

Command Selection

Gilles Bailly

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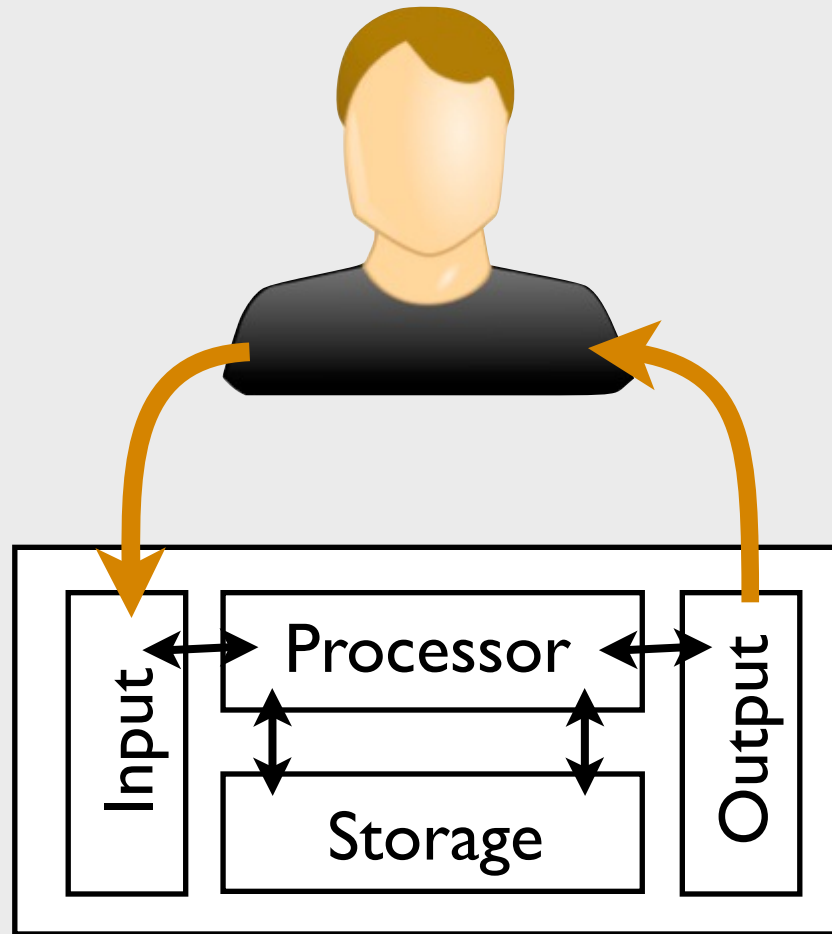
Telecom ParisTech



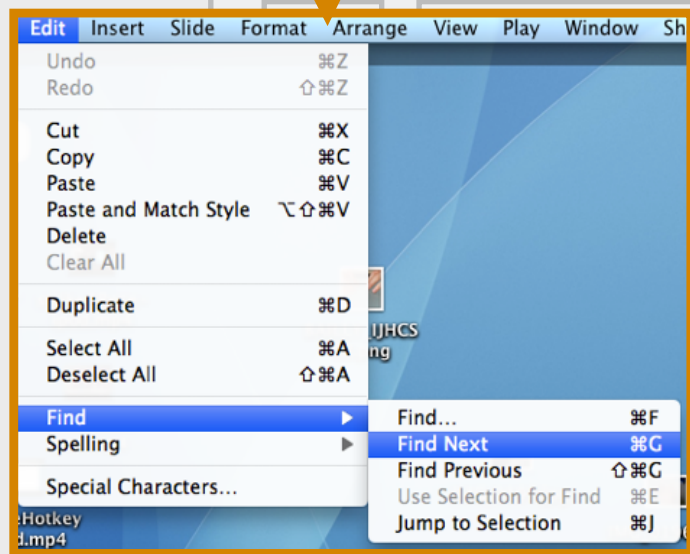
Main NPC Tells Guild Group Auction

>Kayden Clackersbane changes to a bloody stance

What?



Interactive Systems



Command Selection

Edit Insert Slide Format Arrange View Play Window Share

Undo ⌘Z
Redo ⇧⌘Z

Cut ⌘X
Copy ⌘C
Paste ⌘V
Paste and Match Style ⇧⇧⌘V
Delete
Clear All

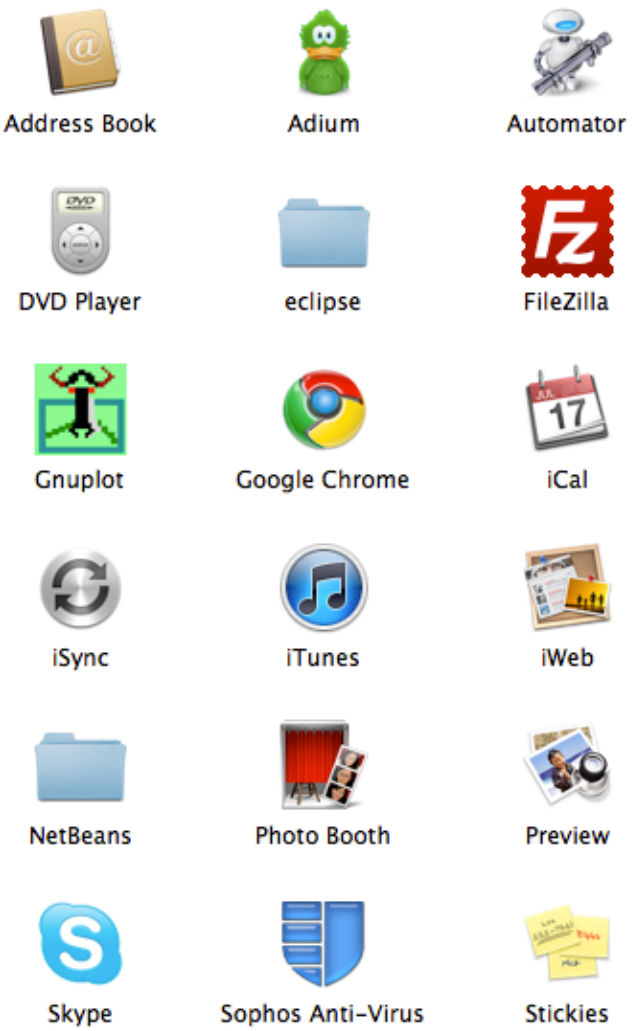
Duplicate ⌘D
Select All ⌘A
Deselect All ⇧⌘A

Find ▶
Spelling ▶
Special Characters...

Find... ⌘F
Find Next ⌘G
Find Previous ⇧⌘G
Use Selection for Find ⌘E
Jump to Selection ⌘J

Menus

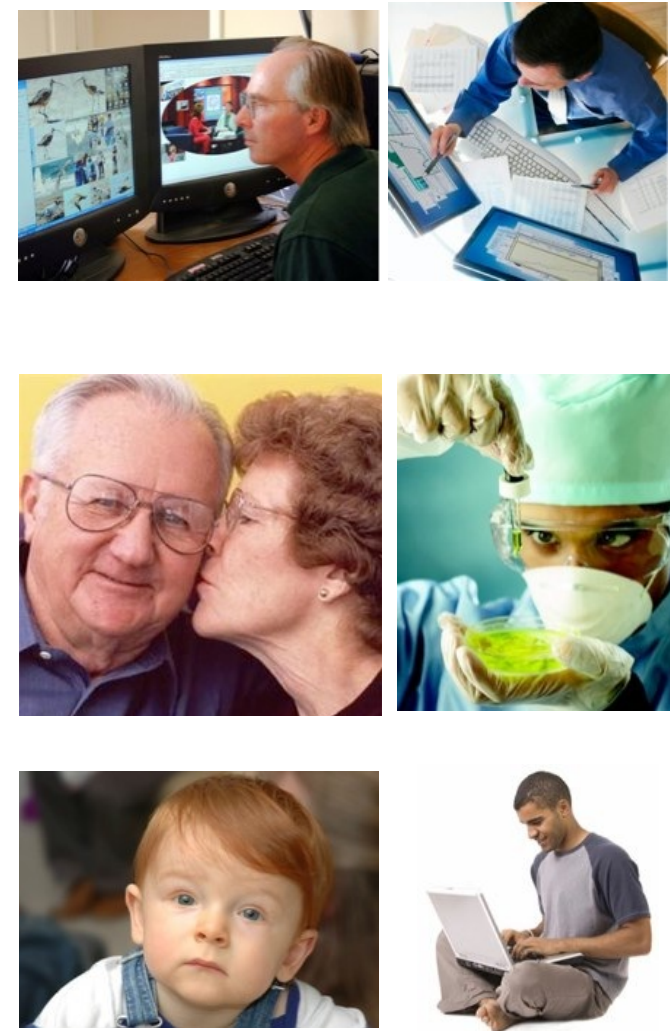
Why?



