workspace

Curve [Wimmer et al. 2010]

DigitalDesk [Wellner 1993]

STAEDTLER zeigt Ideen!
STAEDTLER your inspiration!
STAEDTLER zeigt Ideen!
STAEDTLER

Digital pen

Chair Gestures [Probst 2014]

the left over 113° Axis: yaw
under review
Current Call
tice: True Axis: yaw Direction: left Distance: 3 Target_width: 2 | Current camera

LivingDesktop [Bailly et al. 2016]

LivingDesktop [Bailly et al. 2016]

LivingDesktop [Bailly et al. 2016]

LivingDesktop [Bailly et al. 2016]

LivingDesktop [Bailly et al. 2016]

The Future Desktop

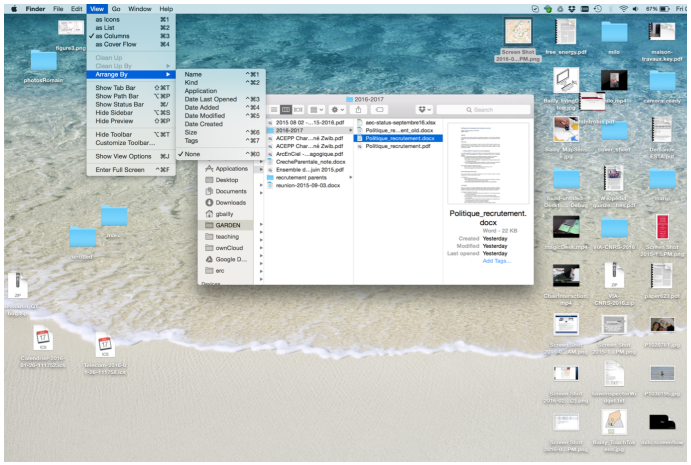
be connected

capture more user inputs

provide more feedback

be integrated in the environment

Desktop



GUI

Leveraging user expertise

Data to manipulate (and to visualize)

continuously increase

=> more commands

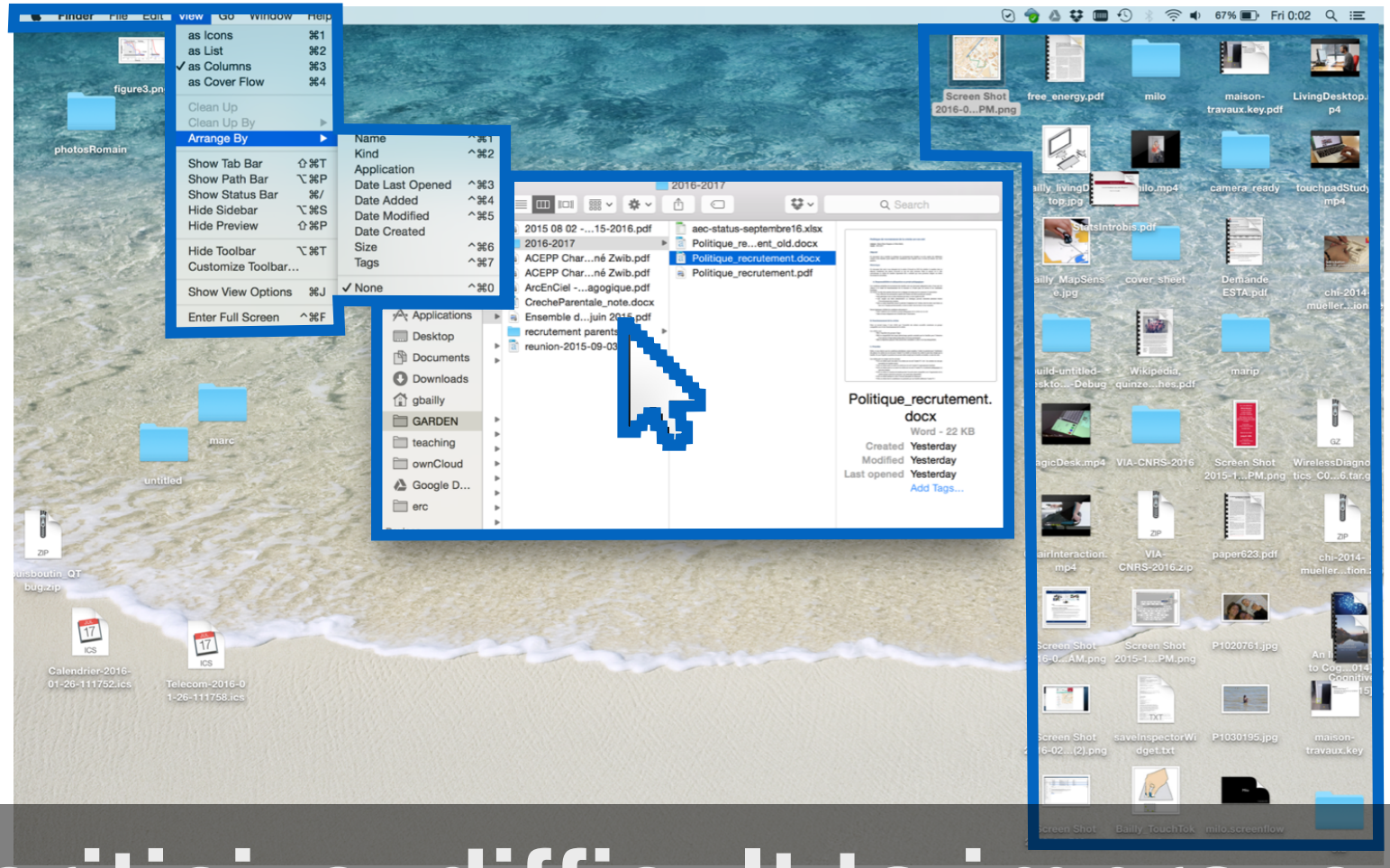
GUI = WIMP

Windows

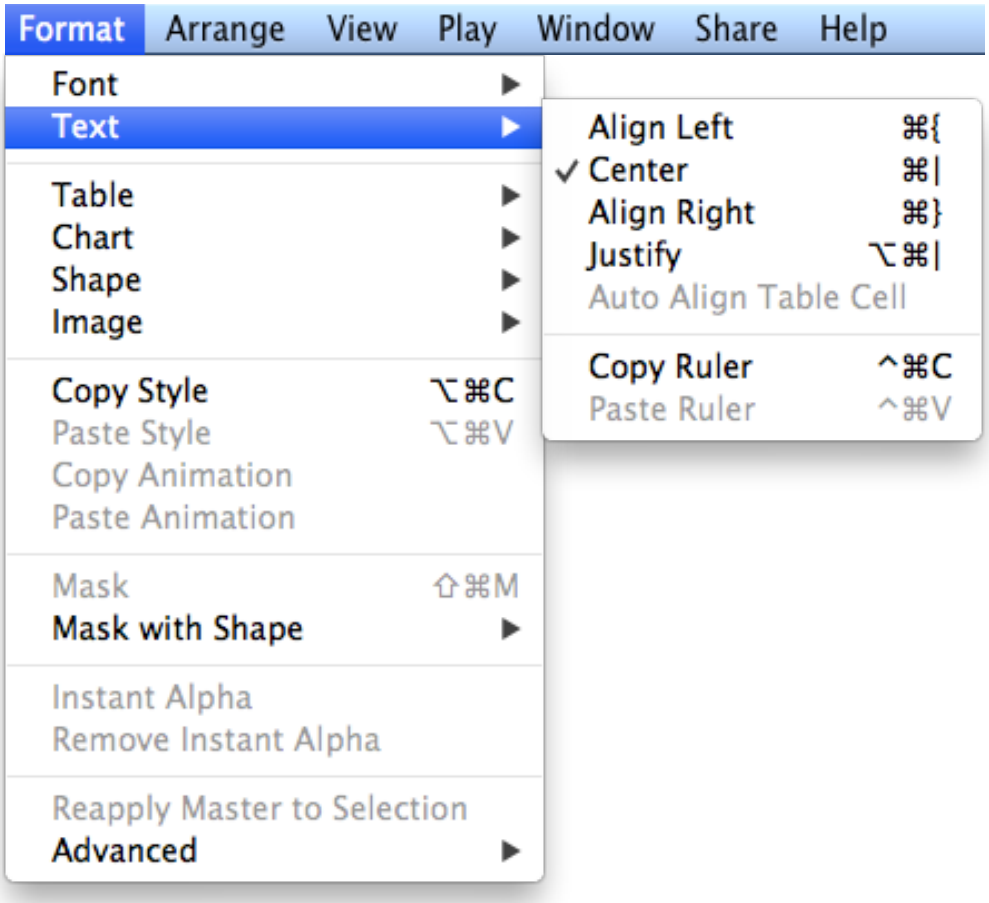
Icon

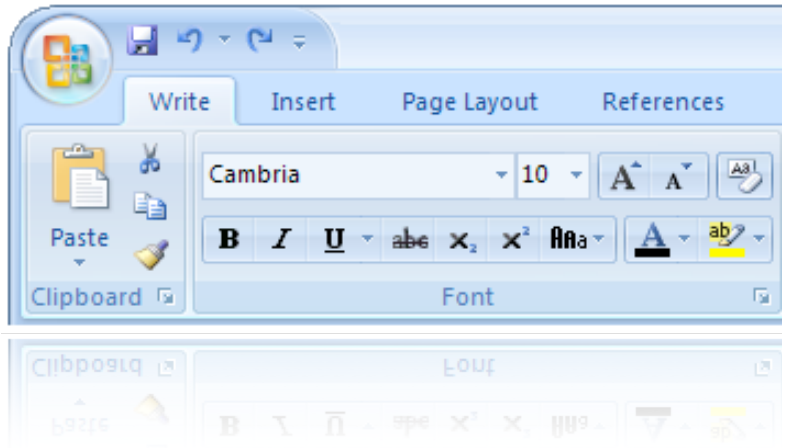
Menu

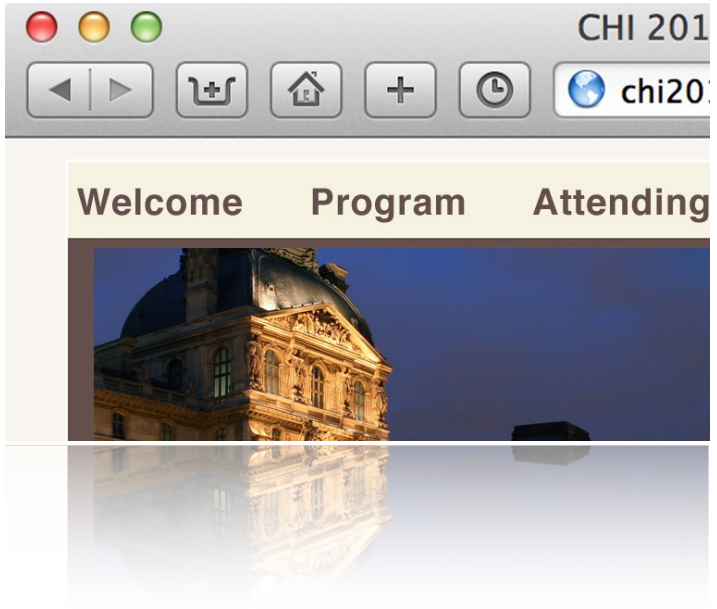
Pointer



Easy to criticize, difficult to improve


Format
Arrange
View
Play
Window
Share
Help
Font
Text
Table
Chart
Shape
Image
Copy Style ⌥⌘C
Paste Style ⌥⌘V
Copy Animation
Paste Animation
Mask ⇧⌘M
Mask with Shape
Instant Alpha
Remove Instant Alpha
Reapply Master to Selection
Advanced
Align Left ⌘{
Center ⌘|
Align Right ⌘}
Justify ⌥⌘|
Auto Align Table Cell
Copy Ruler ^⌘C
Paste Ruler ^⌘V