Application

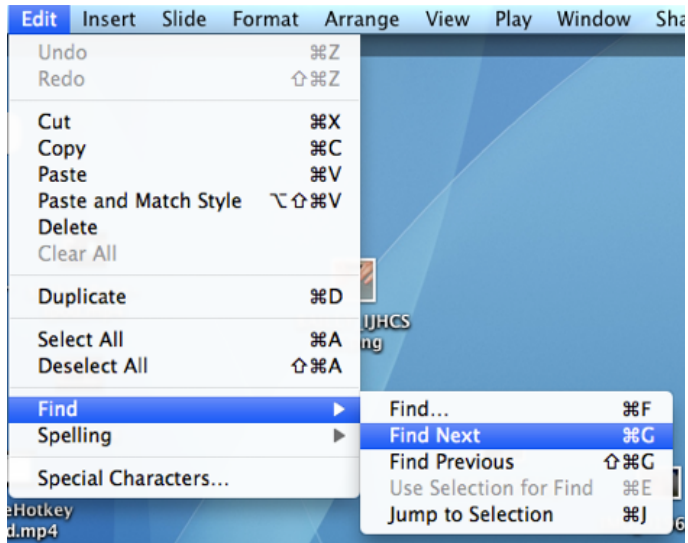


Platform

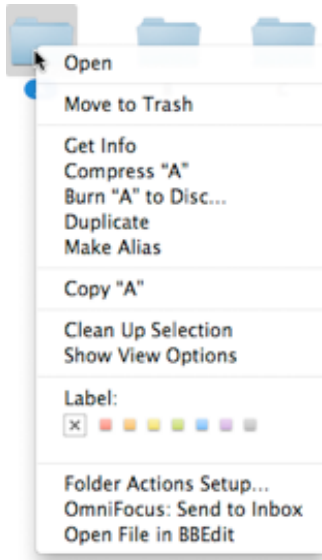


User

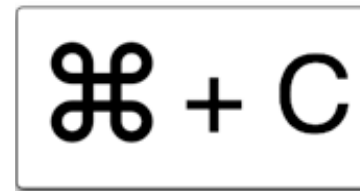
// Affects all Interactive Systems



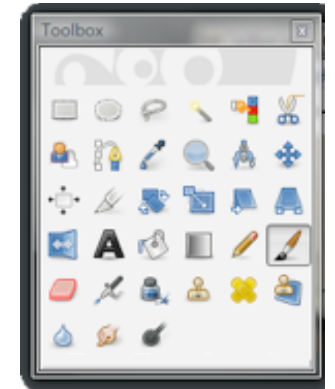
Menubar



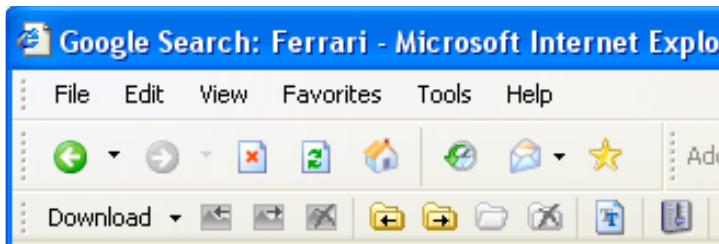
Context menu



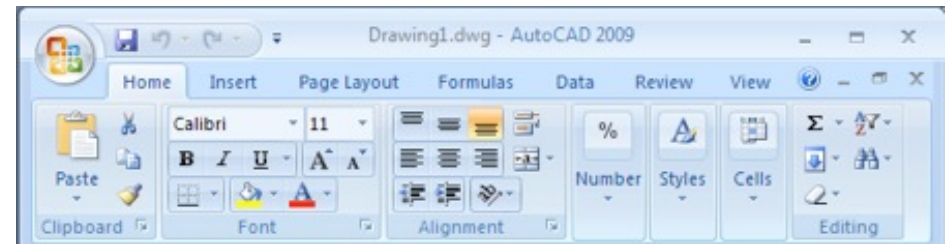
Hotkeys



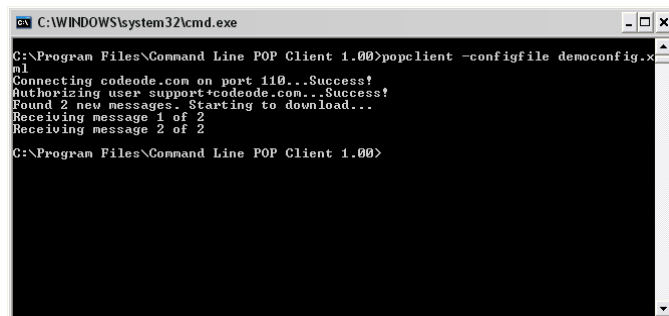
Toolbox



Toolbar



Ribbon

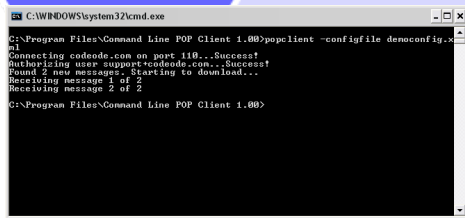


Command line

2/ affect all interaction paradigms

CLI

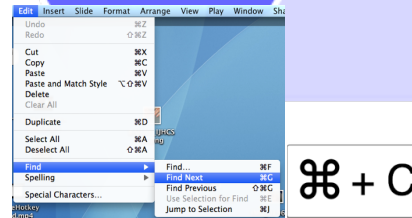
- Codified
- Strict



```
C:\WINDOWS\system32\cmd.exe
C:\Program Files\Command Line POP Client 1.00>popclient -configfile demofconfig.p
Connecting codode.com on port 110...Success!
Authorizing user support@codode.com...Success!
Found 2 new messages. Starting to download...
Receiving message 1 of 2
Receiving message 2 of 2
C:\Program Files\Command Line POP Client 1.00>
```

GUI

- Metaphor
- Exploratory



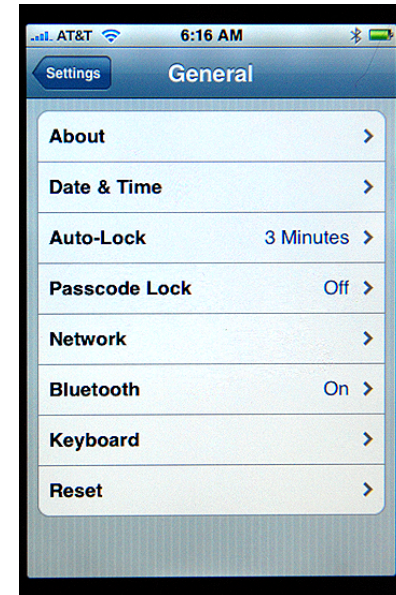
NUI

- Direct
- Intuitive

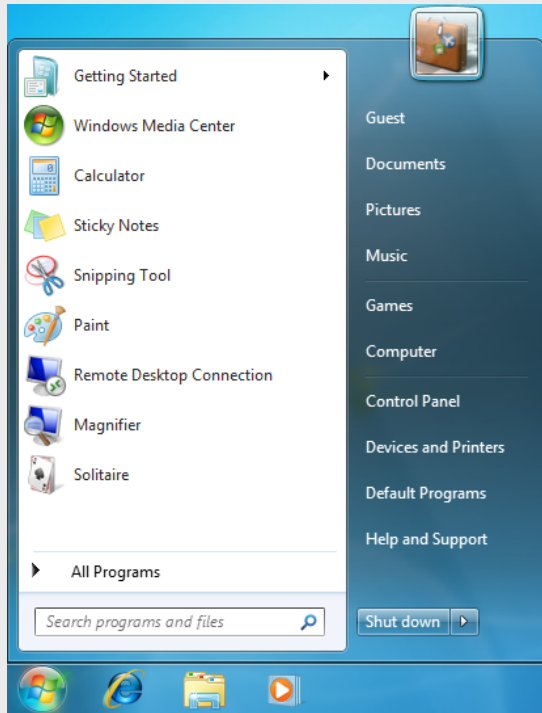


We need to:

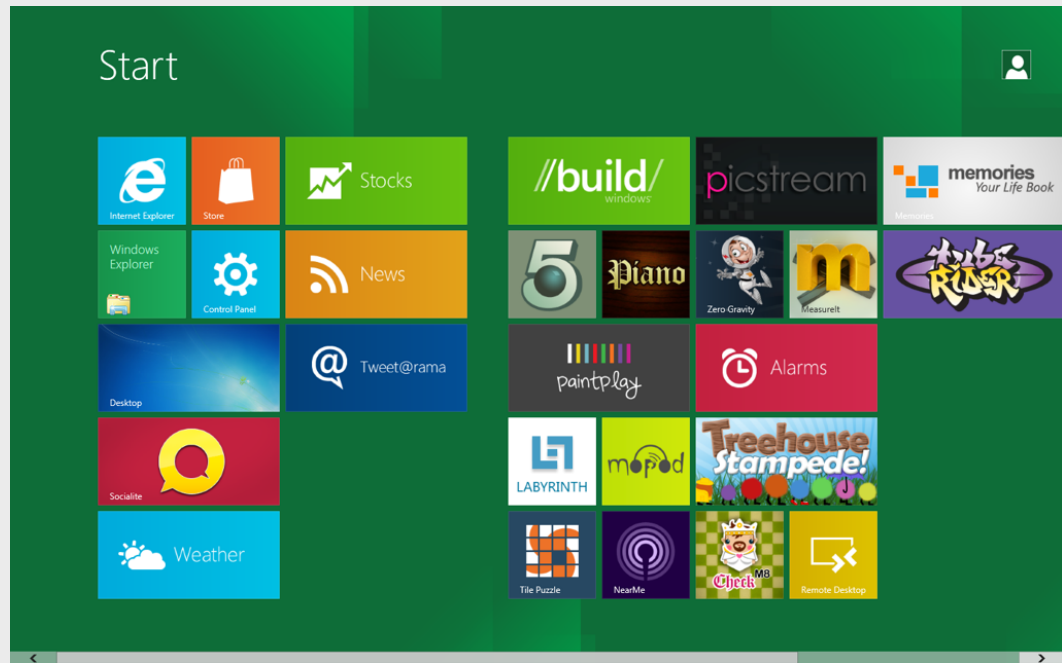
- **present, organize** available commands
- let users **select** commands



Folders & Hierarchies

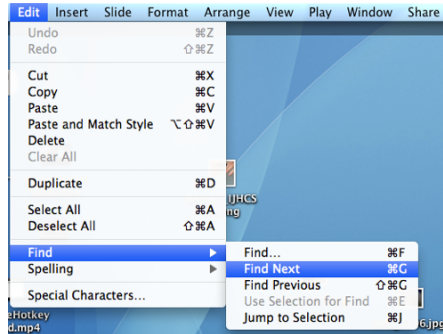


Launch Menu



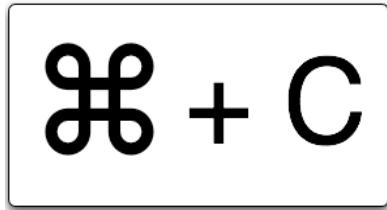
Metro Menu

Some math...



Technique 1

VS.