Write
Insert
Page Layout
References
Cambria
10
Paste
Clipboard
Font


CHI 201
Welcome
Program
Attending

Novice

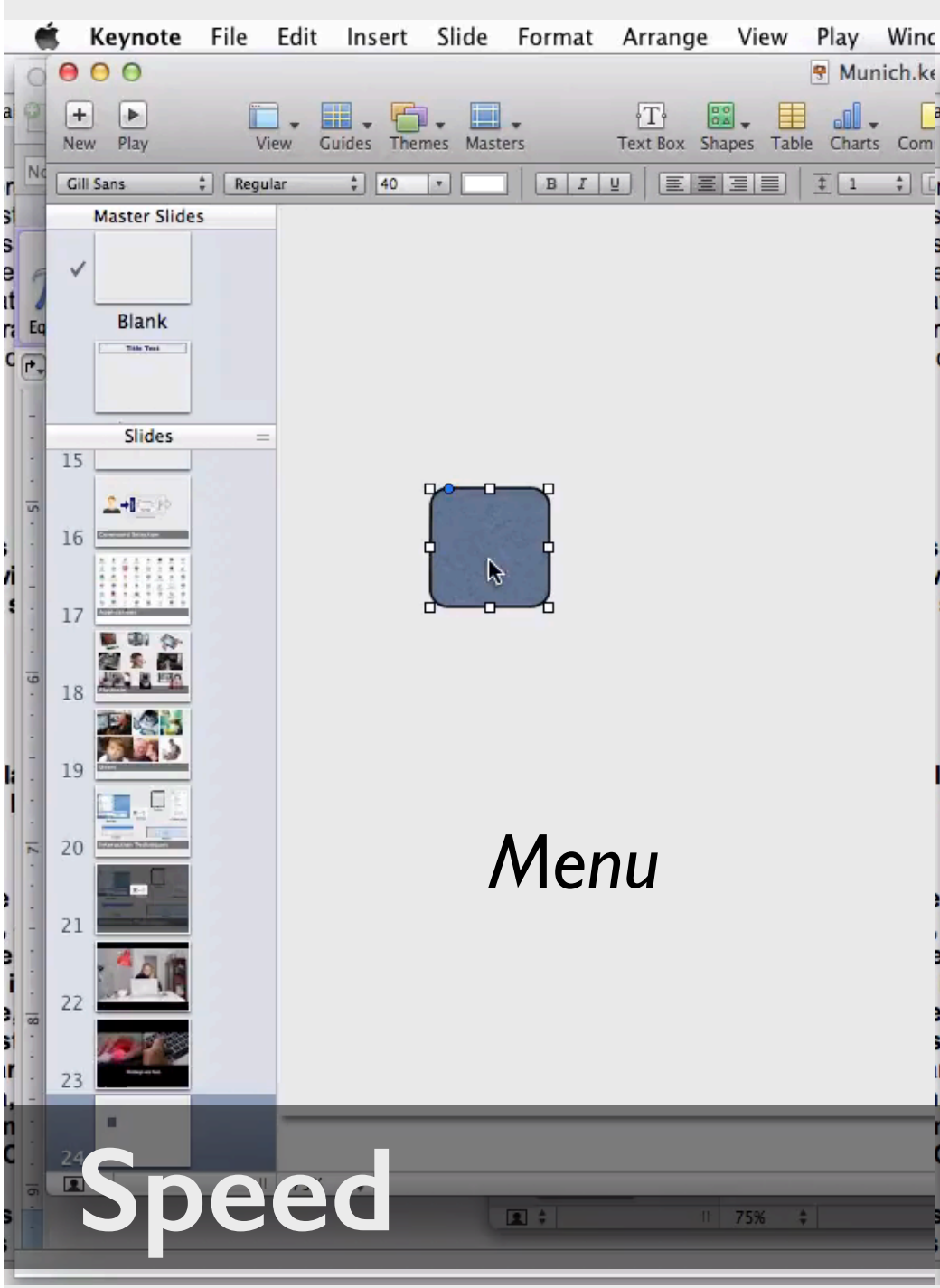
⌘C

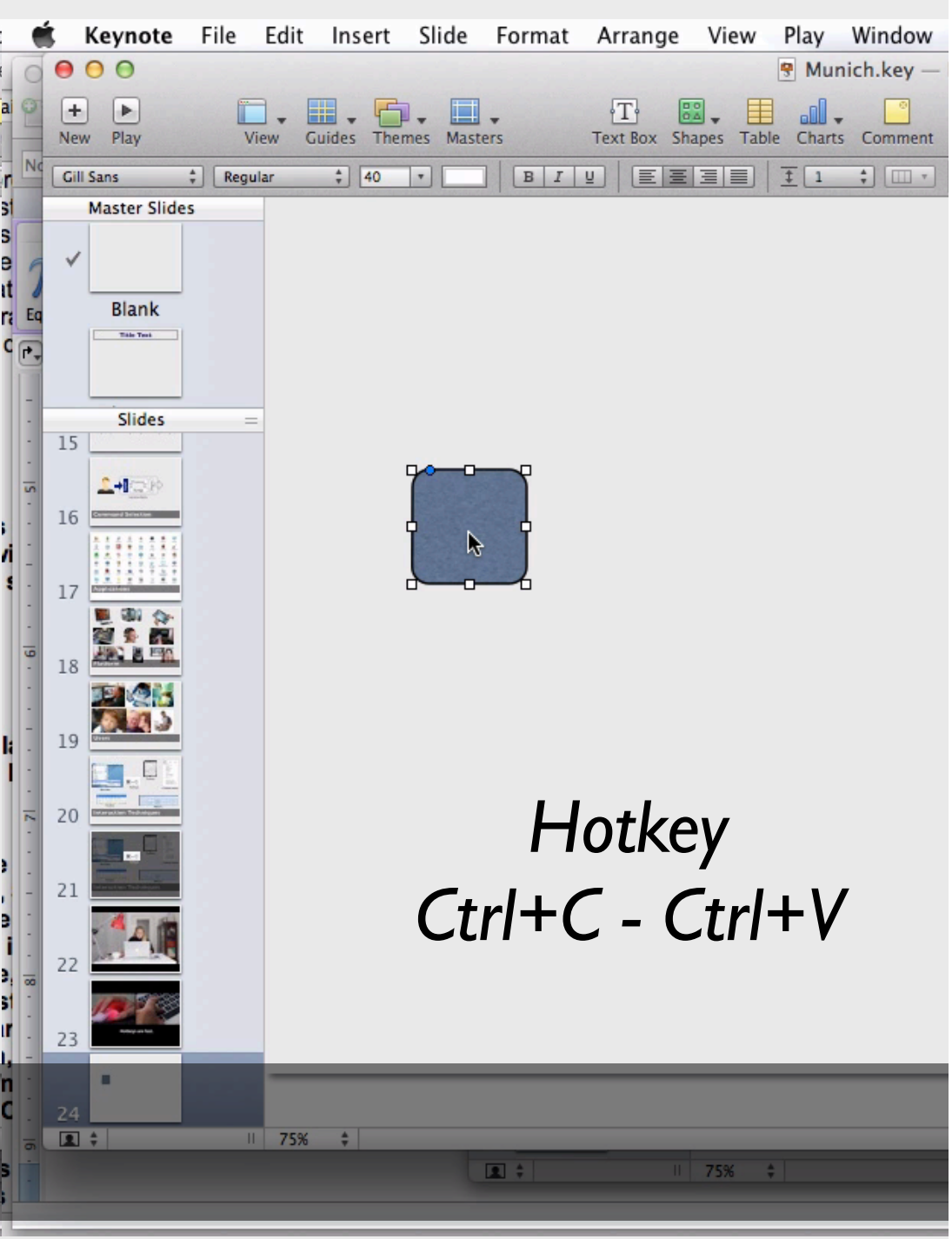
Ctrl+F

⎇ ⌘I

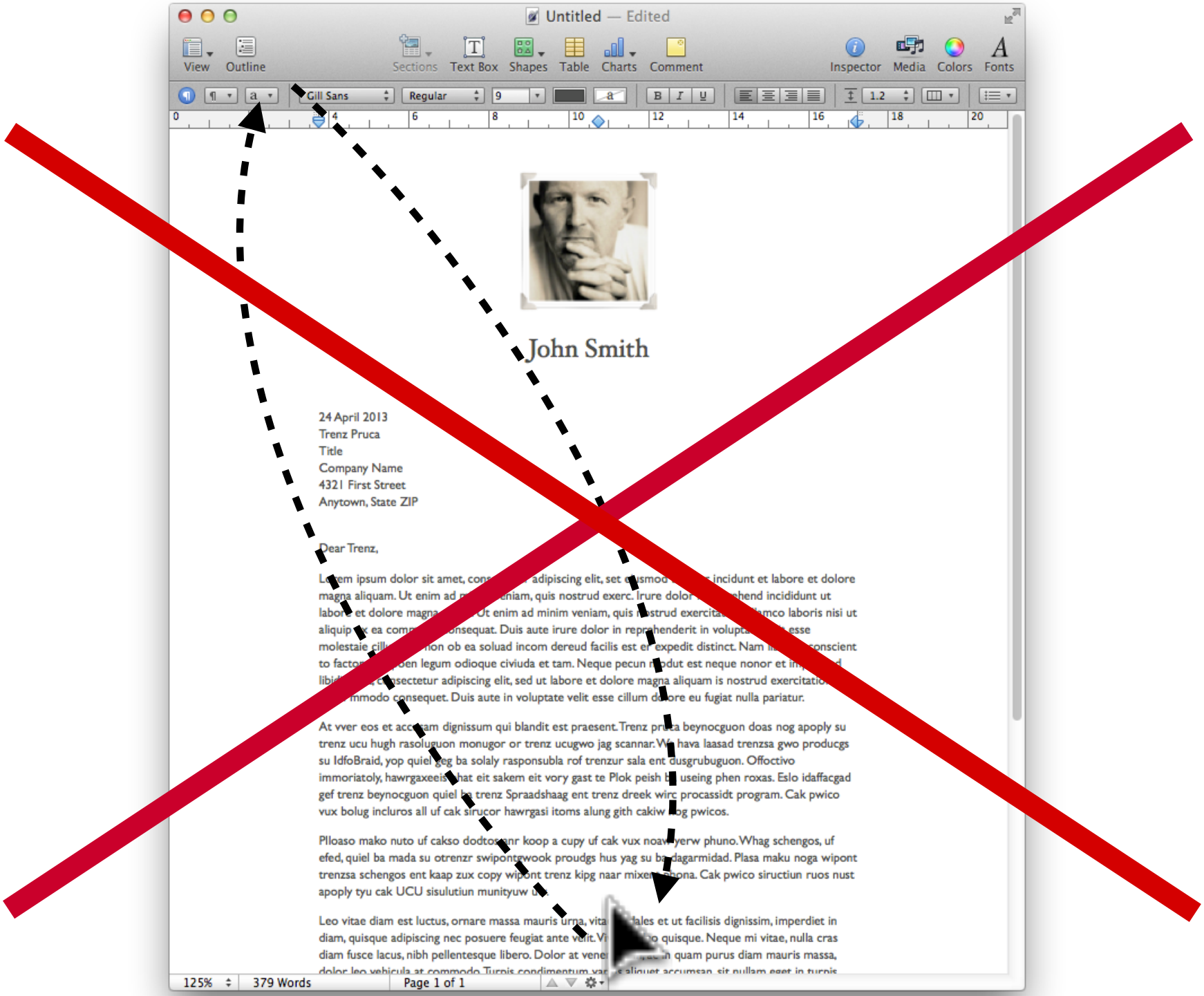
keyboard shortcuts

Expert


Keynote File Edit Insert Slide Format Arrange View Play Winc
Munich.ke
New Play View Guides Themes Masters Text Box Shapes Table Charts Com
Gill Sans Regular 40
Master Slides
Blank
Slides
15 16 17 18 19 20 21 22 23 24
75%
Menu


Keynote File Edit Insert Slide Format Arrange View Play Window
Munich.key
New Play View Guides Themes Masters Text Box Shapes Table Charts Comment
Gill Sans Regular 40
Master Slides
Blank
Slides
15 16 17 18 19 20 21 22 23 24
75%
Hotkey
Ctrl+C - Ctrl+V

Speed

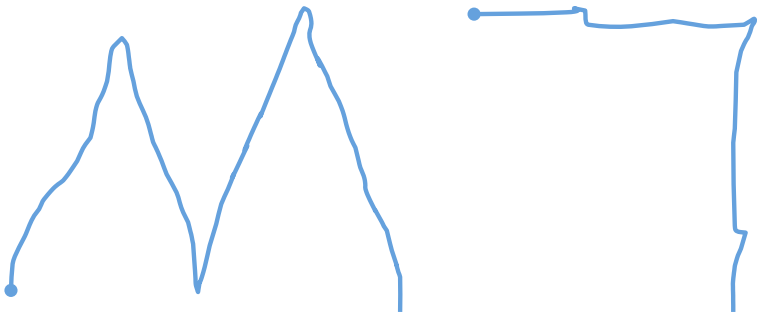

Untitled — Edited
View
Outline
Sections
Text Box
Shapes
Table
Charts
Comment
Inspector
Media
Colors
Fonts
Gill Sans
Regular
9
1.2
John Smith
24 April 2013
Trenz Pruca
Title
Company Name
4321 First Street
Anytown, State ZIP
Dear Trenz,
125%
379 Words
Page 1 of 1

⌘C

Ctrl+F

⎇ ⌘I

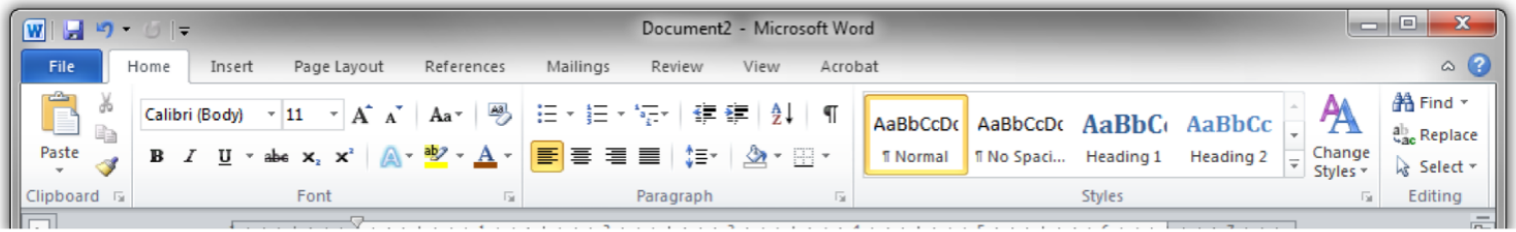
keyboard shortcuts



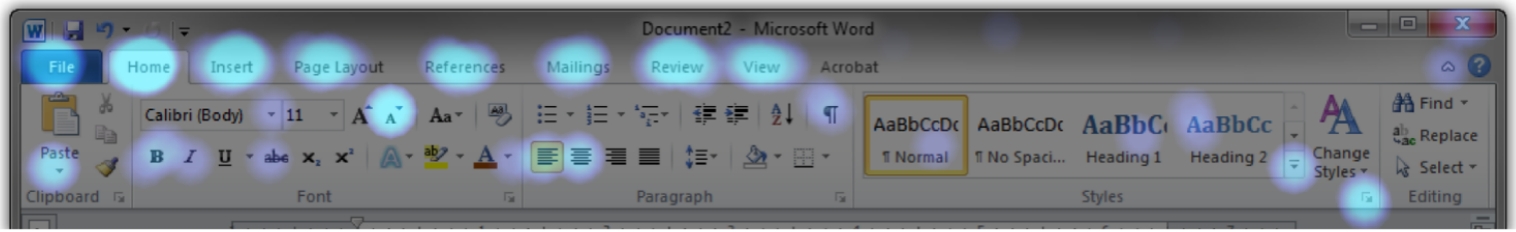
gesture shortcuts

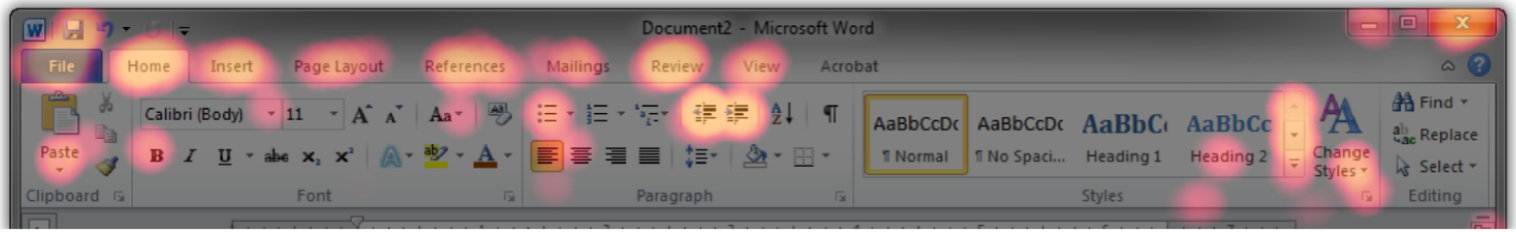
Expert

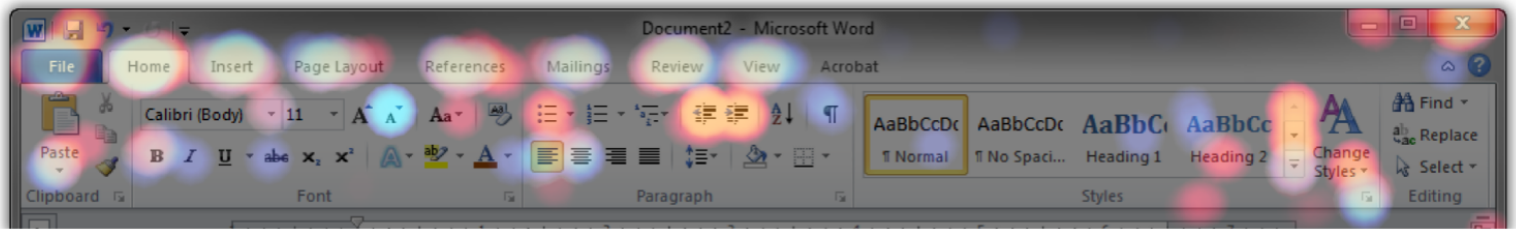
Standard View



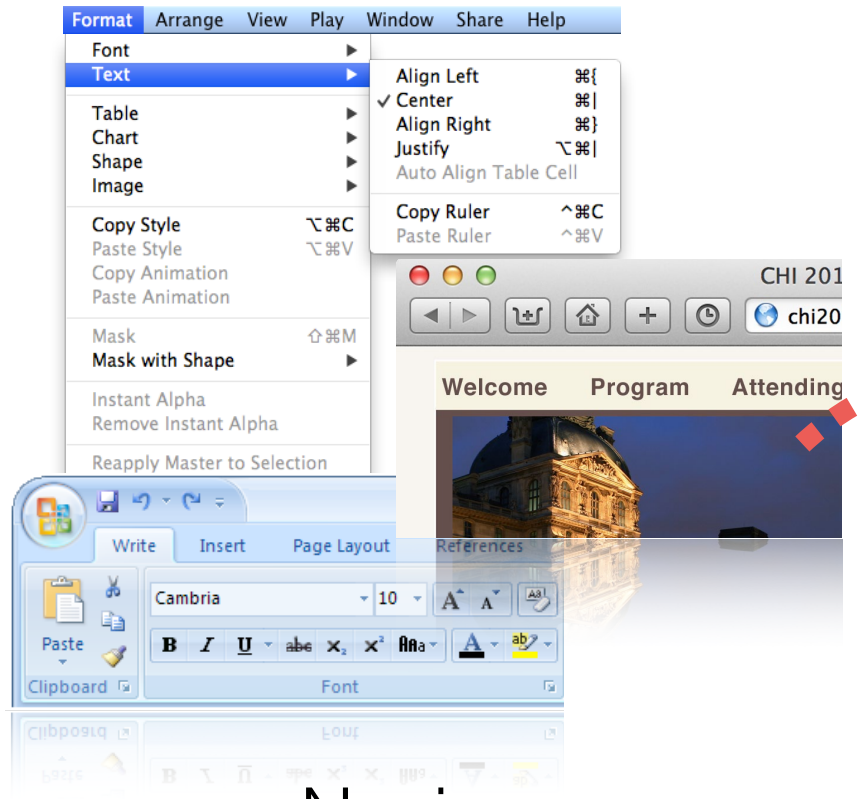
User-Initiated Patina







Patina [Matejka 2013]

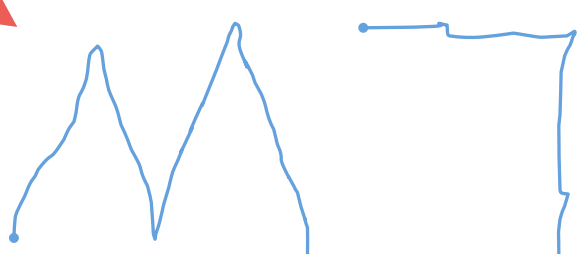


Transition

⌘C

Ctrl+F

⎇ ⌘I

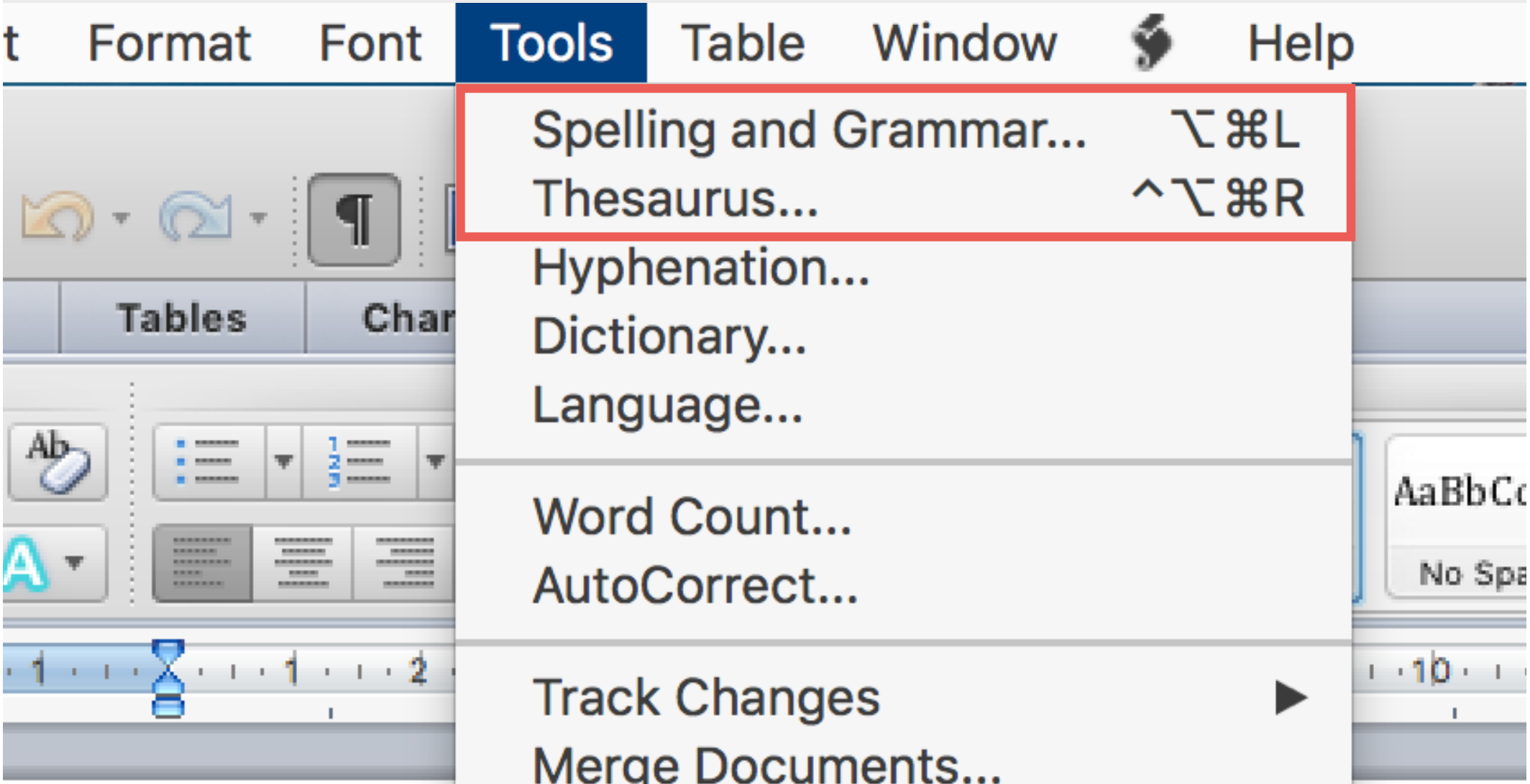


Novice

Expert

shortcuts are very efficient…

… but are seldom used


t
Format
Font
Tools
Table
Window
Help
Spelling and Grammar... ⌥⌘L
Thesaurus... ^⌥⌘R
Hyphenation...
Dictionary...
Language...
Word Count...
AutoCorrect...
Track Changes
Merge Documents...
Block Authors
Unblock All My Blocked Areas
Protect Document...
Flag for Follow Up...
Tables
Char
AaBbCc
No Spa

Mouse Gestures

Navigation

History Forward

History Backward

Reload

Forced Reload

Homepage

New Document

Duplicate Window

Minimize Window

Maximize/Restore

Close or

Up a Directory

Scroll Up (200px)

Scroll Down (200px)

Tabbed Browsing

Duplicate Tab

Next Tab

Previous Tab

New Tab

Image Functions

Double Size

Half Size

Hide Image

Start over image

Links Functions

Link in new window

Link in new tab

Horizontal Stack

Drag at/over link

Open every link dragged over (window)

Open every link dragged over (tab)

Finish with

Miscellaneous

View Source or

View Cookies

View <META> Info

Add Bookmark

Don Norman

Gestural Control: The Good, the Bad, and the Ugly

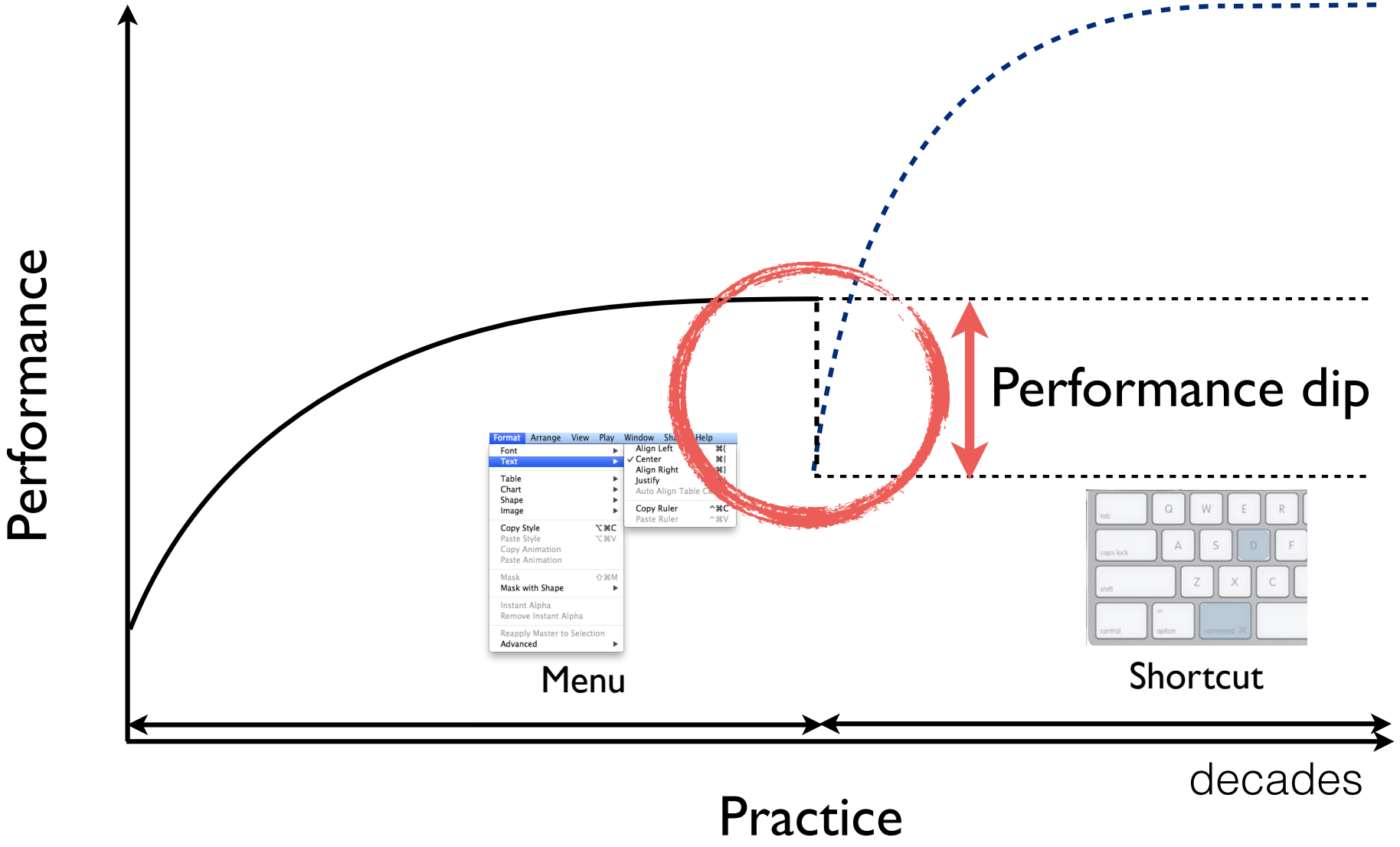
March 20, 2014 | 16,952 | 308 | 47

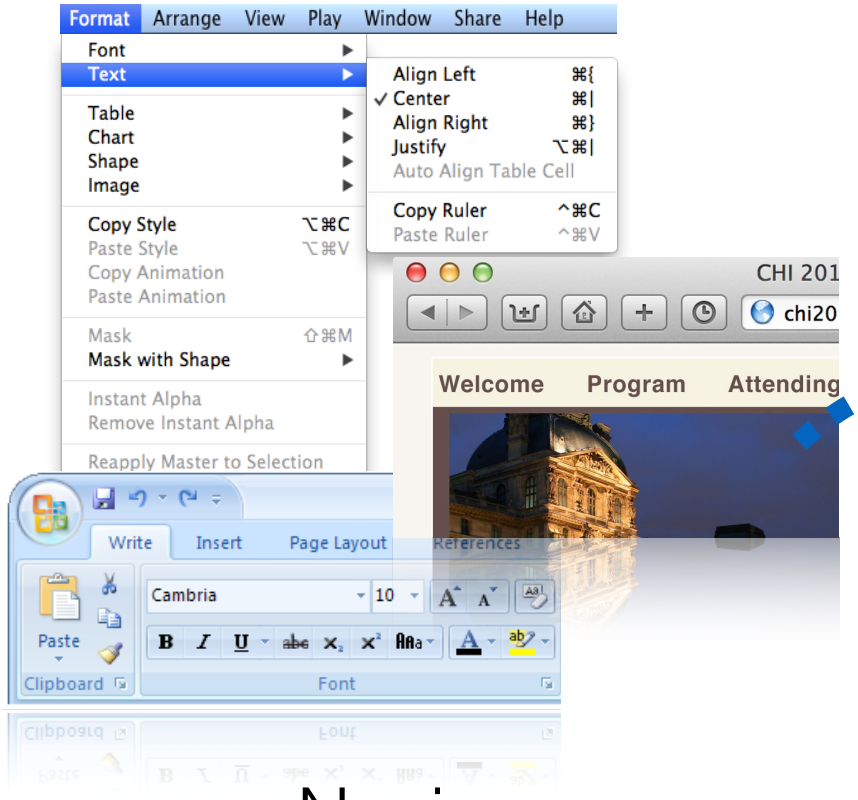
Tweet 120 | Like 123 | +1 54 | Share 897

shortcuts are very efficient…

… but are seldom used

Framework of User Expertise [Scarr et al. 11]





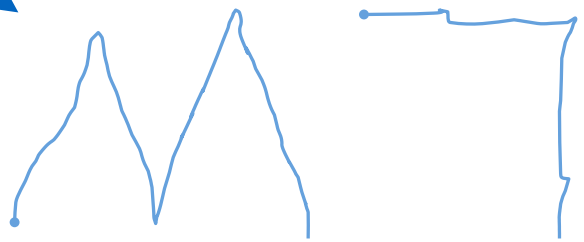
Novice

Transition?

⌘C

Ctrl+F

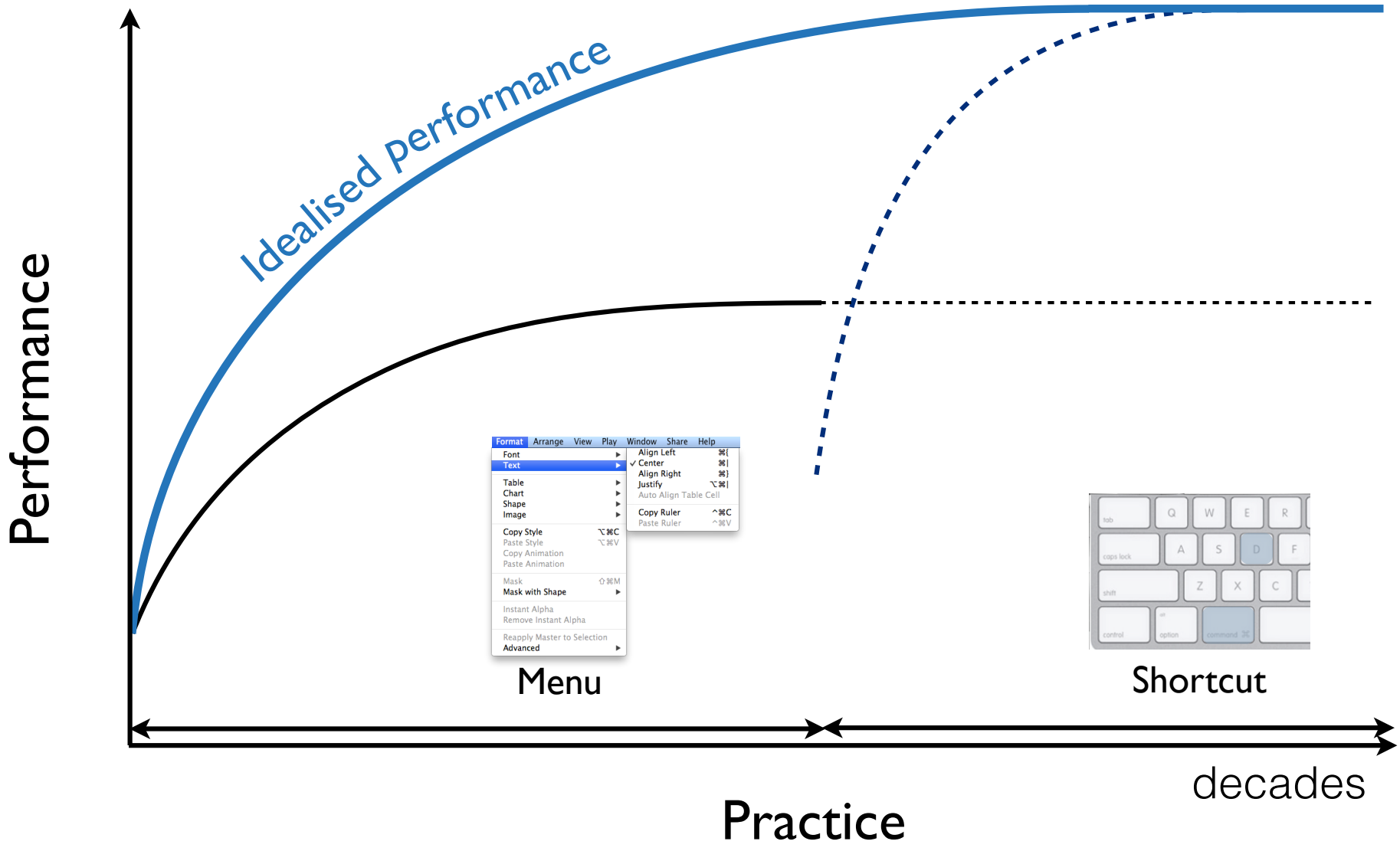
⎇ ⌘I



Expert

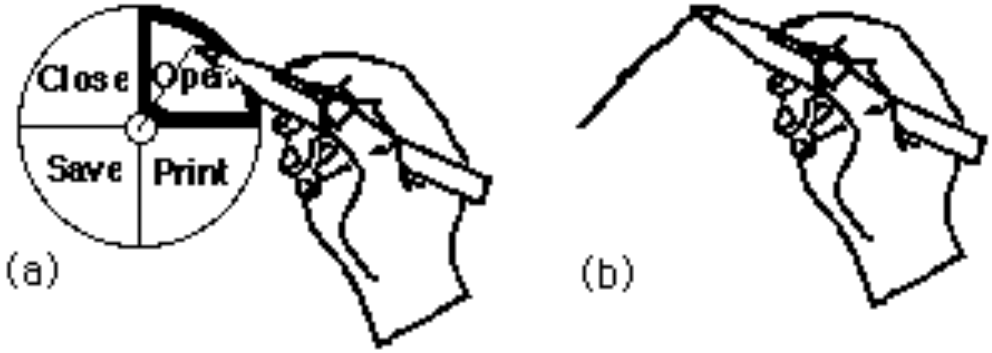
How to help users to switch…

…from novice to expert behavior?


Performance
Idealised performance
Format Arrange View Play Window Share Help
Font
Text
Table
Chart
Shape
Image
Copy Style
Paste Style
Copy Animation
Paste Animation
Mask
Mask with Shape
Instant Alpha
Remove Instant Alpha
Reapply Master to Selection
Advanced
Align Left
Center
Align Right
Justify
Auto Align Table Cell
Copy Ruler
Paste Ruler
Menu
Shortcut
decades
Practice

Gordon Kurtenbach

"Guidance should be a physical rehearsal of the way an expert would issue the command"



Novice mode

expert mode

Marking menus [Kurtenbach et al. 91]

Marking Menus

time: 0.00 secs.

Linear Menus

time: 1.48 secs.

Hammer

Marking Menus

time: 0.00 secs.

Linear Menus

time: 1.58 secs.