Technique 2

0.5 seconds

500 million users

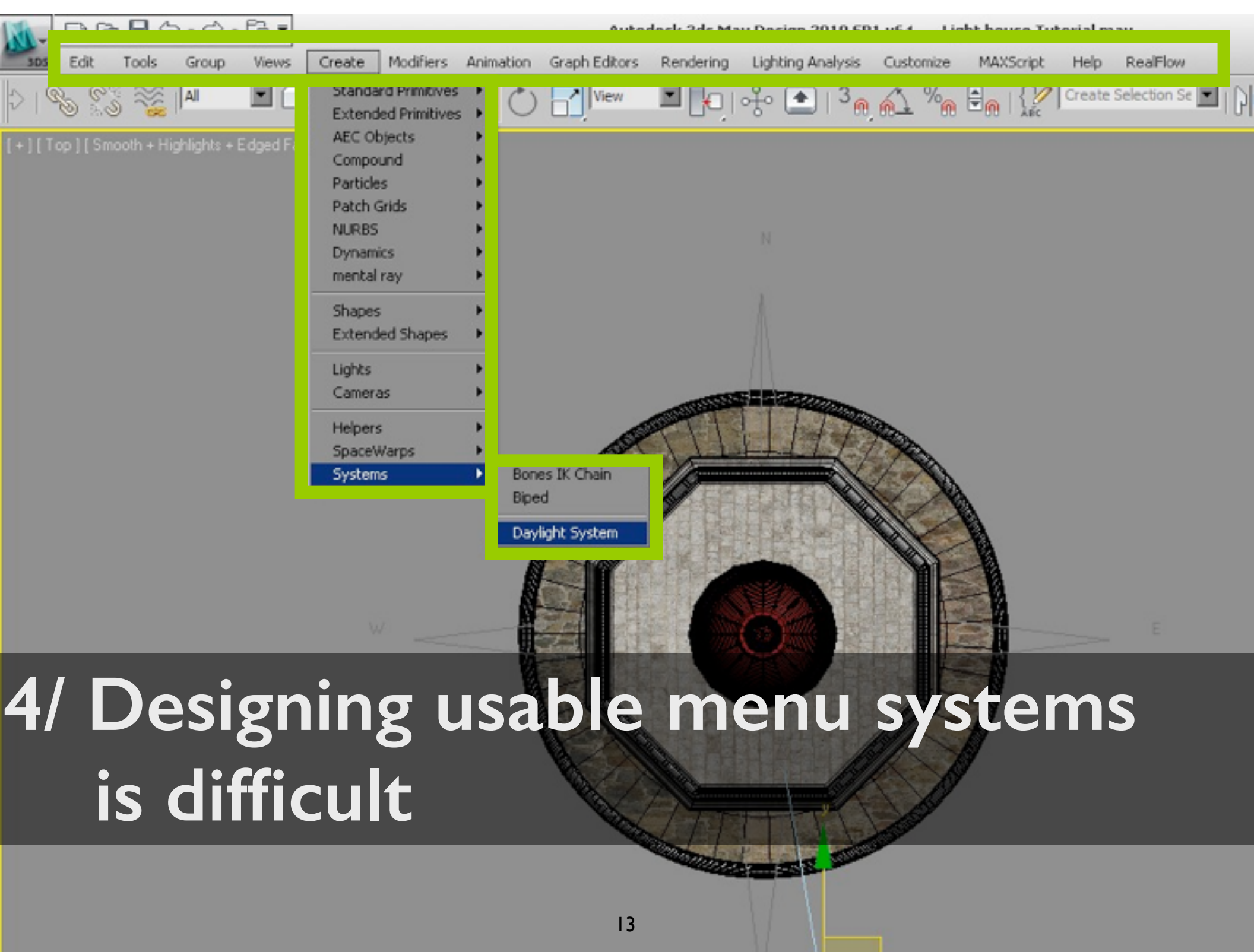
5 commands per user per day

= 465 billion seconds per year

= 126 million hours

= 14,400 years

3/ can have a big impact



4/ Designing usable menu systems is difficult

Numerous novel **interaction techniques**

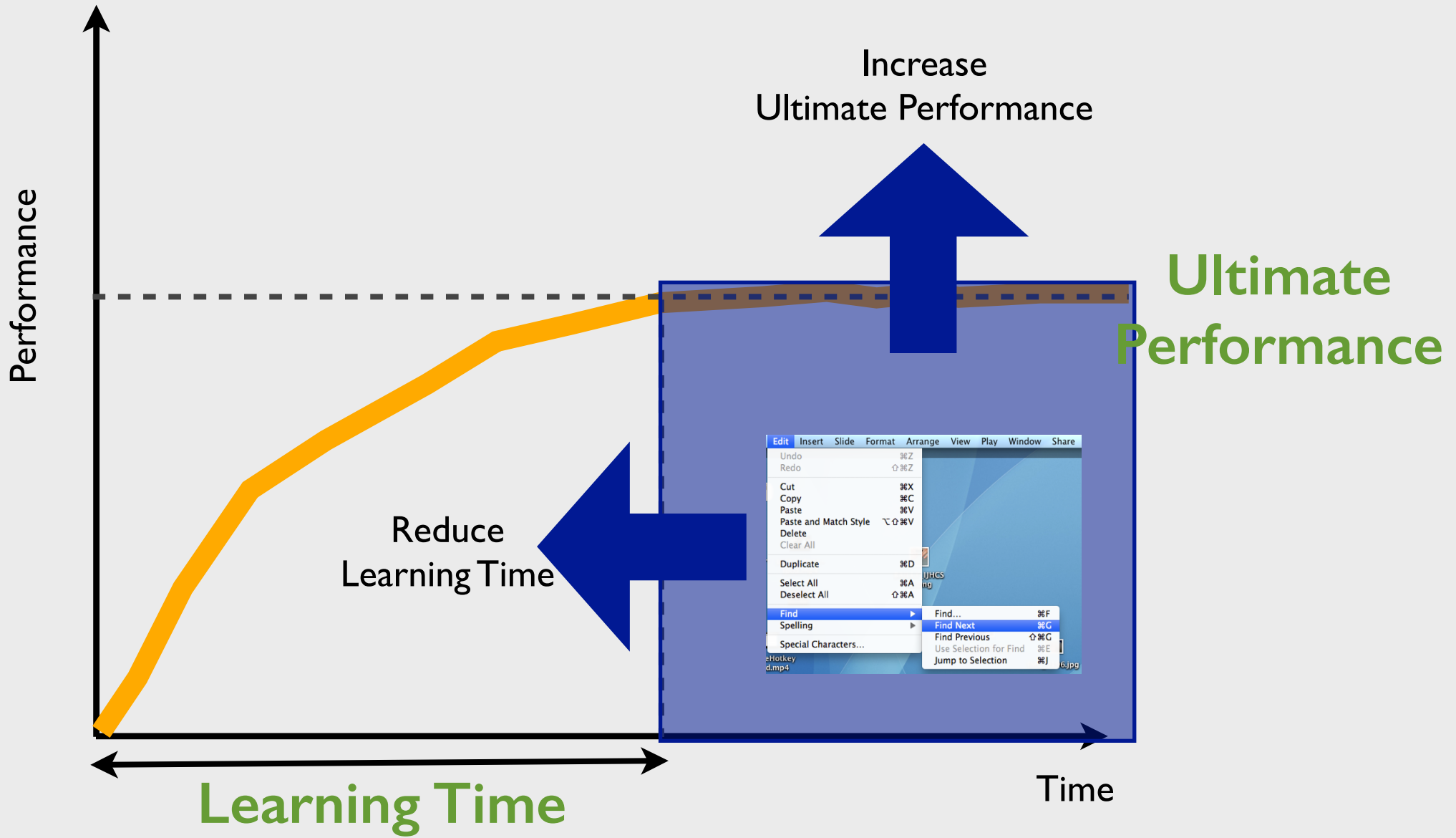
have been proposed in the **literature**