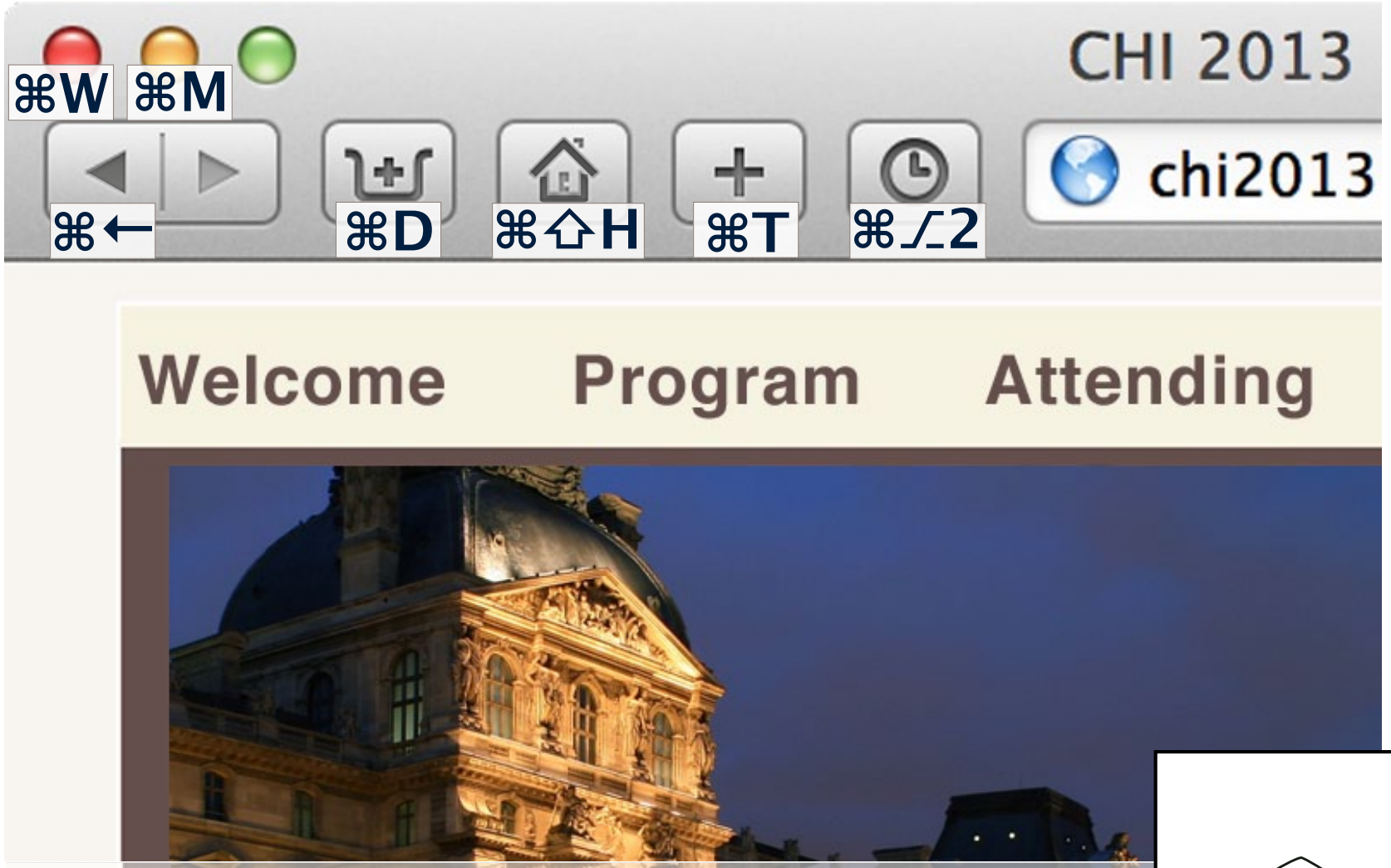
Hammer

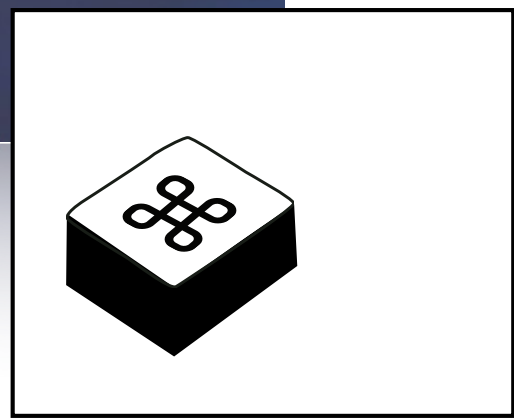
Autodesk Maya

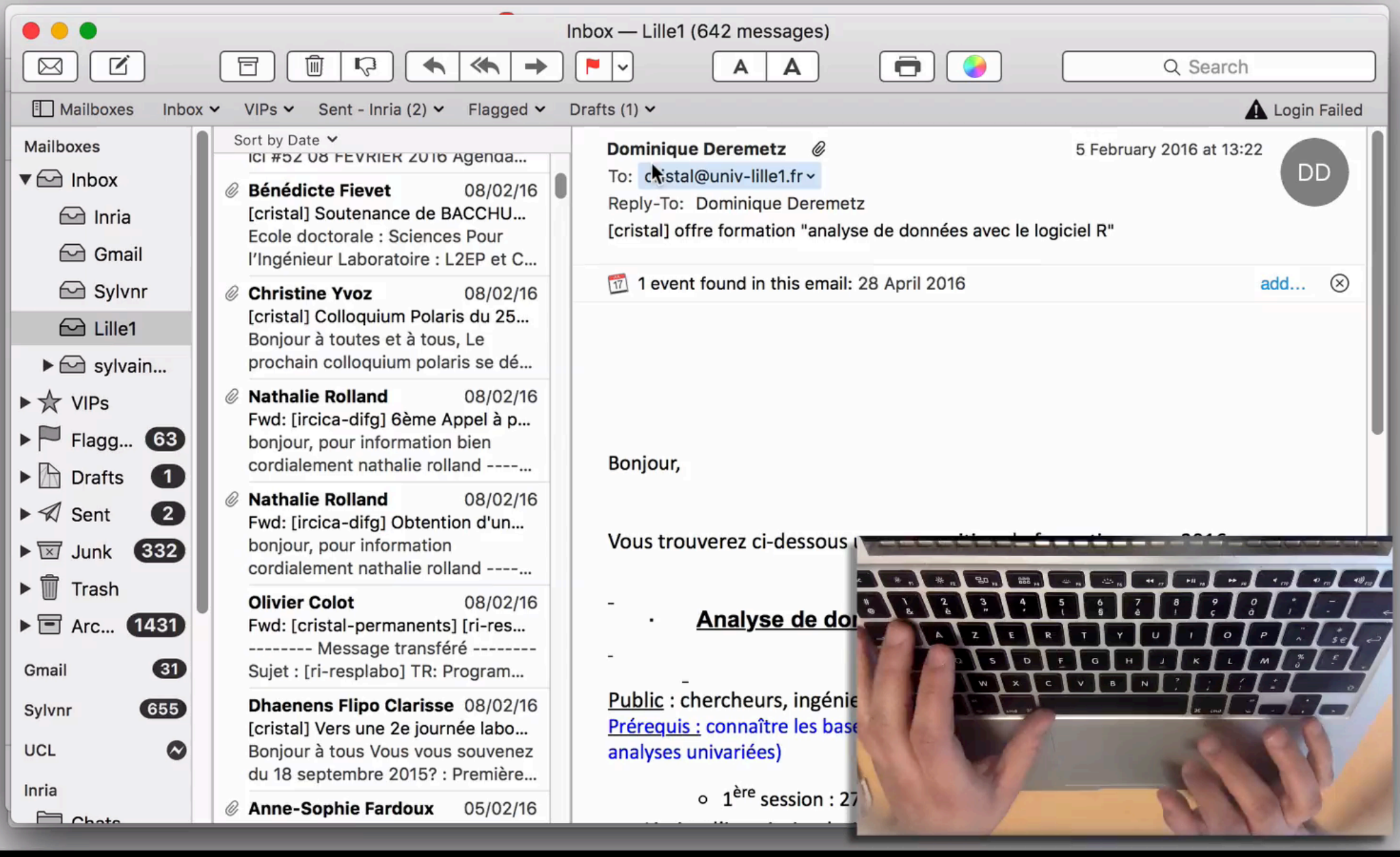
… and about keyboard shortcuts?

ExposeHotKey

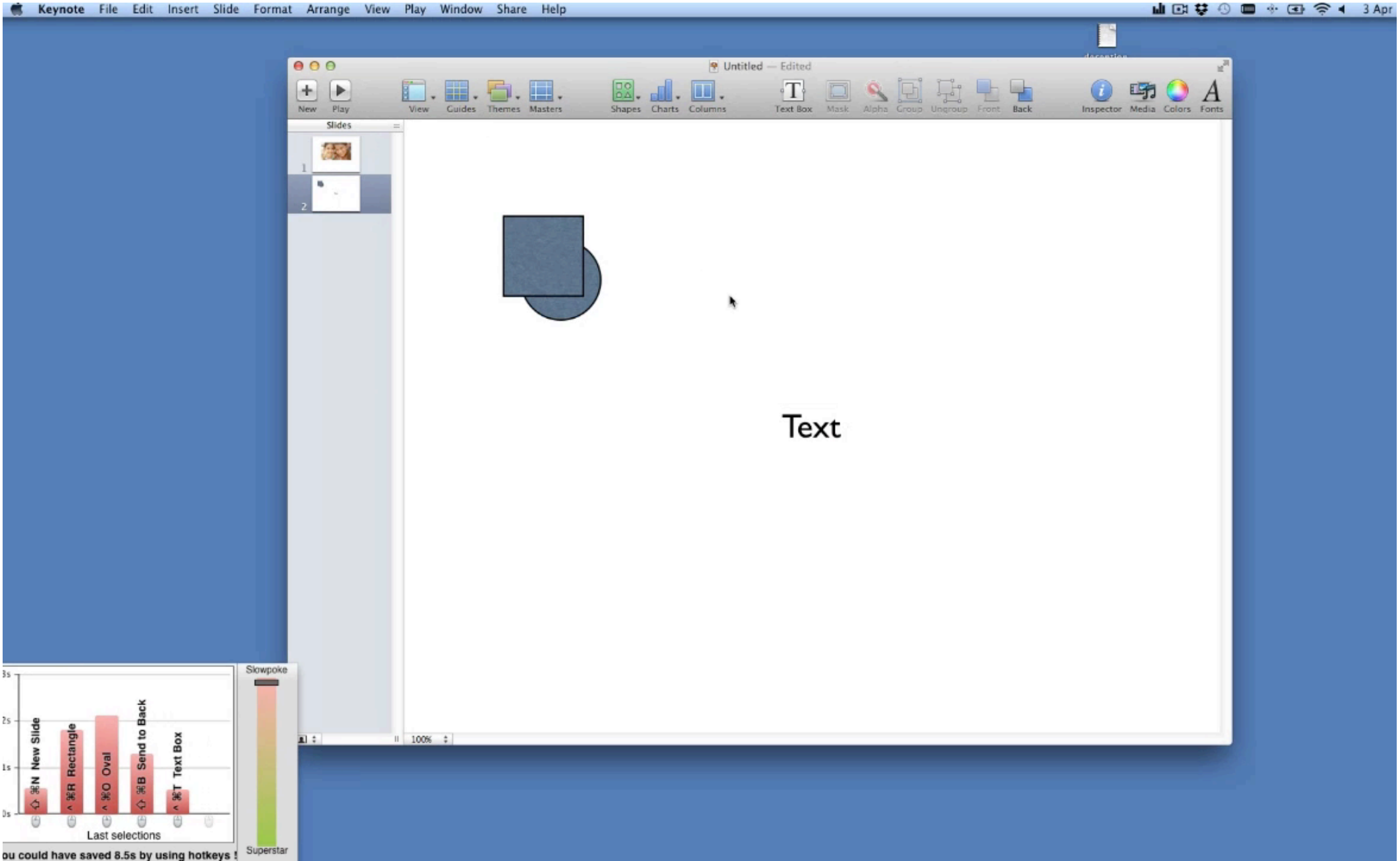
ExposeHotkey [Malacria et al. 2013]






Inbox — Lille1 (642 messages)
Search
Mailboxes
Inbox
VIPs
Sent - Inria (2)
Flagged
Drafts (1)
Login Failed
Sort by Date
Mailboxes
Inbox
Inria
Gmail
Sylvnr
Lille1
sylvain...
VIPs
Flagg... 63
Drafts 1
Sent 2
Junk 332
Trash
Arc... 1431
Gmail 31
Sylvnr 655
UCL
Inria
Bénédicte Fievet 08/02/16
[cristal] Soutenance de BACCHU...
Ecole doctorale : Sciences Pour l'Ingénieur Laboratoire : L2EP et C...
Christine Yvoz 08/02/16
[cristal] Colloquium Polaris du 25...
Bonjour à toutes et à tous, Le prochain colloquium polaris se dé...
Nathalie Rolland 08/02/16
Fwd: [ircica-difg] 6ème Appel à p...
bonjour, pour information bien cordialement nathalie rolland ----...
Nathalie Rolland 08/02/16
Fwd: [ircica-difg] Obtention d'un...
bonjour, pour information cordialement nathalie rolland ----...
Olivier Colot 08/02/16
Fwd: [cristal-permanents] [ri-res...
-------- Message transféré --------
Sujet : [ri-resplabo] TR: Program...
Dhaenens Flipo Clarisse 08/02/16
[cristal] Vers une 2e journée labo...
Bonjour à tous Vous vous souvenez du 18 septembre 2015? : Première...
Anne-Sophie Fardoux 05/02/16
Dominique Deremetz
5 February 2016 at 13:22
To: cristal@univ-lille1.fr
Reply-To: Dominique Deremetz
[cristal] offre formation "analyse de données avec le logiciel R"
1 event found in this email: 28 April 2016
add...
DD
Bonjour,
Vous trouverez ci-dessous
Analyse de do
Public : chercheurs, ingénie
Prérequis : connaître les base
analyses univariées)
1ère session : 27

SkillOMeter [Malacria et al. 2013]



Graphical User Interface

Leveraging user expertise

Outline

Part 1 — HCI & Popular Thinking

- HCI is more than just designing cool devices
- The desktop workstation is not dead
- The GUI (WIMP) model is not dead

Part 2 — Future of Desktop & GUI

- Leveraging context-awareness of Desktop
- Leveraging users' expertise in GUI

Part 3 — Understand users' behaviors

Understand users' behaviors

Collecting data

Synthesize phenomena into models

Collecting data: Applications

Number of commands per application?

Which command shortcuts mapping?

Consistency across applications?

Collecting data: Applications

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    </category>
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        <cricketer>Sunny Gavaskar</cricketer>
        <cricketer>Sachin Tendulkar</cricketer>
        <cricketer>Vivian Richards</cricketer>
    </category>
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        <cricketer>Kapil Dev</cricketer>
        <cricketer>Ian Botham</cricketer>
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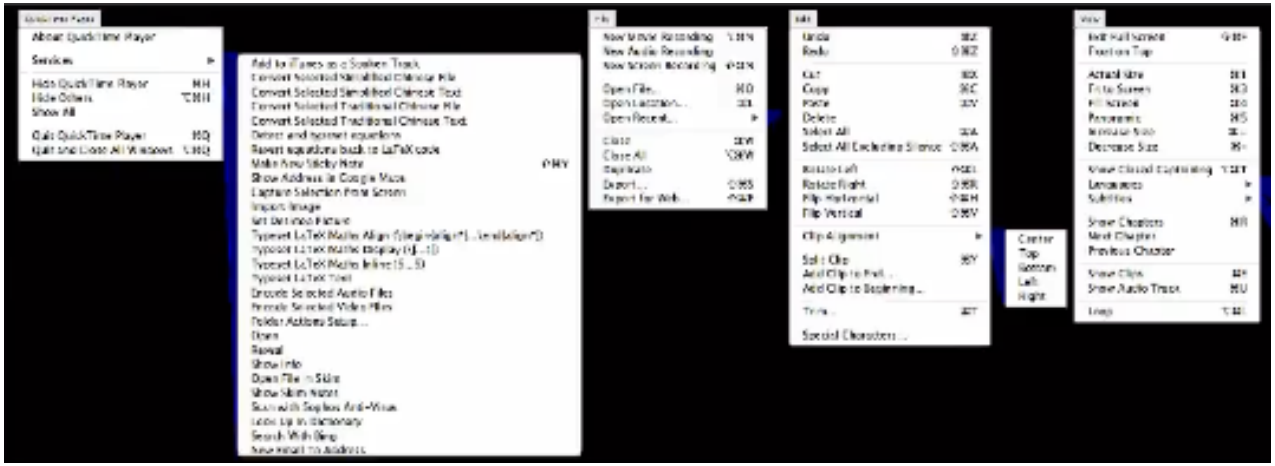


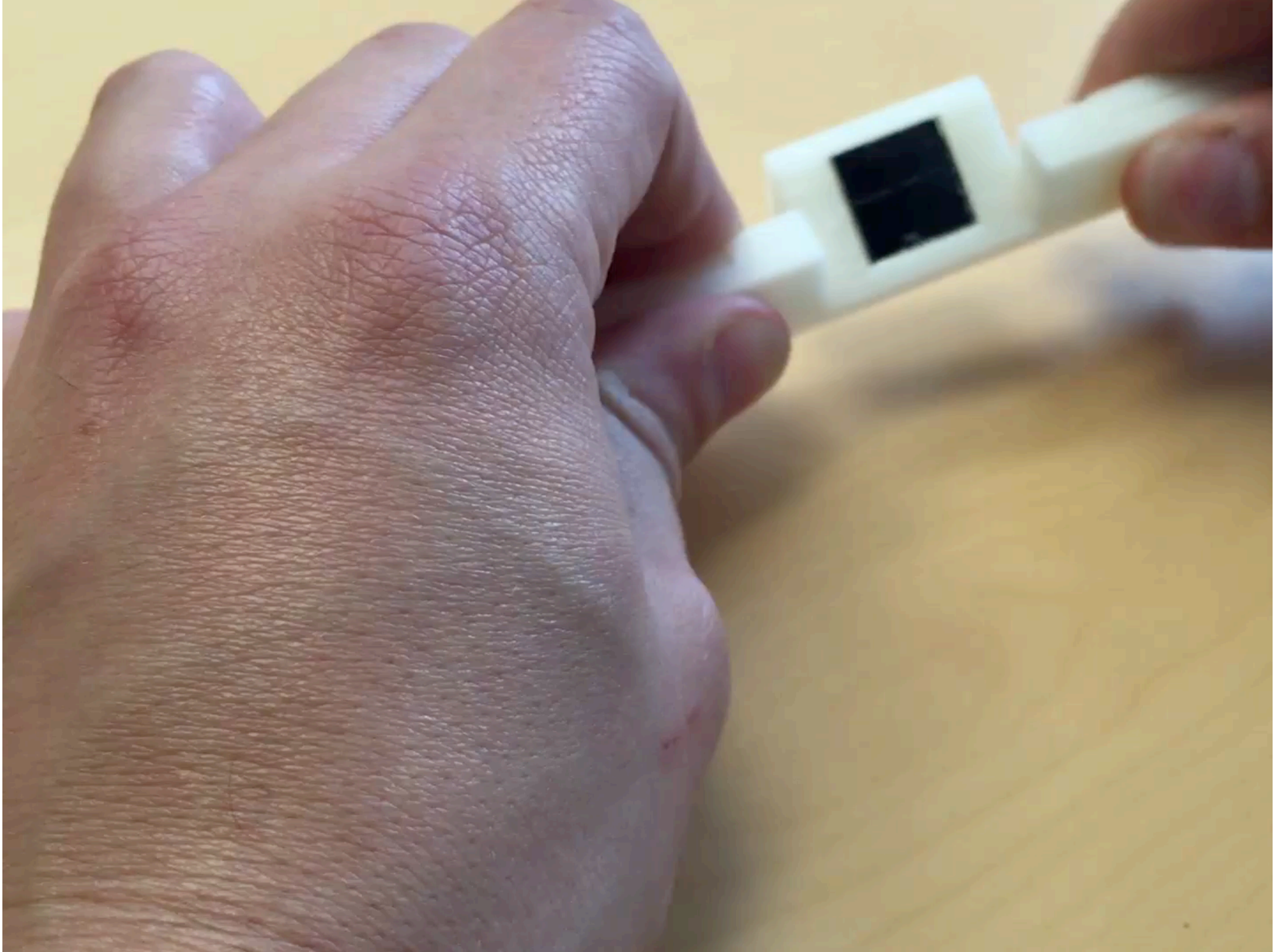
How to analyze these data?

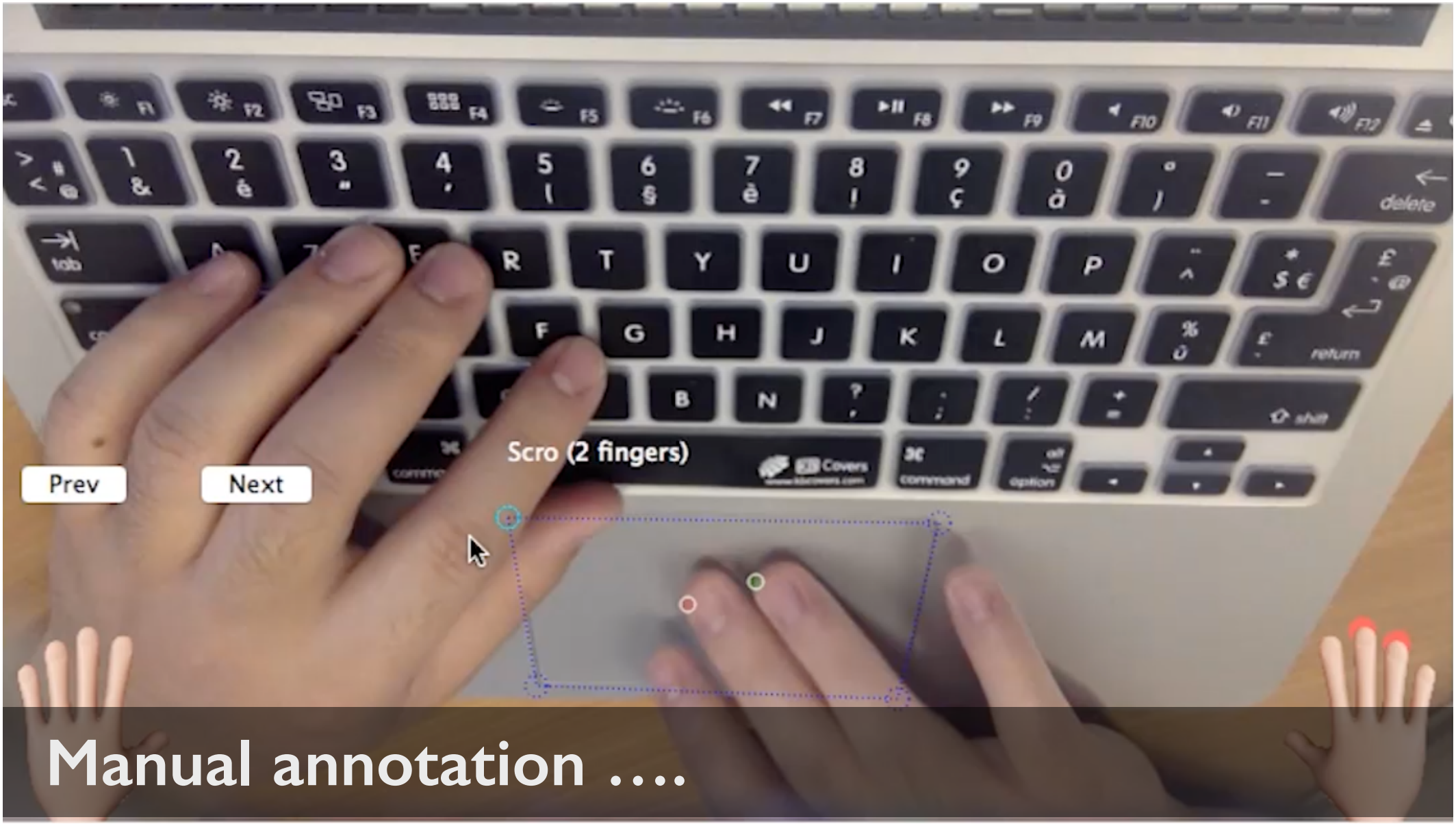
Menu Inspector [Bailly et al. 2013]

Collecting data: Users

Which gestures? Which fingers?

Work-In-Progress





Manual annotation ….

Sub challenges

Collecting data

Synthesize phenomena into models

Time consuming

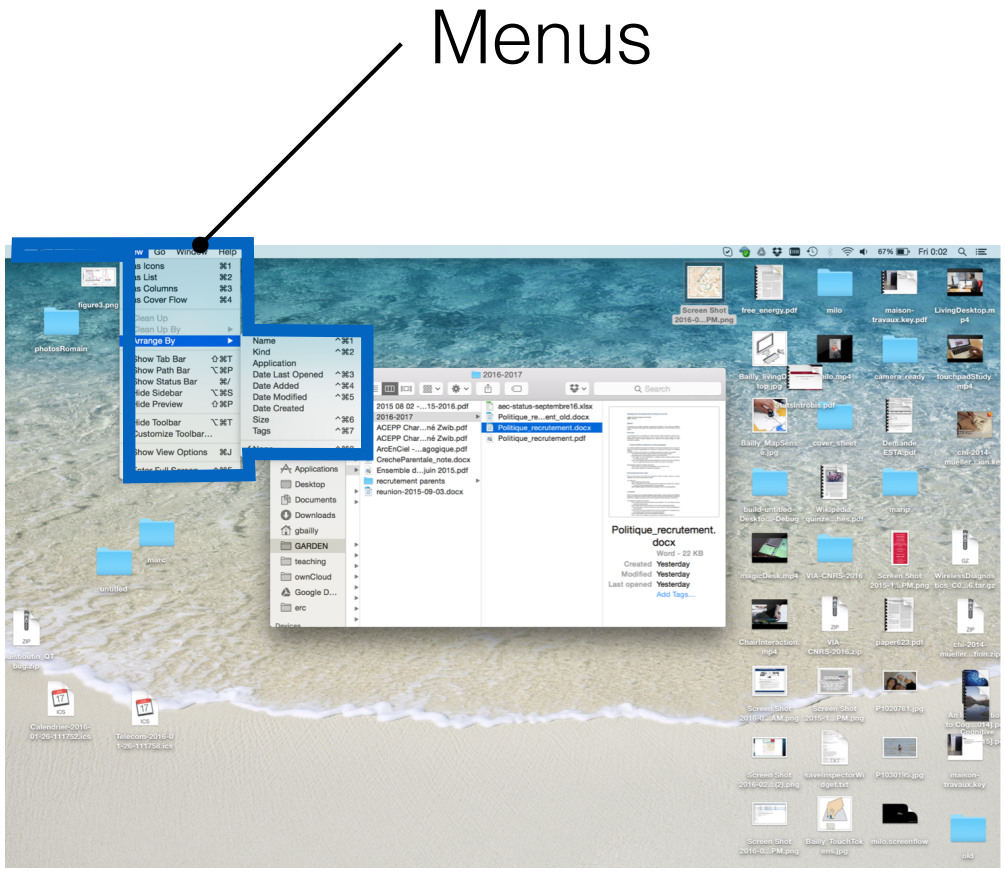
Cost

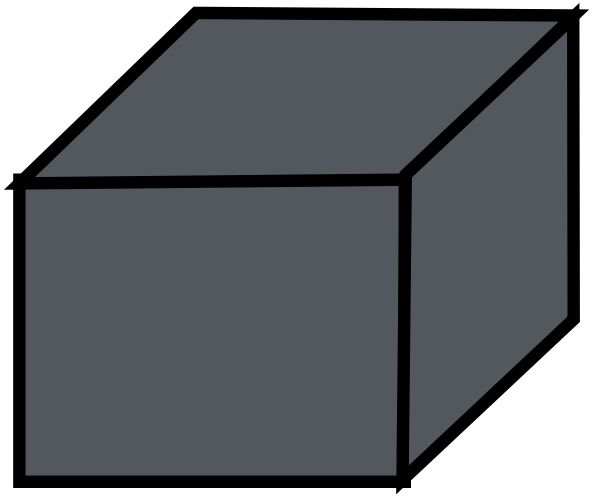
User studies

Can we predict…

…the performance of an interface?

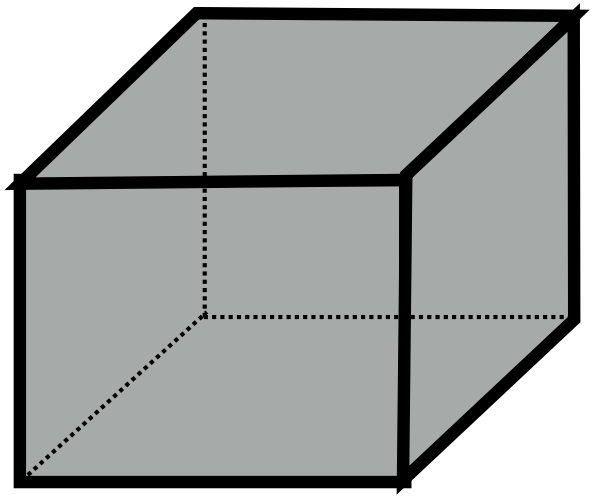
Predicting user behavior: a difficult exercice



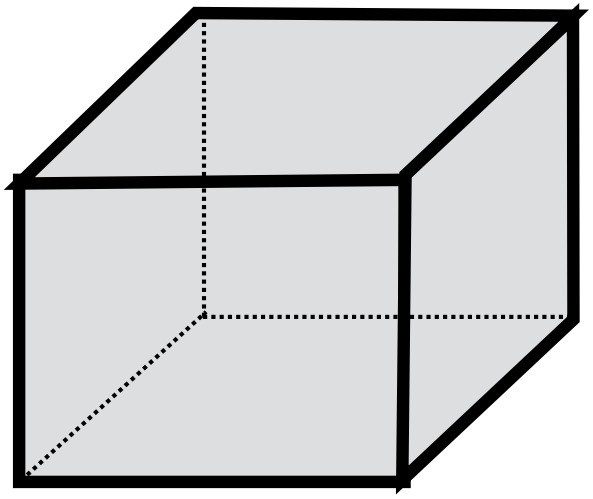


Machine learning

do not explain
cognitive process



HCI



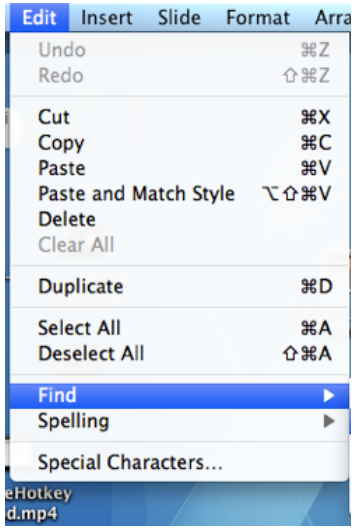
Cognitive Science

complex
difficult to apply

Time = f(

&

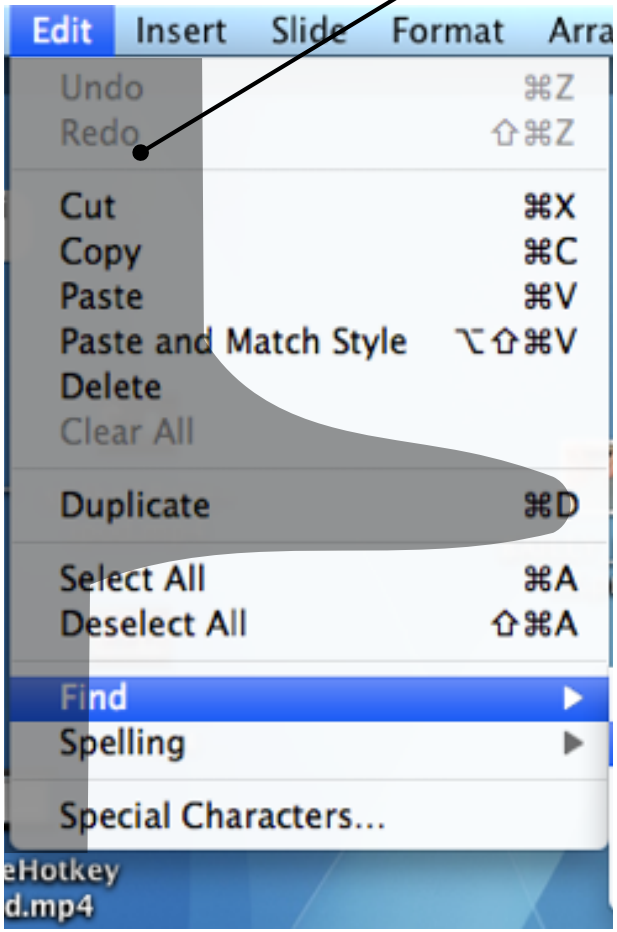
Gaze distribution



)

menu length
menu organization
target position
practice

Gaze distribution



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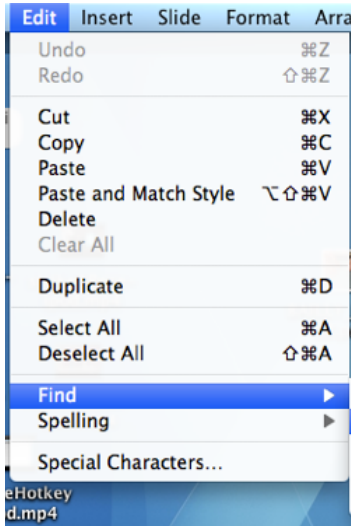
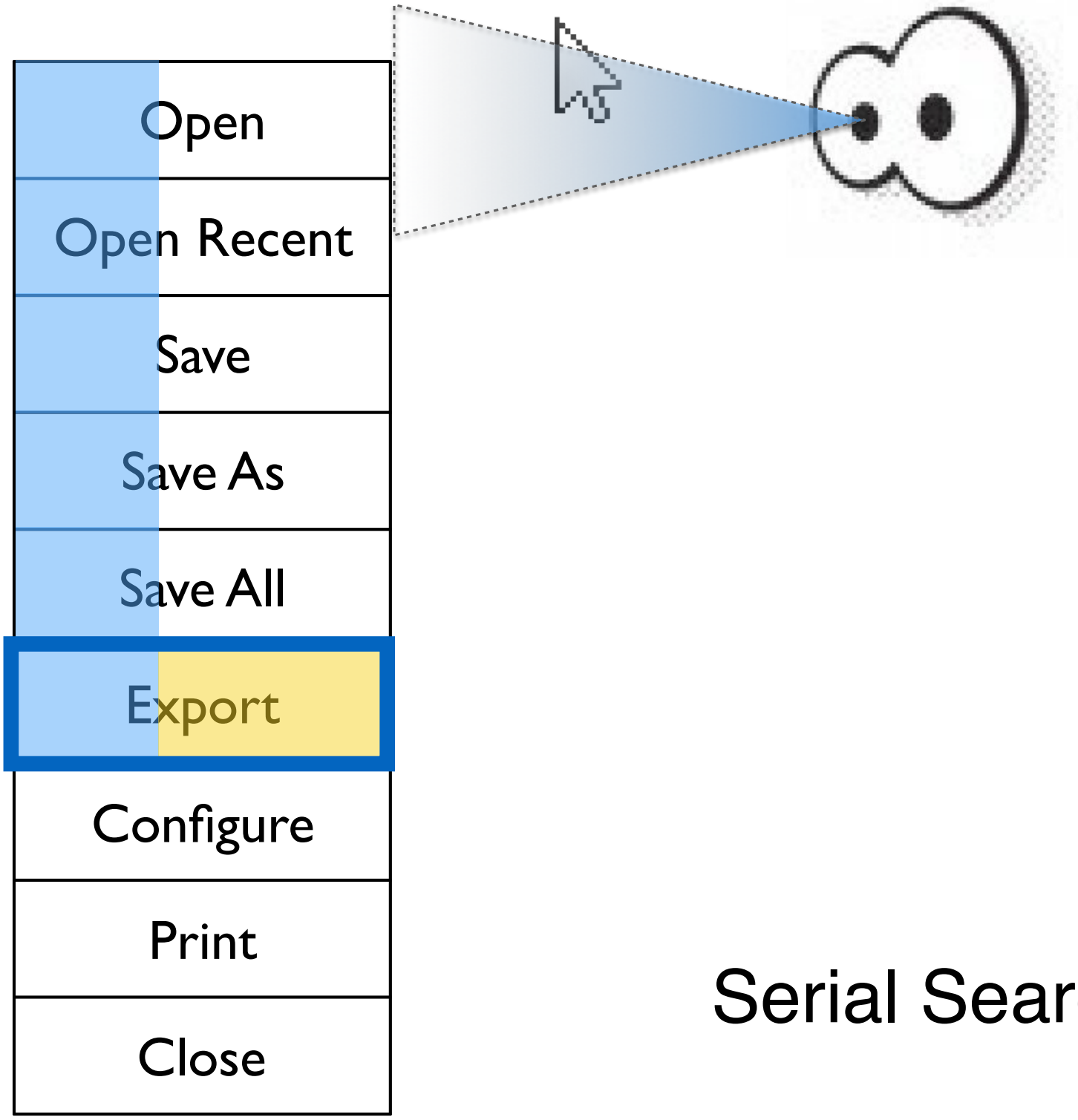
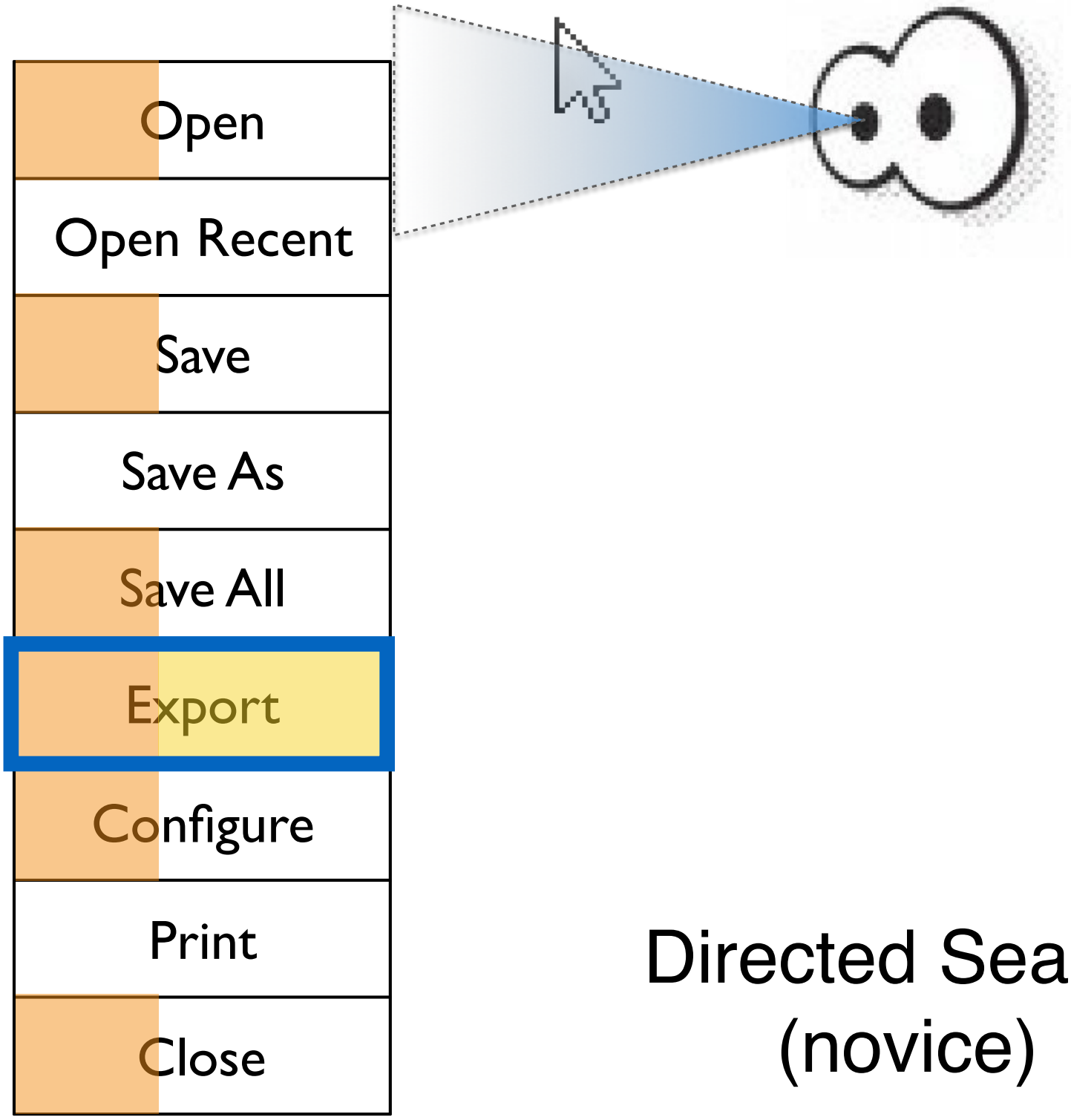