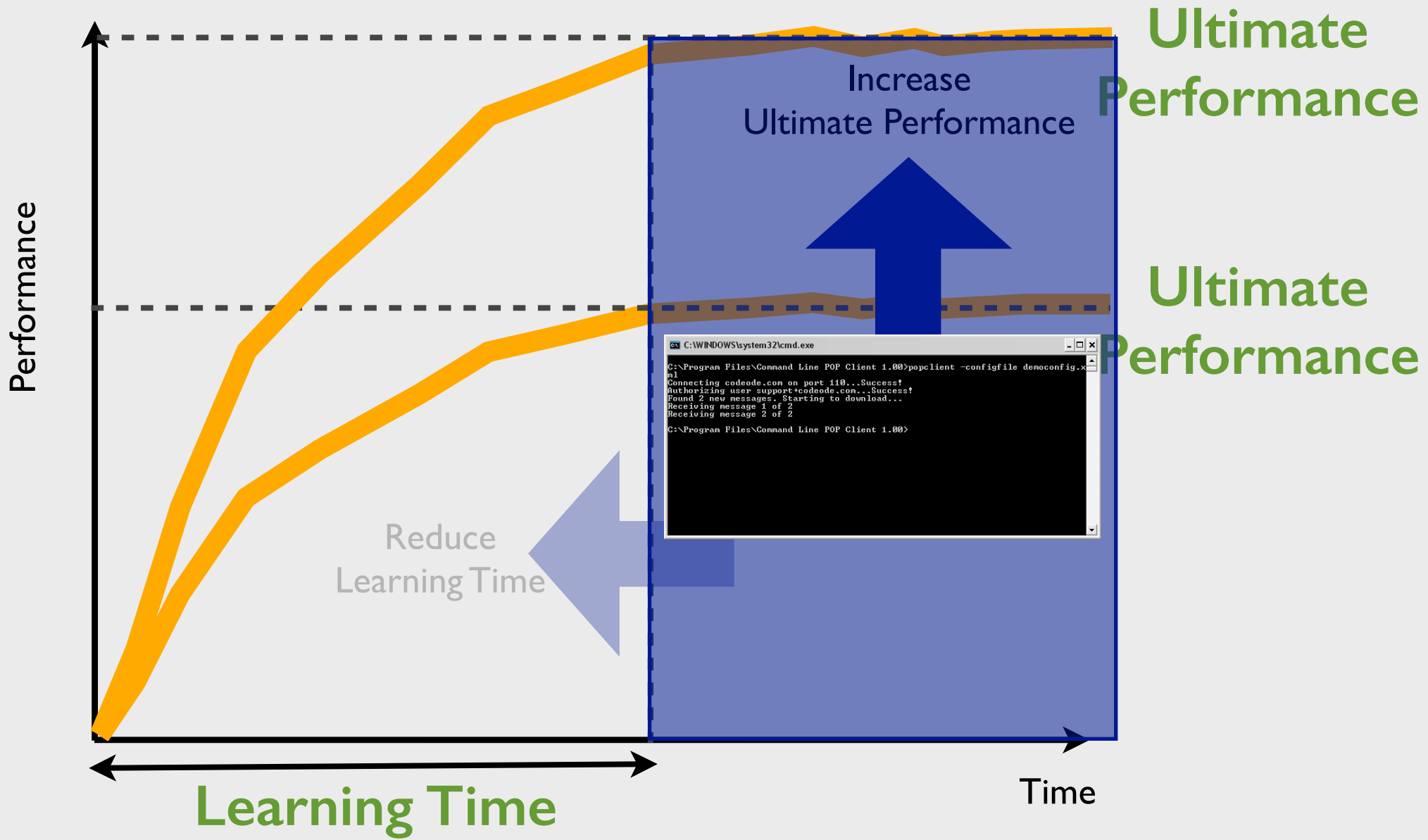
Goals

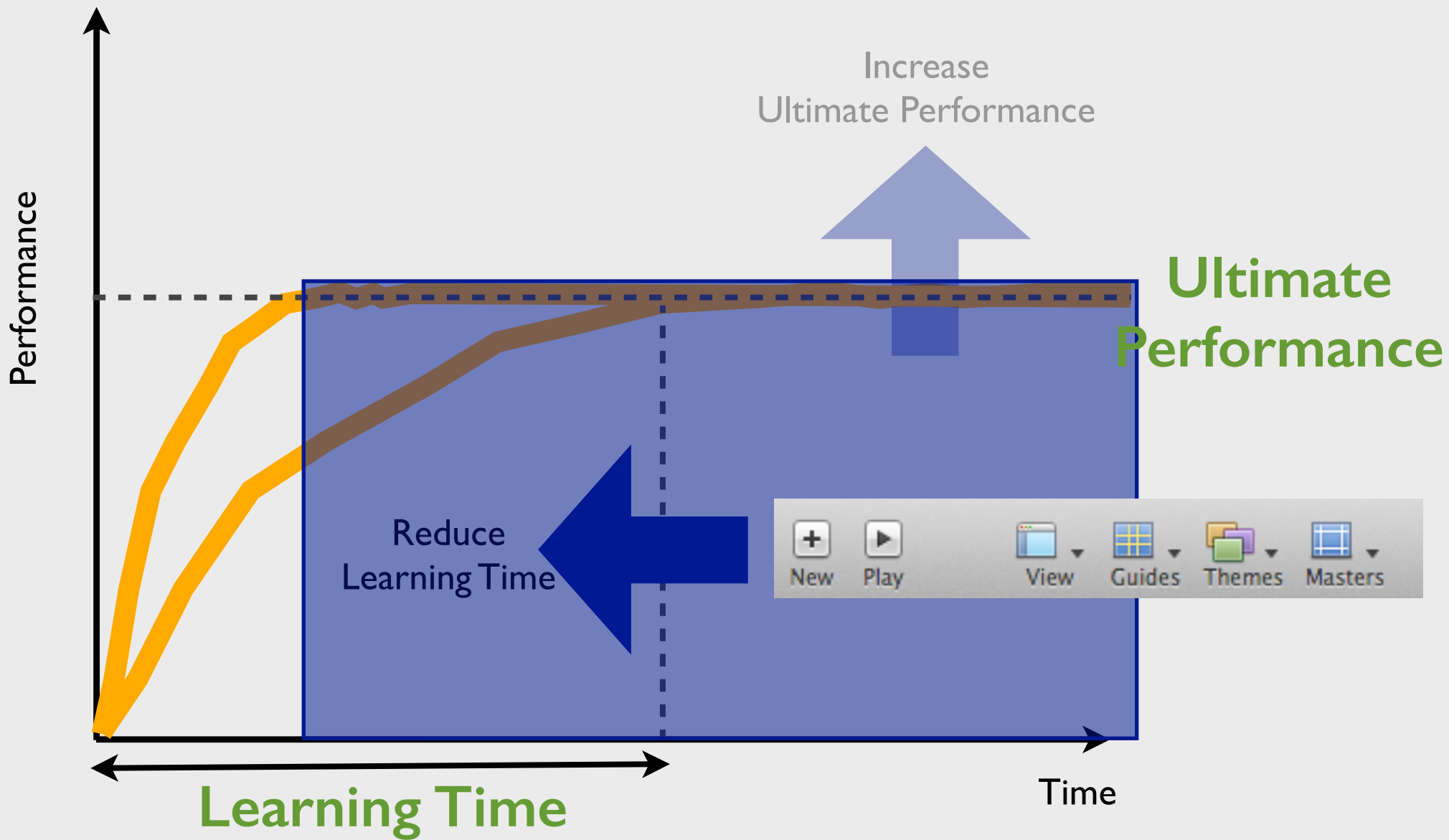
Simple Model of Performance

J Scarr, A Cockburn, C Gutwin and P Quinn.

Dips and Ceilings: Understanding and Supporting Transitions to Expertise in User Interfaces. Proceedings of ACM CHI'2011 Conference on Human Factors in Computing Systems. Vancouver, Canada. 2011. 2741-2750.

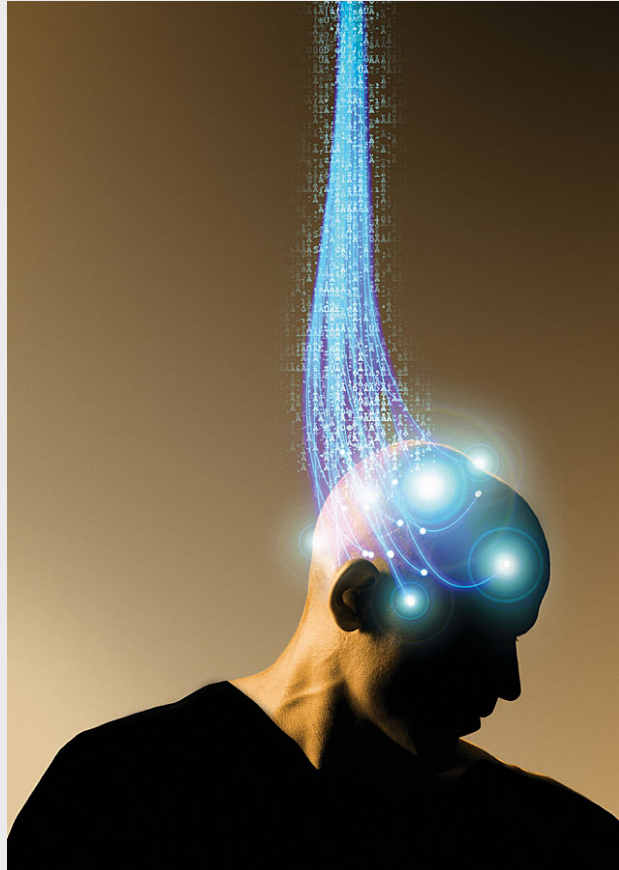






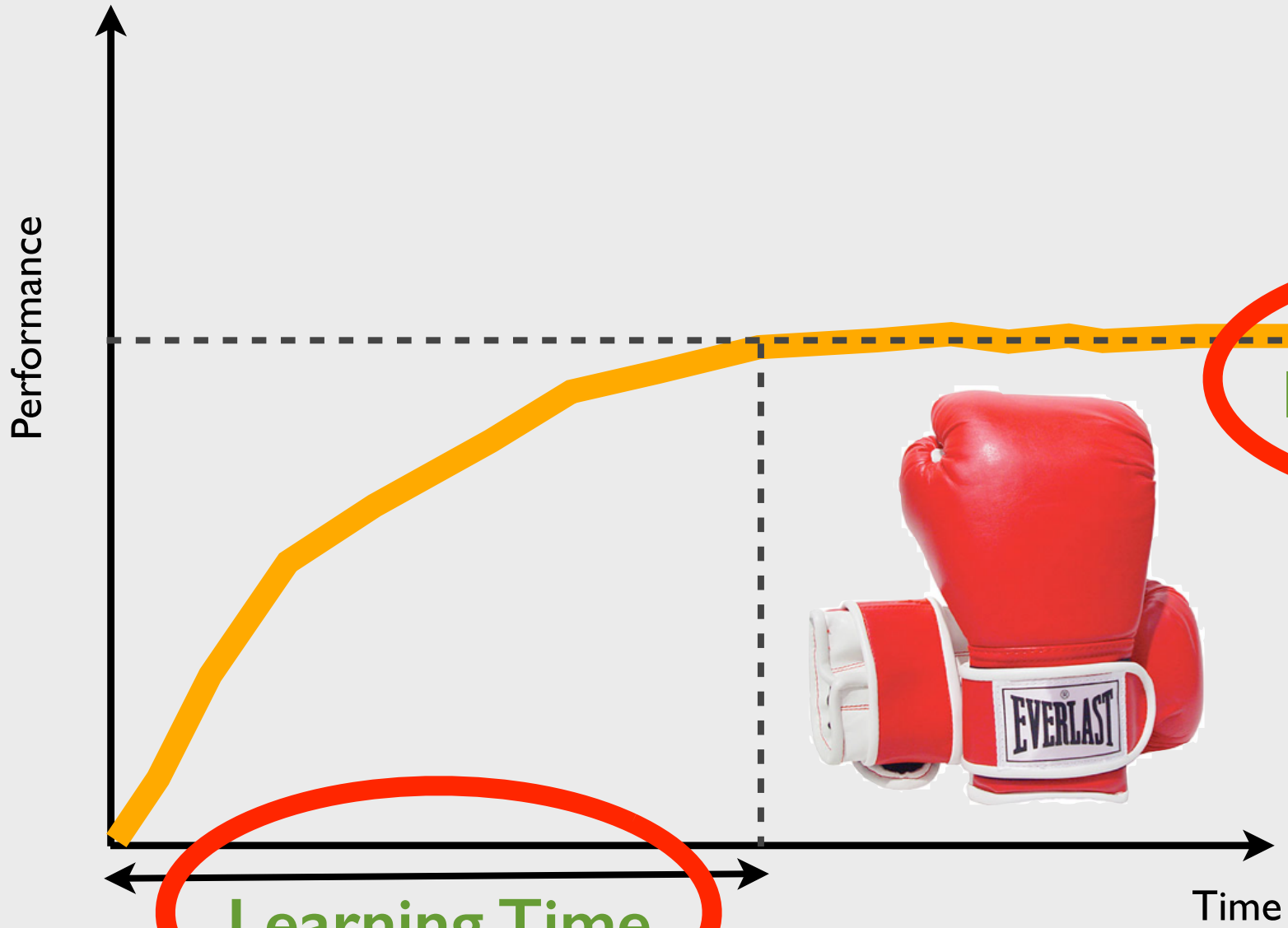
Performance

Ultimate
Performance



Learning Time

Time



Learning Time

Ultimate Performance



Criteria

30s Brainstorming

Ultimate
Performance

Learning Time

Criteria

Accessibility
Satisfaction
Fatigue
etc.