)

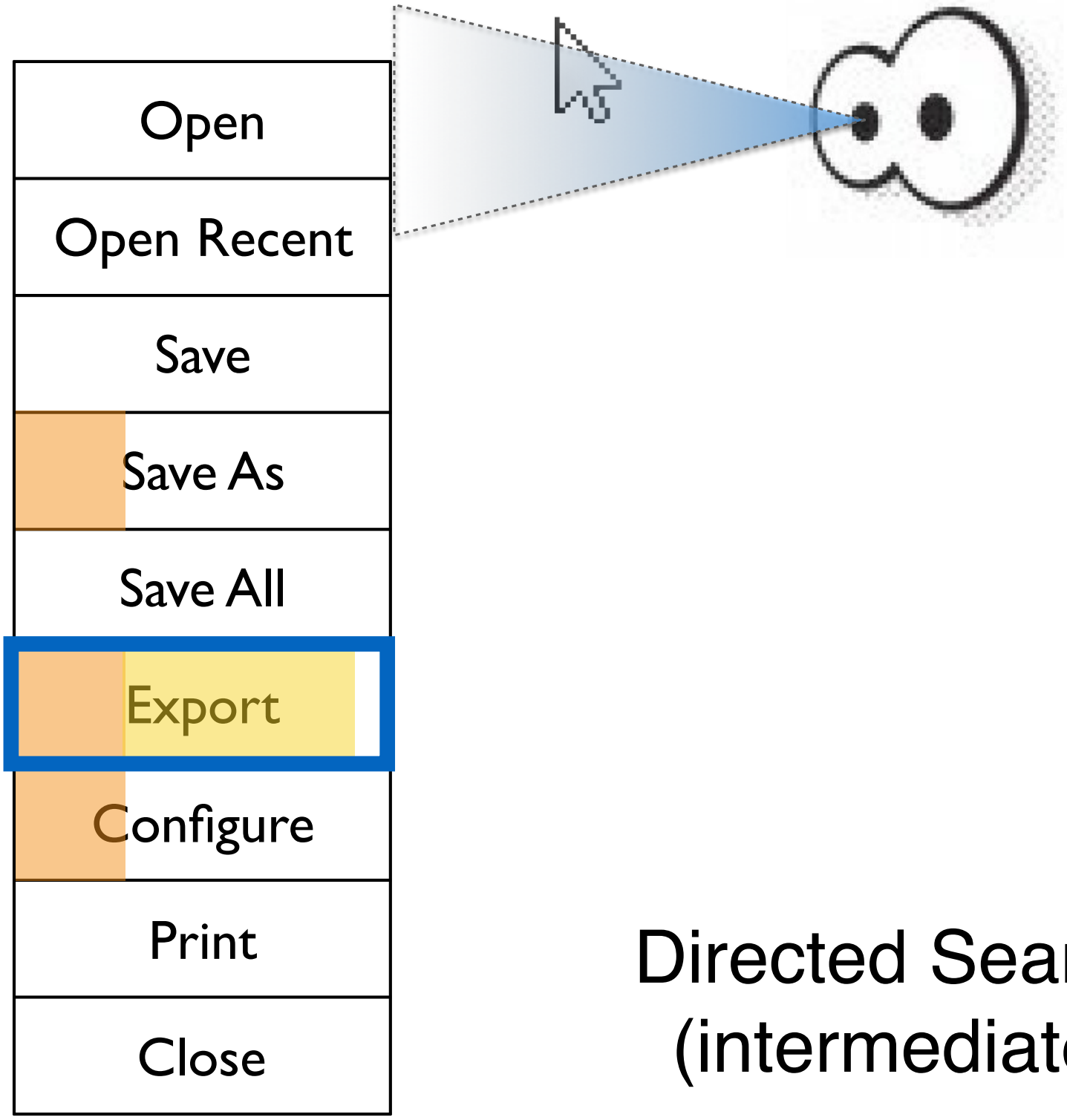
menu length
menu organization
target position
practice



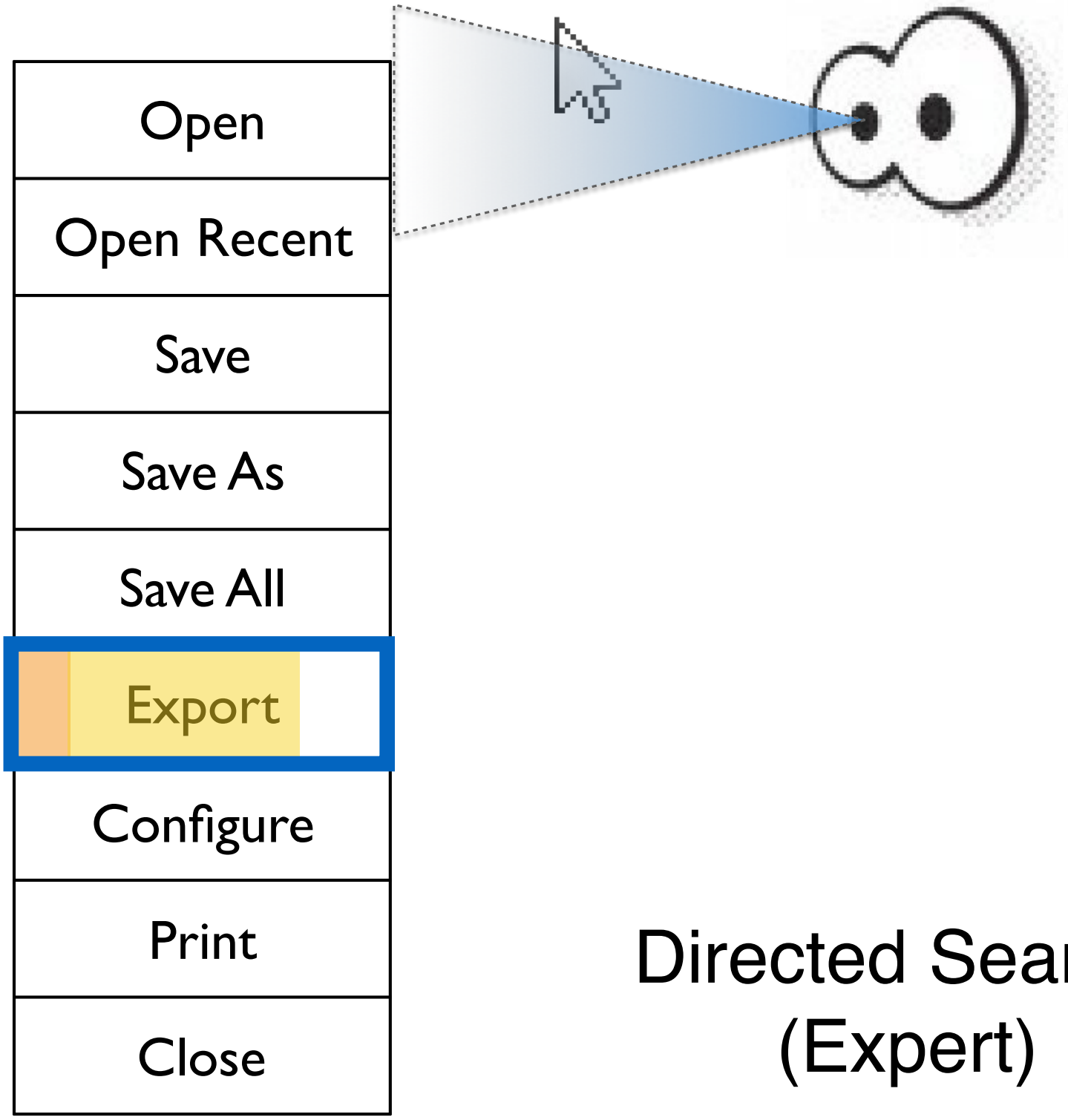
Serial Search



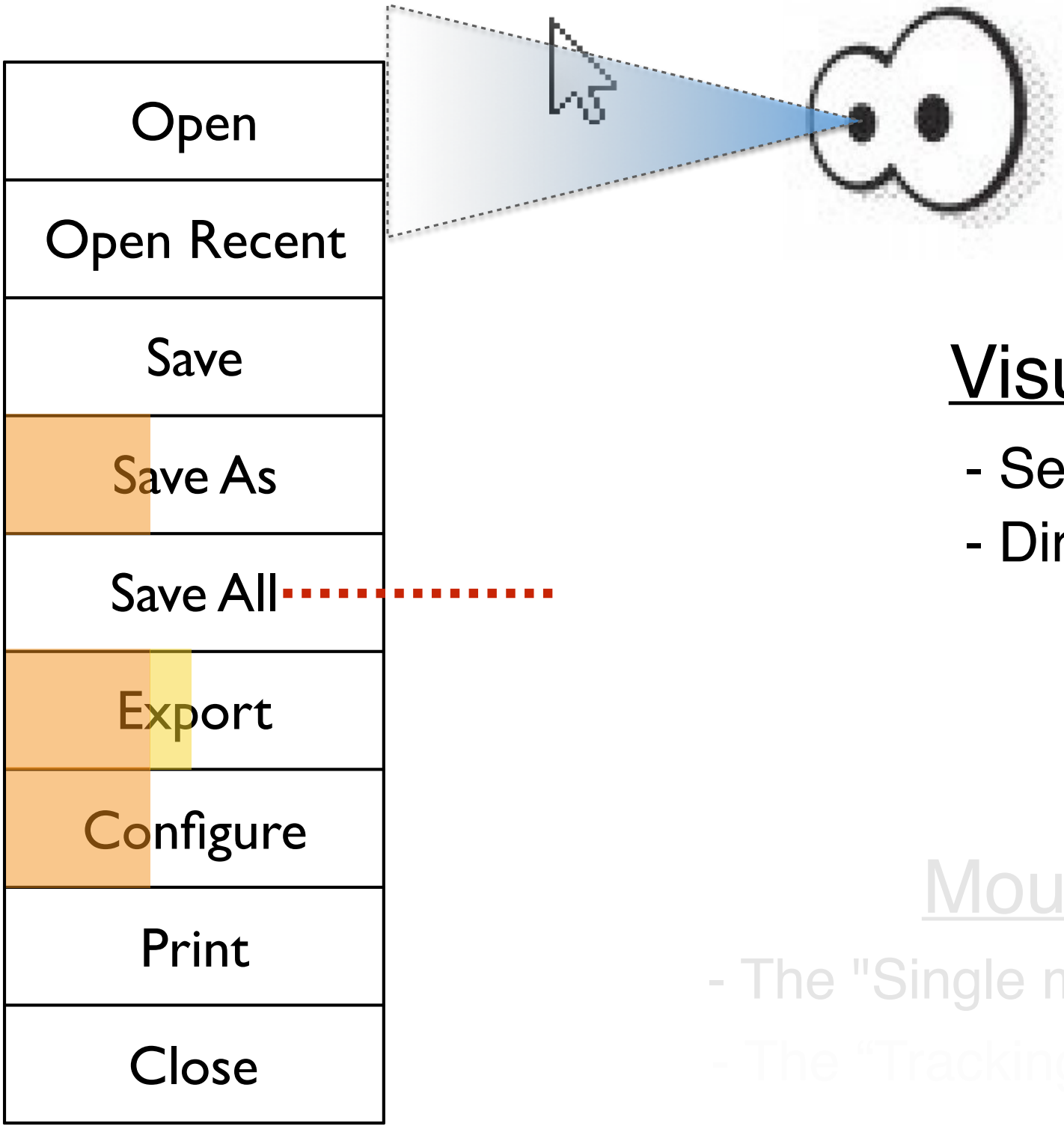
Directed Search
(novice)



Directed Search
(intermediate)



Directed Search
(Expert)