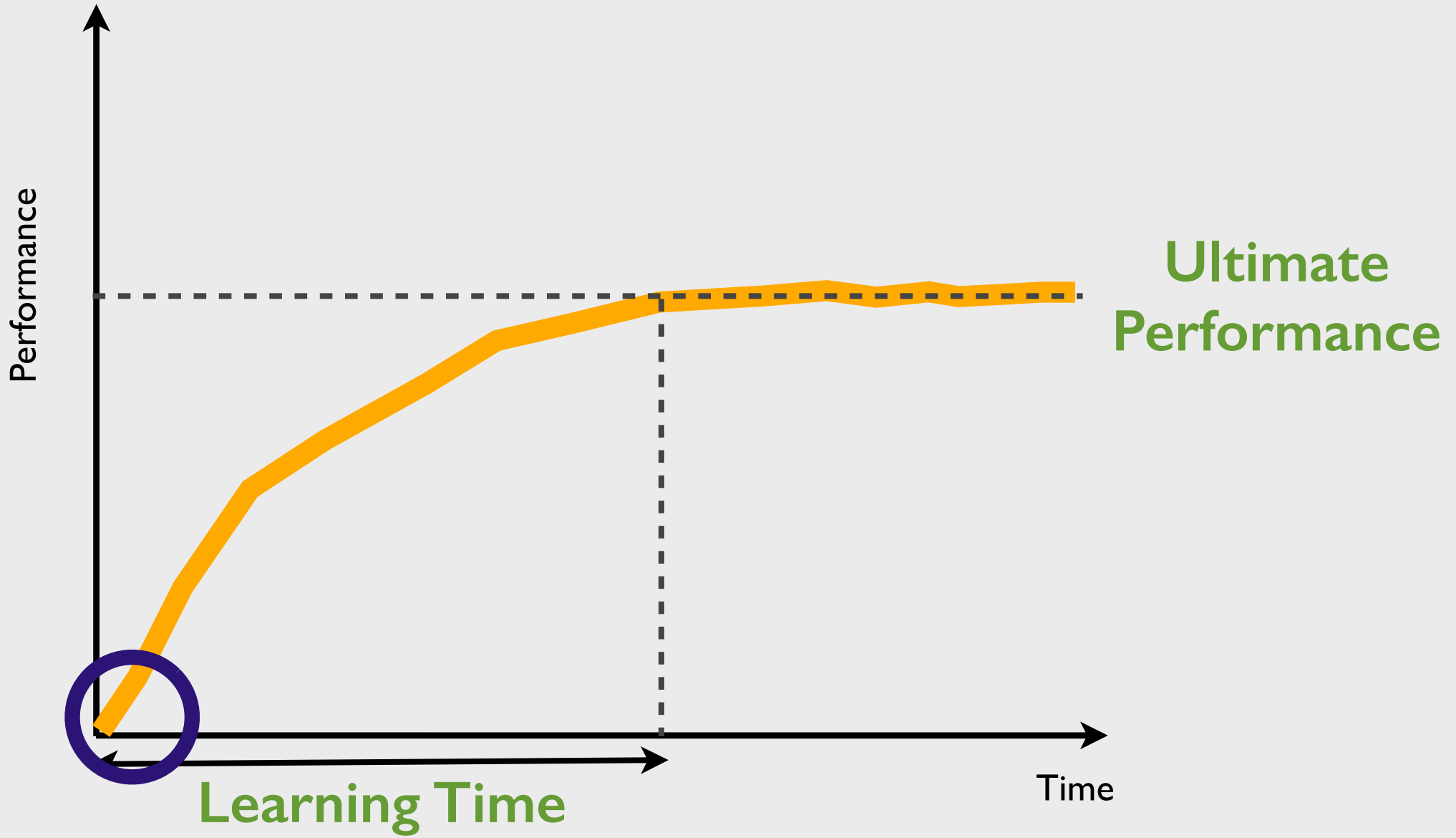
Speed
Accuracy

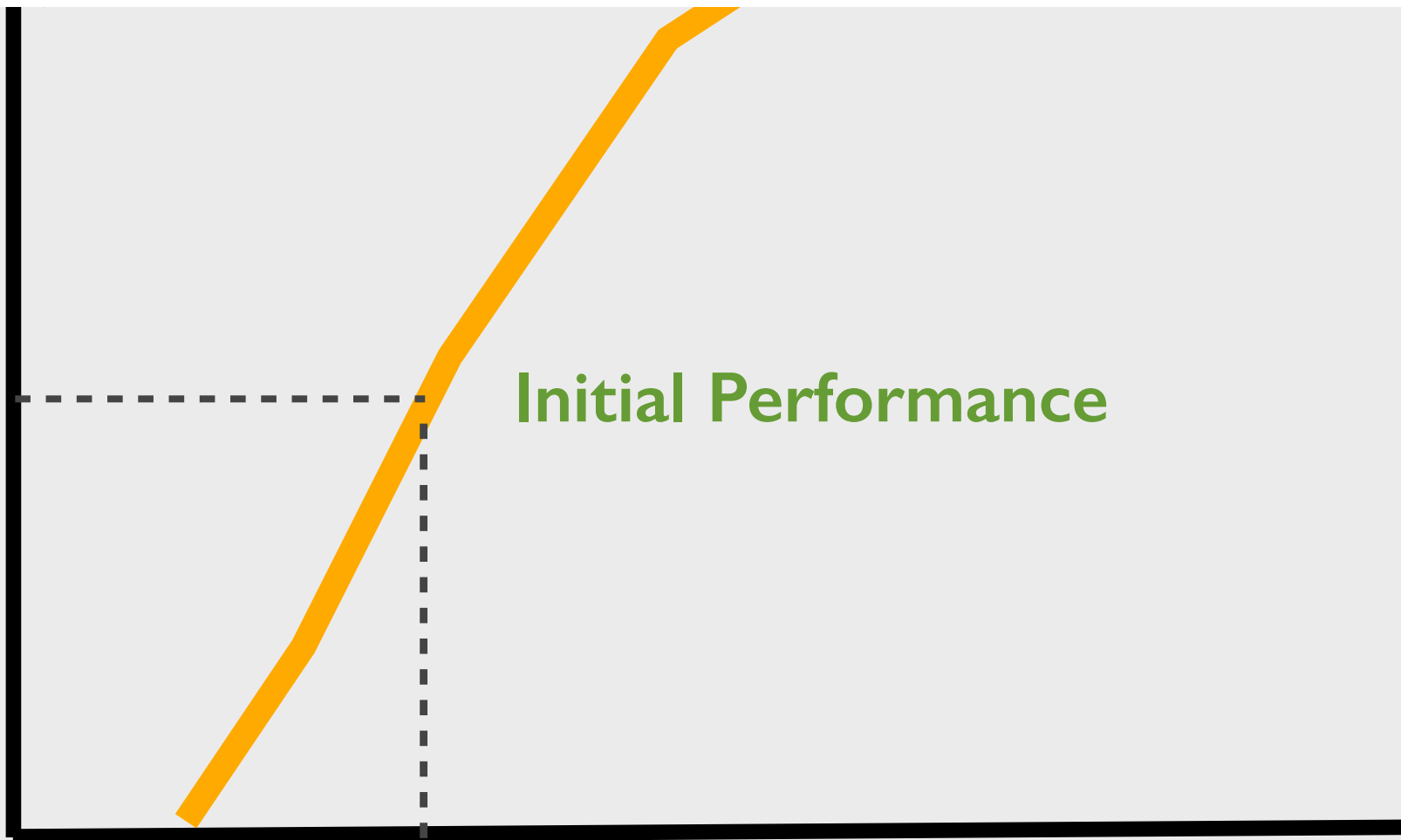
Ultimate
Performance

Immediate Usability

Extended Learning

Learning Time





Initial Performance

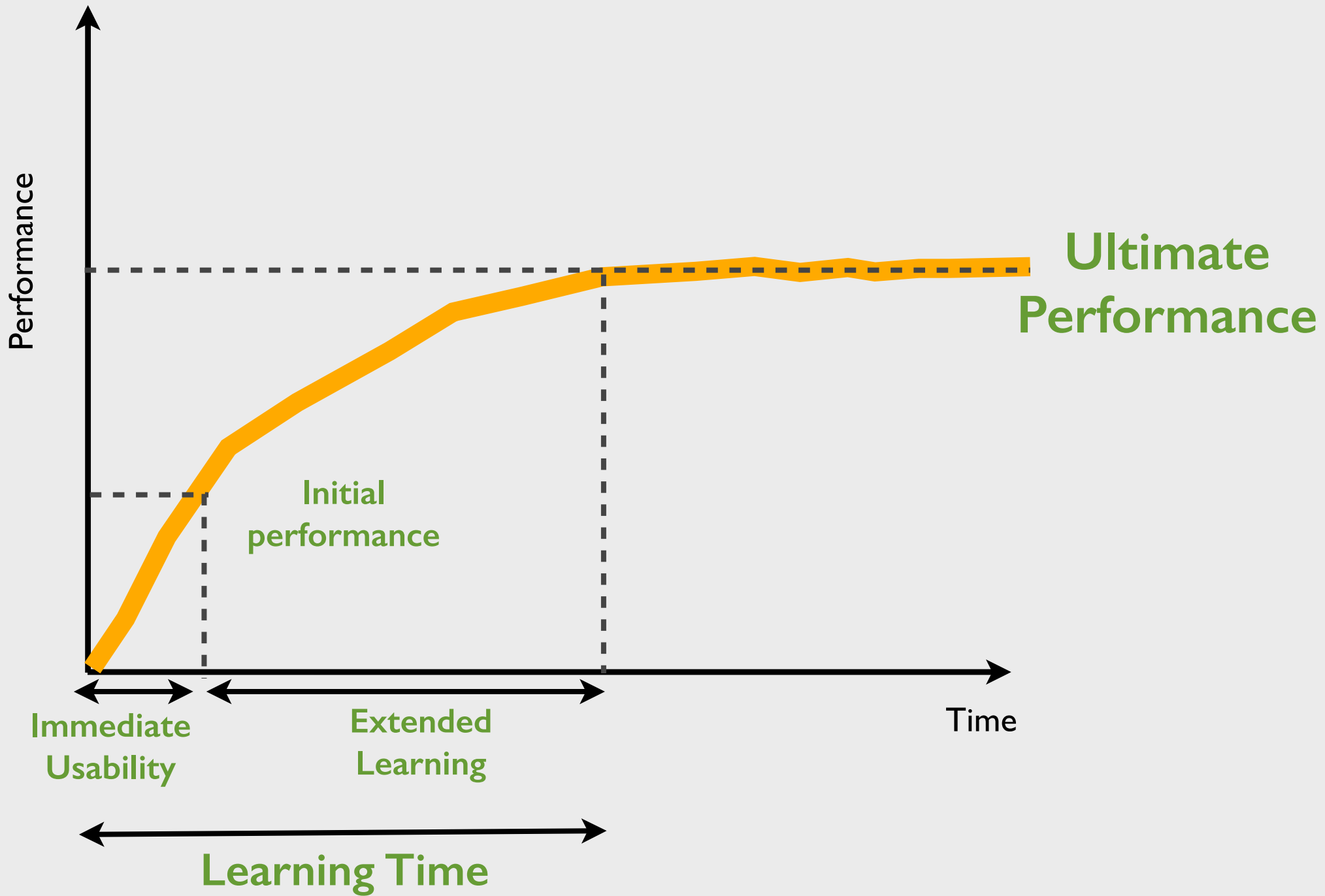
Immediate Usability

Extended Learning