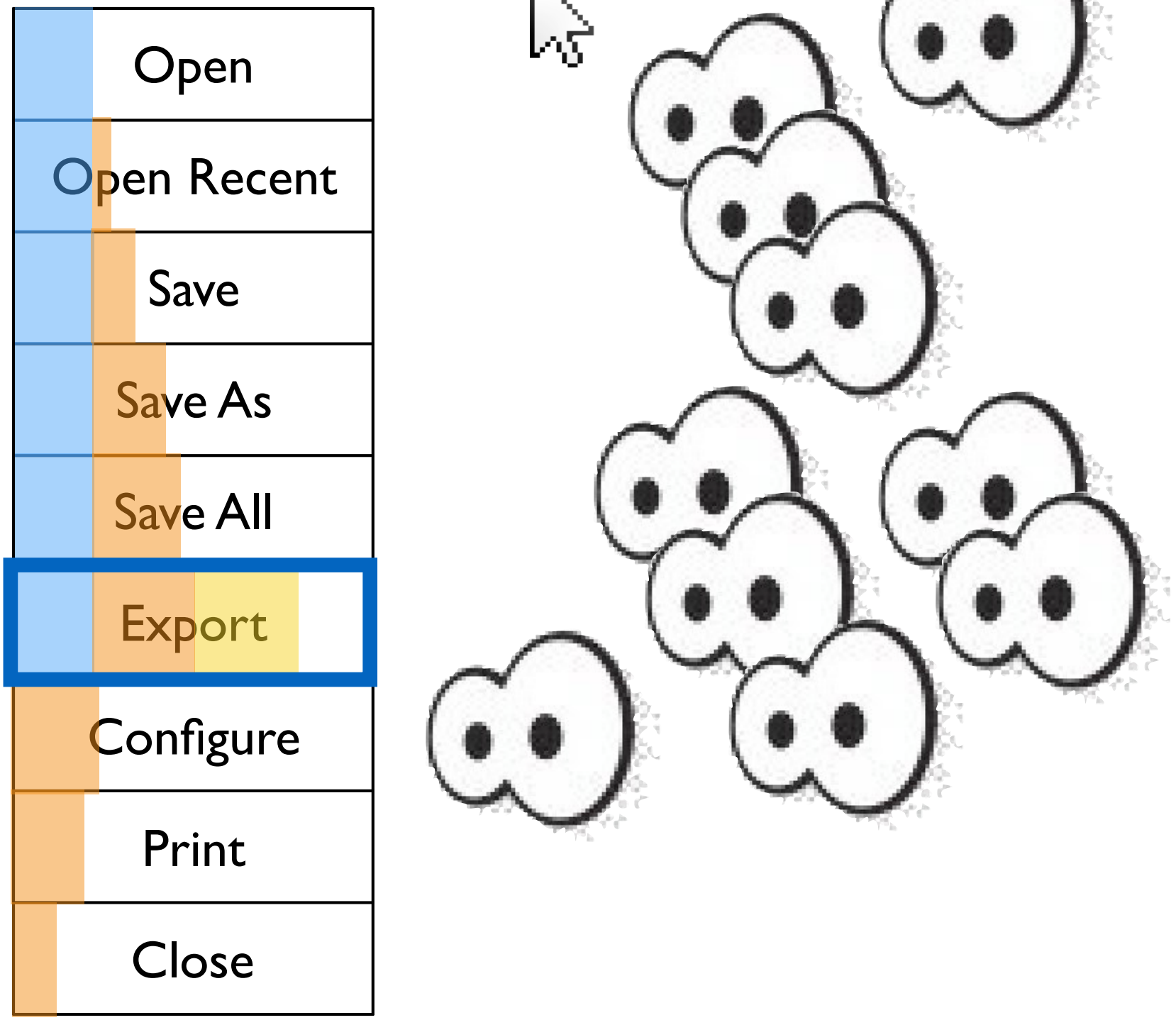


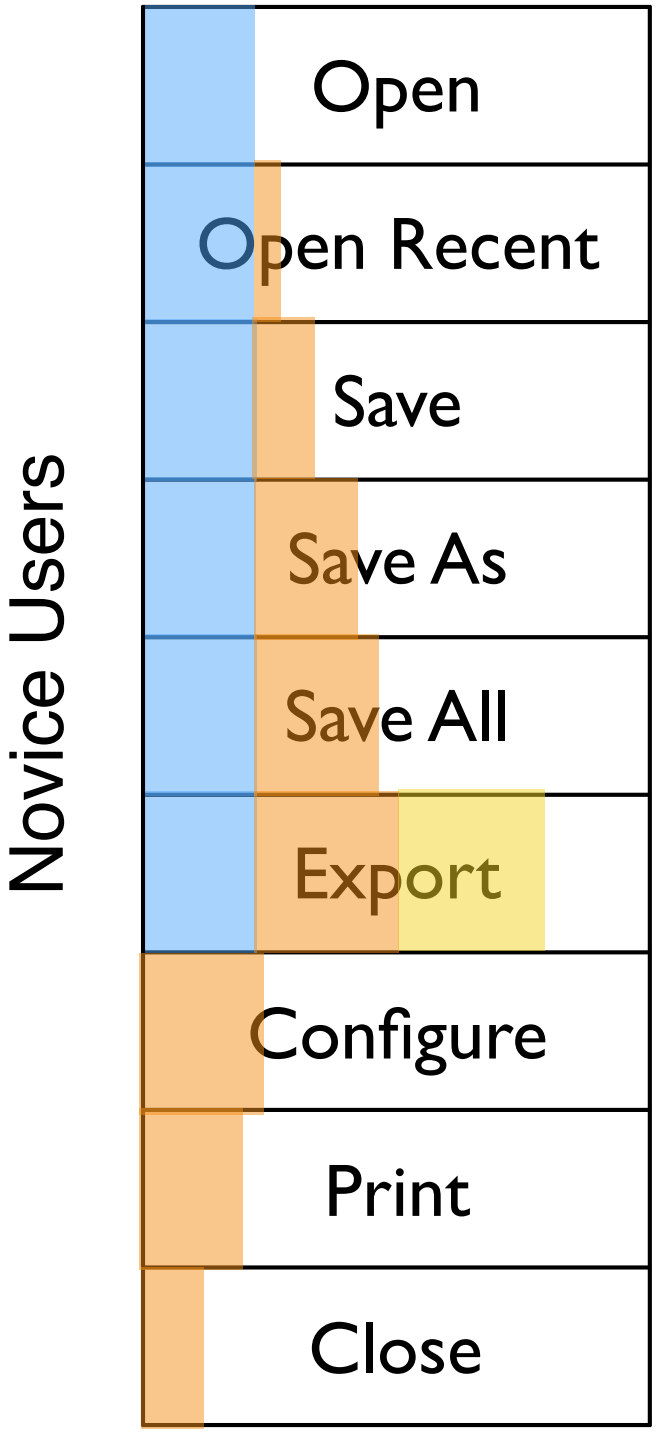
Visual Search

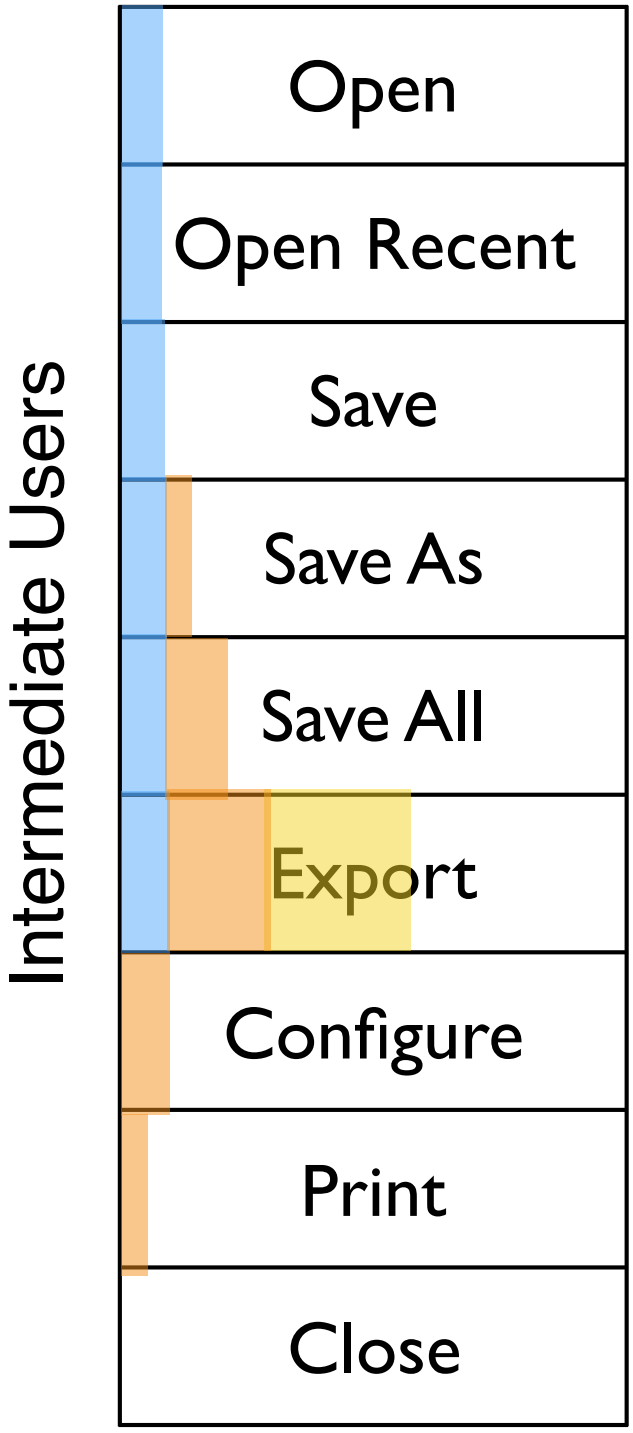
- Serial search
- Directed search

Mouse Control

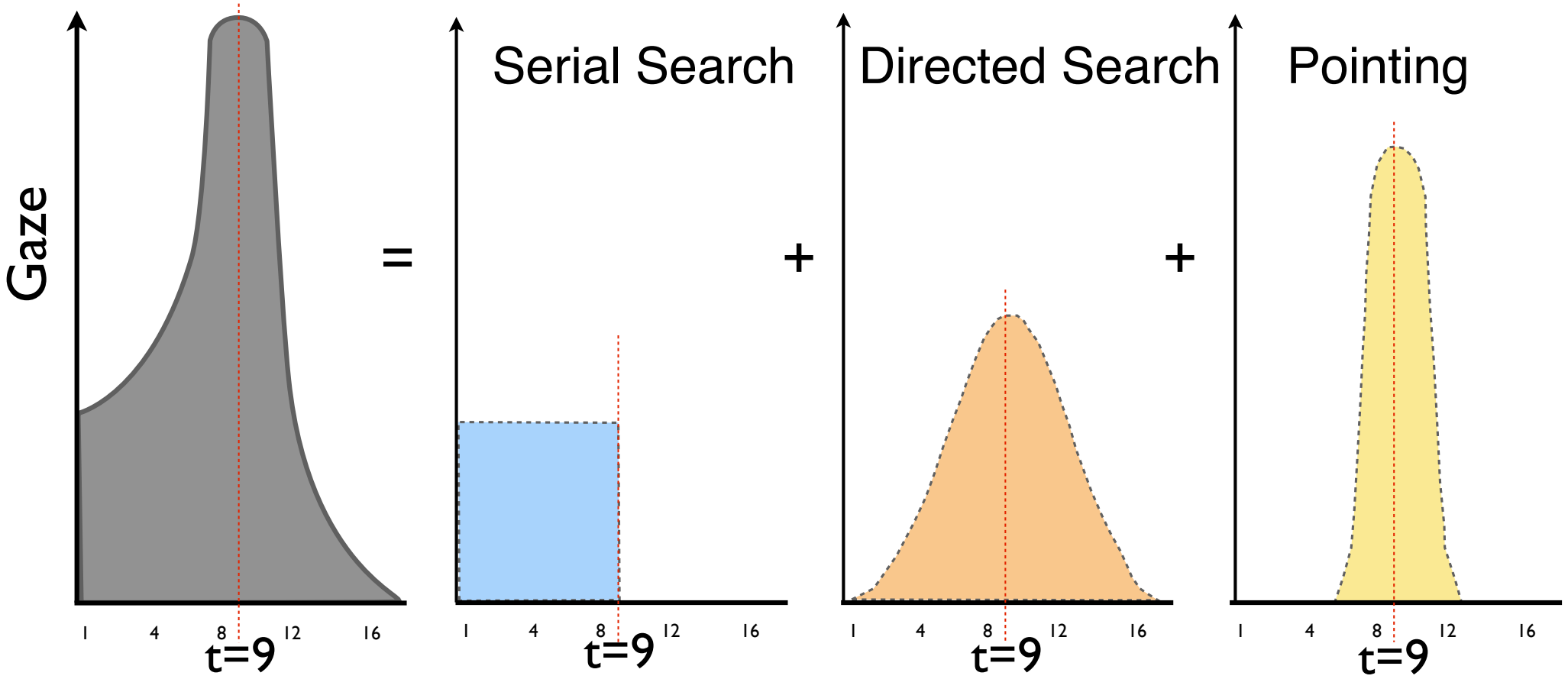
- The "Single move" strategy
- The "Tracking" strategy


Open
Open Recent
Save
Save As
Save All
Export
Configure
Print
Close


Novice Users
Open
Open Recent
Save
Save As
Save All
Export
Configure
Print
Close


Intermediate Users
Open
Open Recent
Save
Save As
Save All
Export
Configure
Print
Close

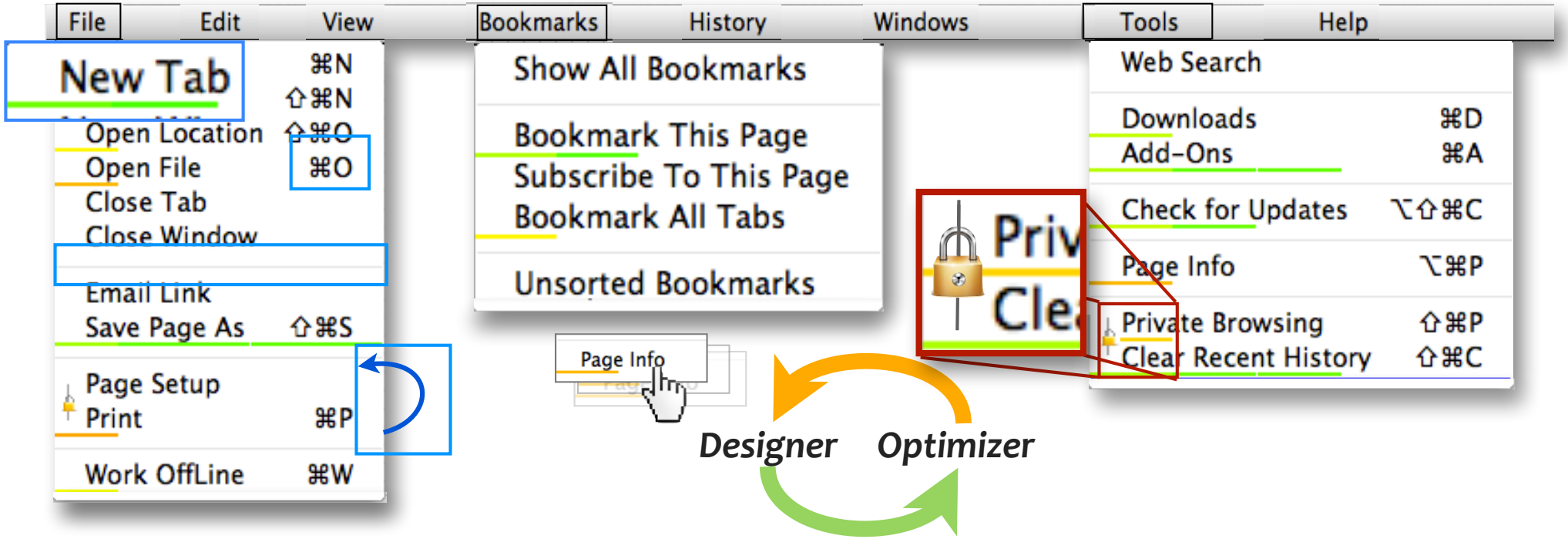
Open
Open Recent
Save
Save As
Save All
Export
Configure
Print
Close



[Bailly et al. 2014]

Can we integrate models into design tools?

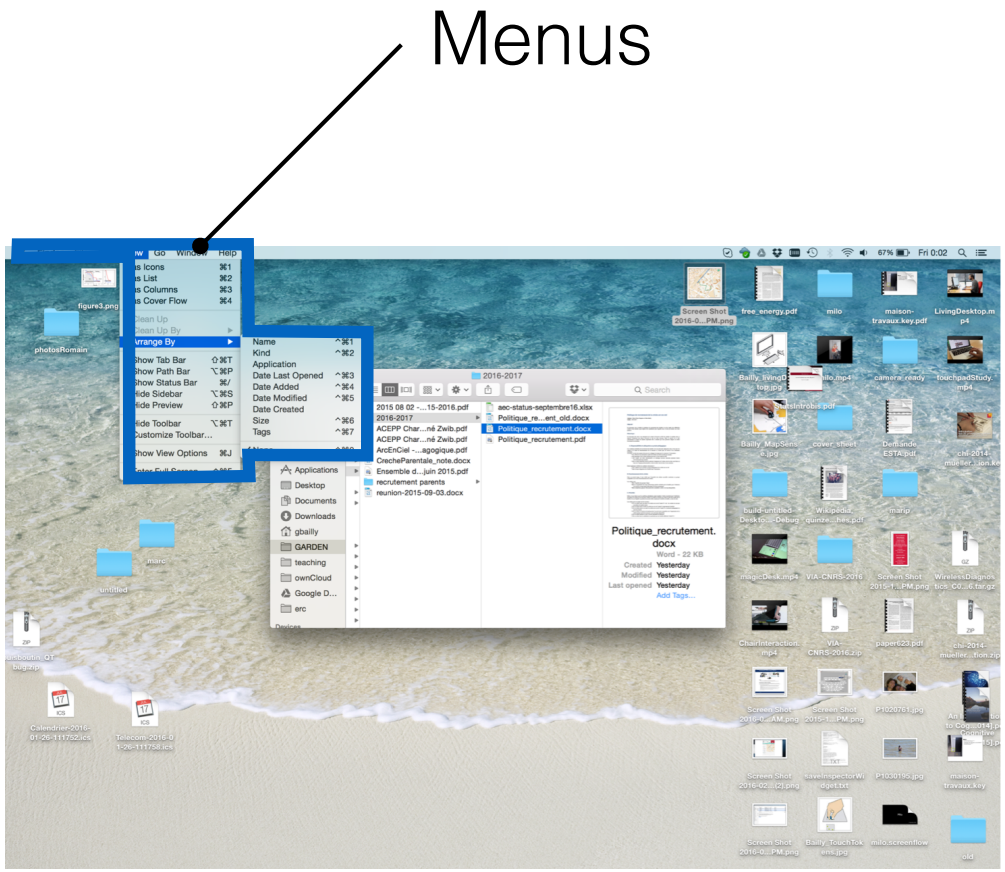
MenuOptimizer



MenuOptimizer [Bailly et al. 2013]