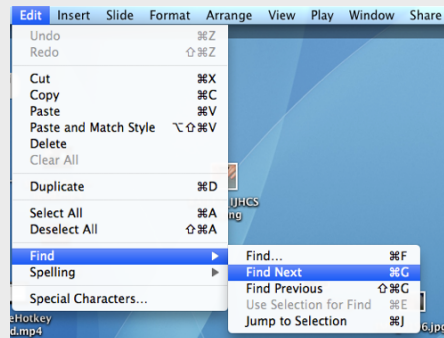
Learning Time



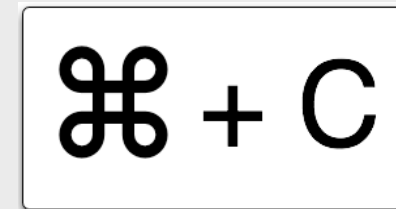
Interactive Public Displays



is it so easy?

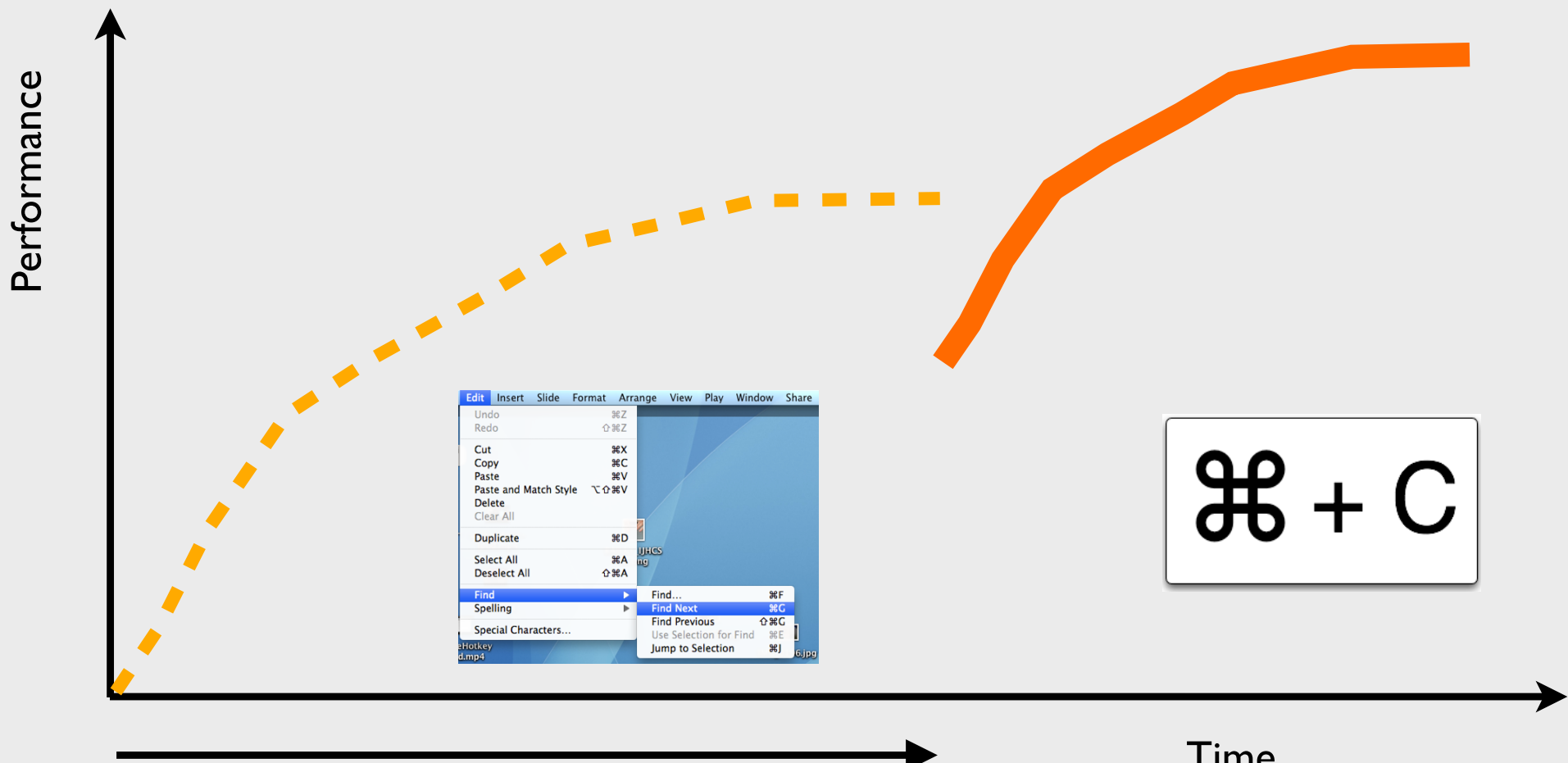


First modality
ex: Menu



Second modality
ex: Hotkeys

Several Modalities?