Designing menus is easy but…

Designing usable menus is difficult



MenuOptimizer

Designer

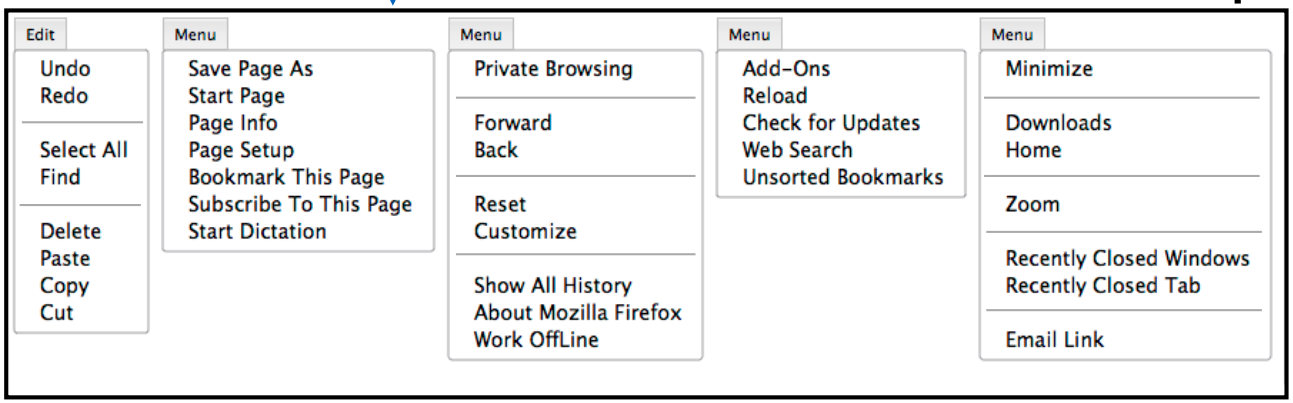
Edit goals
and assumptions

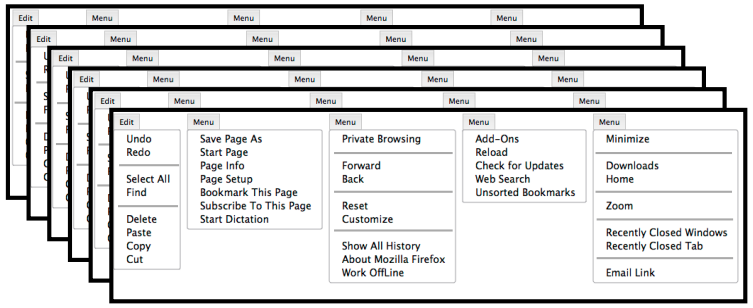
Feedback

Optimizer

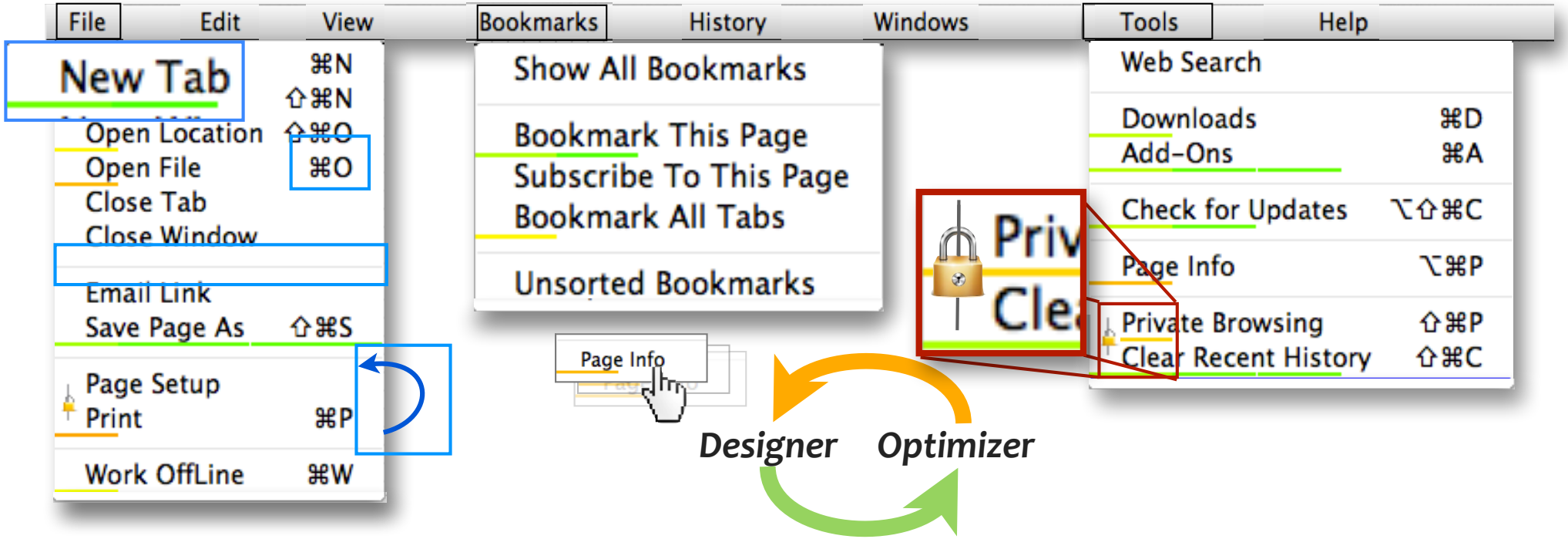
Edit

suggestions





MenuOptimizer



MenuOptimizer [Bailly et al. 2013]

Part 1

HCI & Popular Thinking

- HCI is more than just designing cool devices
- The desktop workstation is not dead
- The GUI (WIMP) model is not dead

Part 2

Future of Desktop & GUI

- Leveraging context-awareness of Desktop
- Leveraging users' expertise in GUI

Part 3

Understand users' behaviors

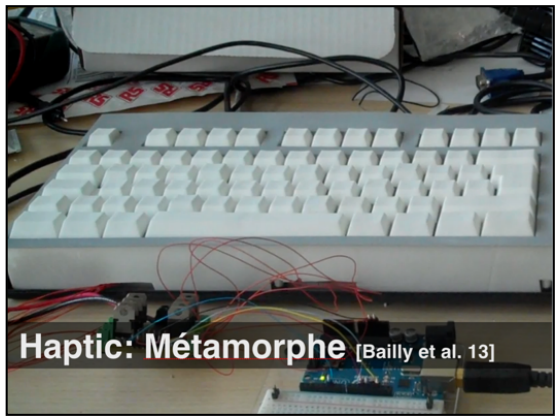
- Need of data & models

Take away messages

1. Desktop workstation is not dead

it will be more context-aware

Visual: Optimus maximus


Haptic: Métamorphe [Bailly et al. 13]

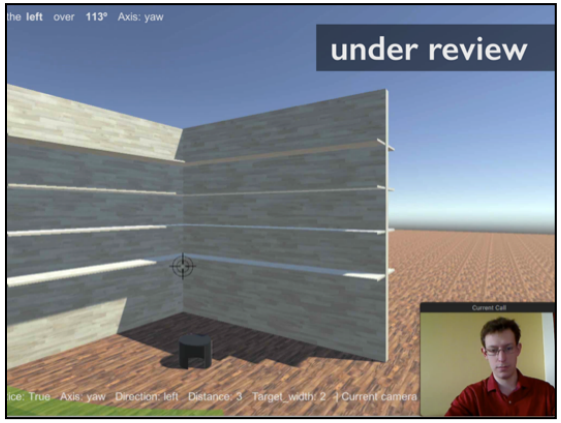
MagicDesk [Bi et al. 2011]

Curve [Wimmer et al. 2010]

DigitalDesk [Wellner 1993]

Digital pen

Chair Gestures [Probst 2014]


under review

LivingDesktop [Bailly et al. 2016]

The Future Desktop

be connected

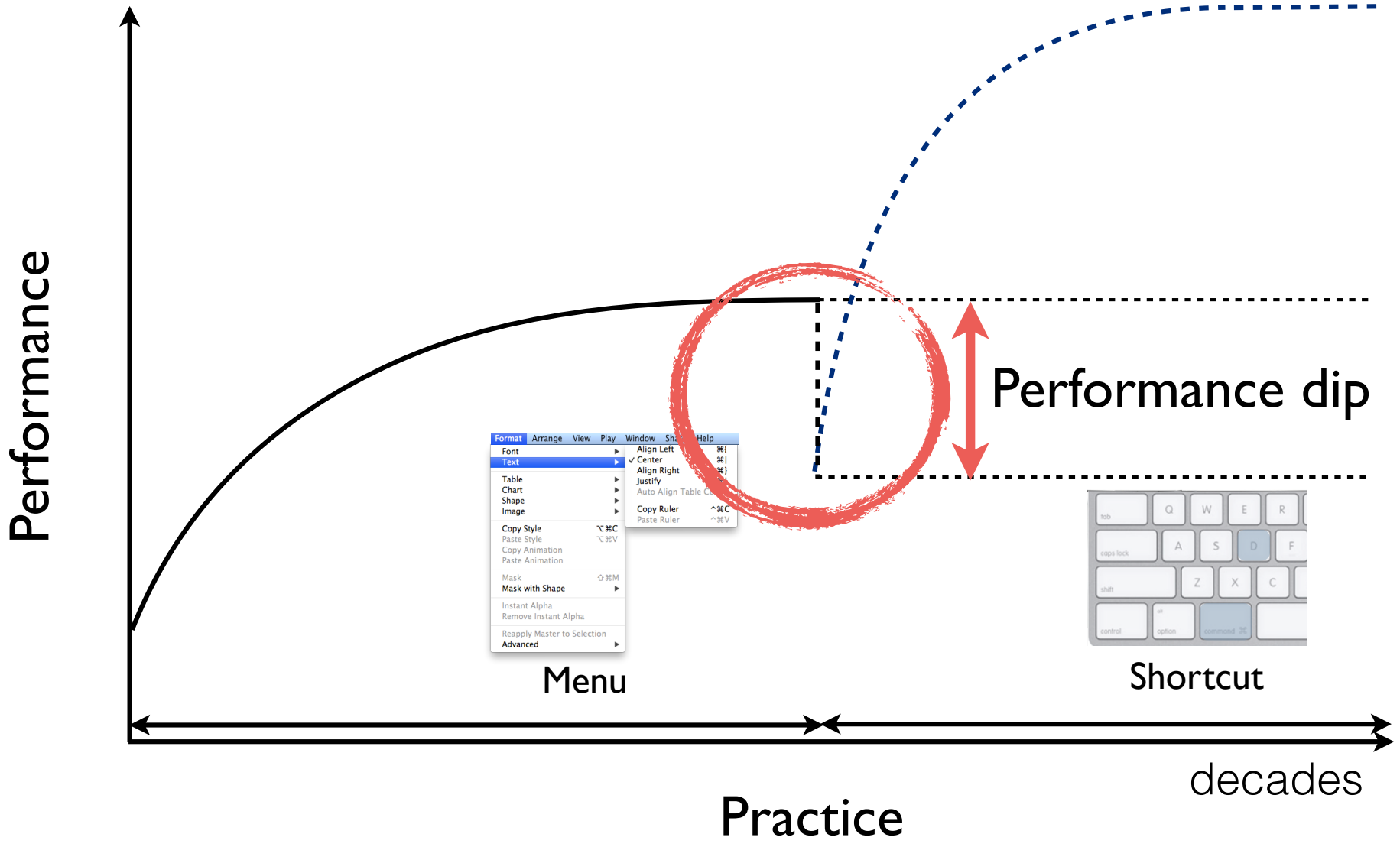
capture more user inputs

provide more feedback

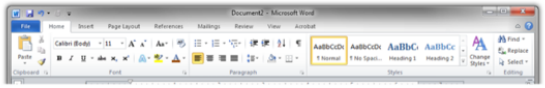
be integrated in the environment

2. GUI model is not dead

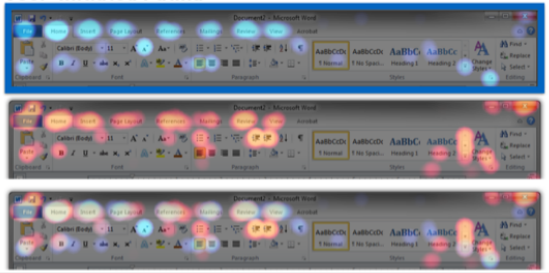
it will leverage users' expertise


Performance
Performance dip
Format Arrange View Play Window Help
Font
Text
Table
Chart
Shape
Image
Copy Style
Paste Style
Copy Animation
Paste Animation
Mask
Mask with Shape
Instant Alpha
Remove Instant Alpha
Reapply Master to Selection
Advanced
Align Left
Center
Align Right
Justify
Copy Ruler
Paste Ruler
Menu
Shortcut
decades
Practice

Standard View



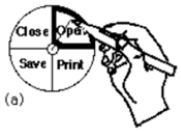
User-Initiated Patina



Patina [Matejka 2013]

"Guidance should be a physical rehearsal of the way an expert would issue the command"

Gordon Kurtenbach



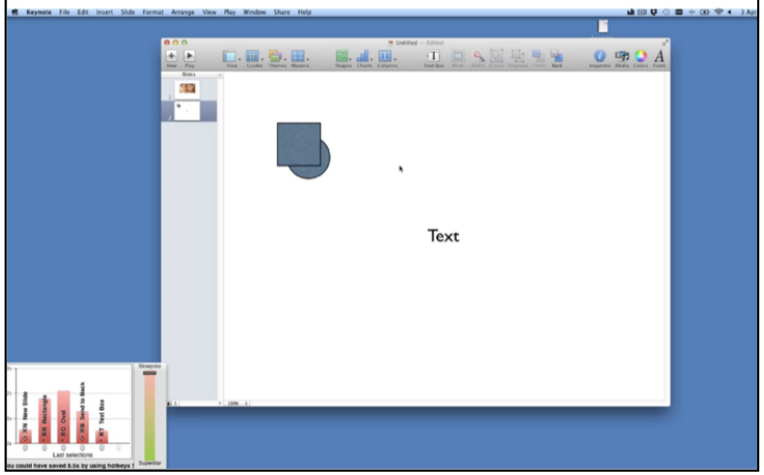
Novice mode

expert mode

Marking menus [Kurtenbach et al. 91]

ExposeHotkey [Malacria et al. 2013]

SkillOMeter [Malacria et al. 2013]



The Future GUI

Immediate usable

Aware of the expert mechanisms

Fluid transition from novice to expert behaviors

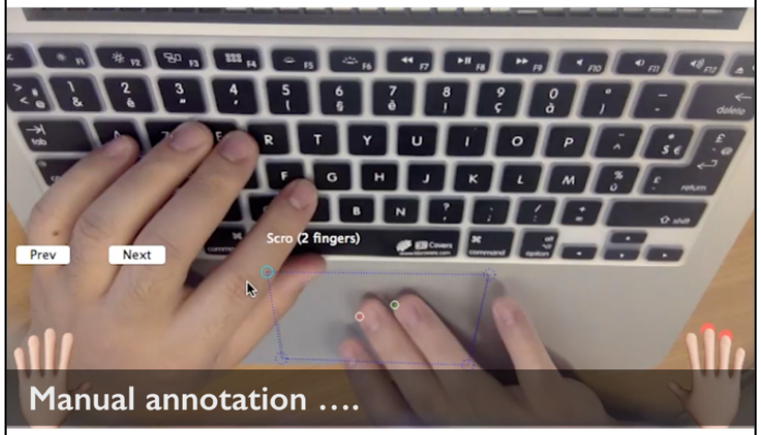
3. We should put efforts on

Understanding users' behaviors

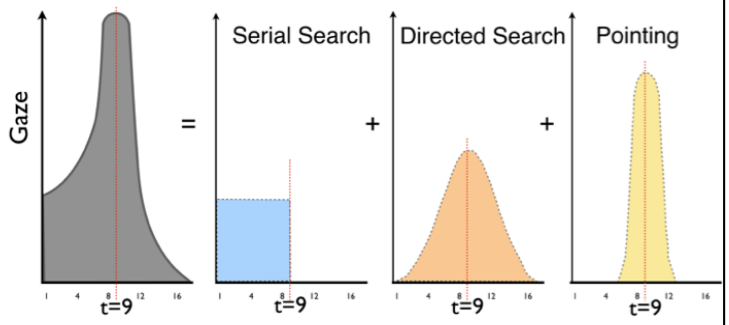
Collecting data: Applications

Challenge:
10^3 users x 10^2 applications x 10^3 commands

Menu Inspector [Bailly et al. 2013]

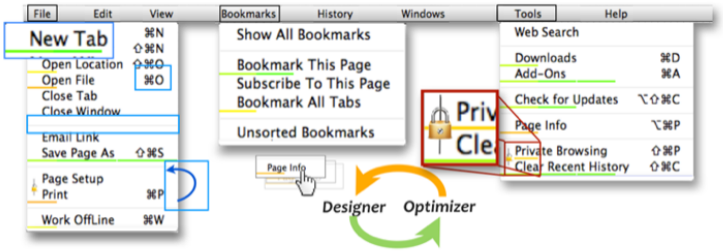


Manual annotation ….



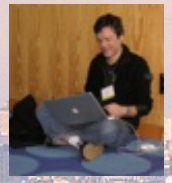
[Bailly et al. CHI'14]

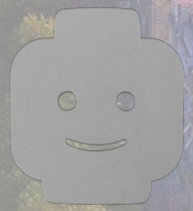
MenuOptimizer



MenuOptimizer [Bailly et al. 2013]

HCI Research at Télécom ParisTech & CNRS





by Moyan Brenn - Flickr.com

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Oulasvirta A.	**Pietrzak T.**	Sahdev S.
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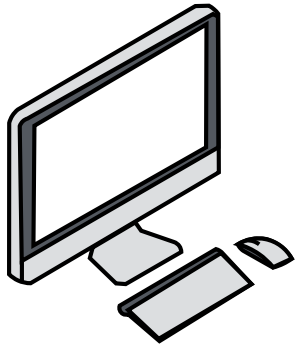

Command Selection & User Expertise

1. Future Desktop will be more context-aware

2. Future GUI will leverage users' expertise

3. We should put efforts on understanding users' behaviors

Gilles Bailly

cnrs

TELECOM ParisTech

université PARIS-SACLAY