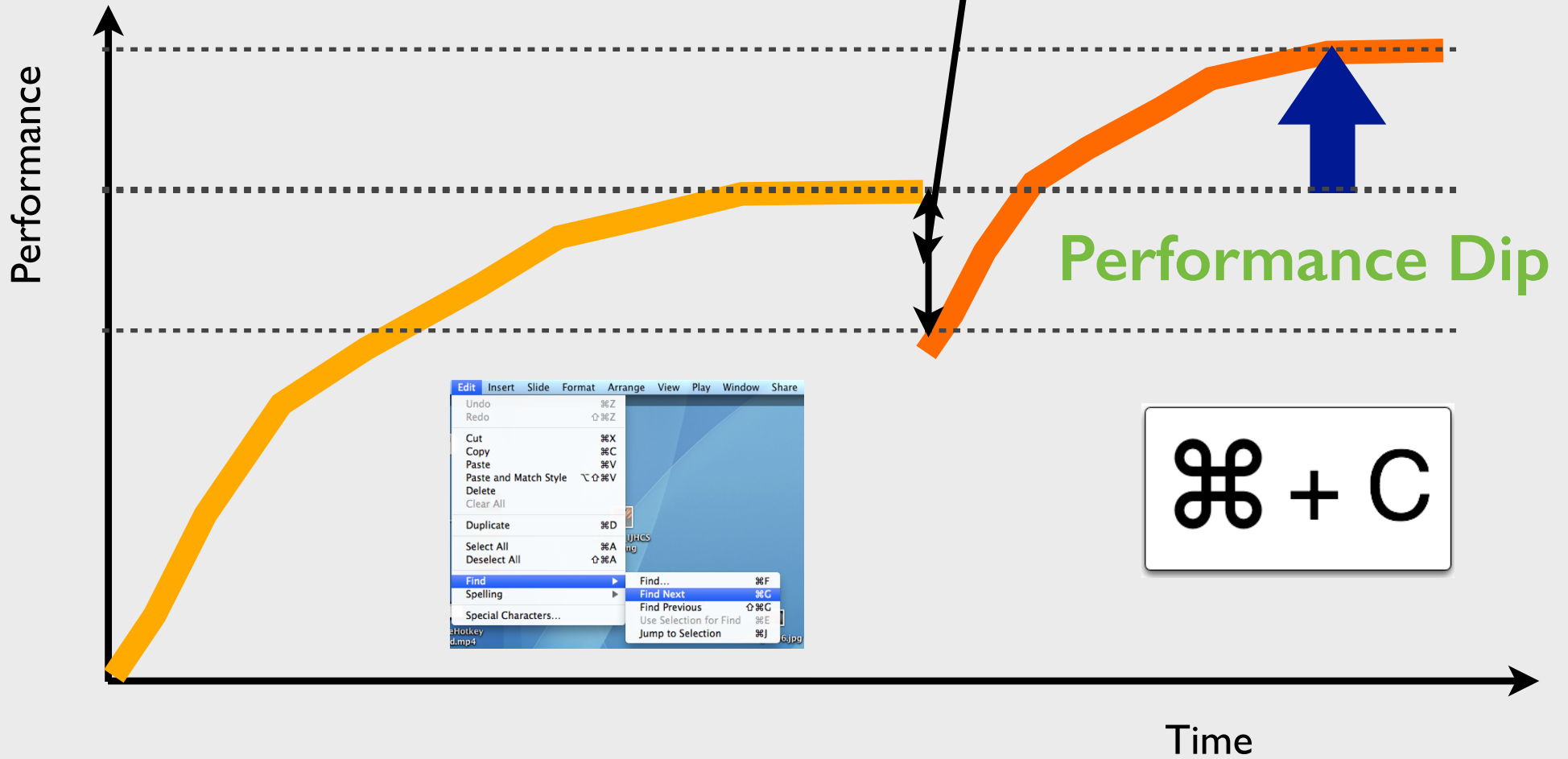
Learning Time

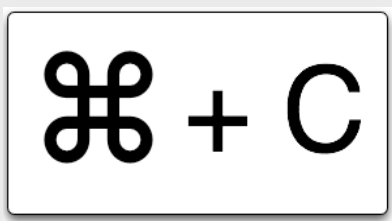
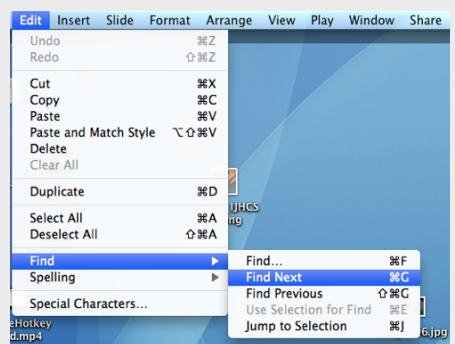
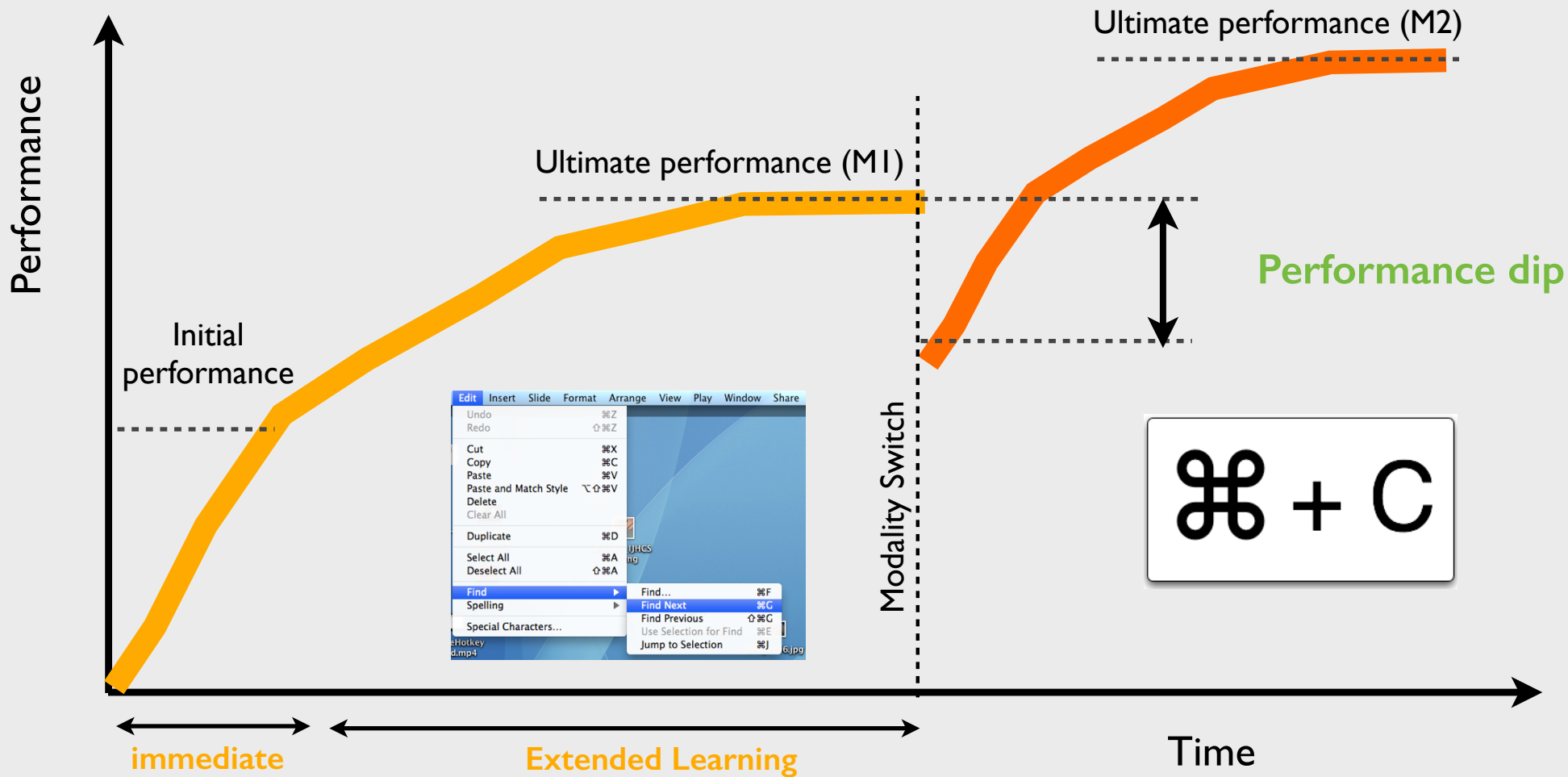
Time

Menu

Hotkey

Modality Switch





Modality 1

Modality 2

Basic Tasks in HCI

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Pointing



Text entry



commands



iPad 2



iPhone



iPod touch



iPod nano



iPod shuffle



iPod classic



MacBook Air



MacBook Pro



iMac

Questions

Pointing

- **Quel est le nom de la loi de Pointage?**
- la loi de Fitts
- **Quelle est la formule?**
- $T = a + b \log (1 + D/W)$
- **Indice de difficulté ID**
- $ID = \log(1+D/W)$
- **Solutions pour améliorer le pointage?**
- interaction derrière le dispositif, lentille, interaction gestuelle, etc.

Questions

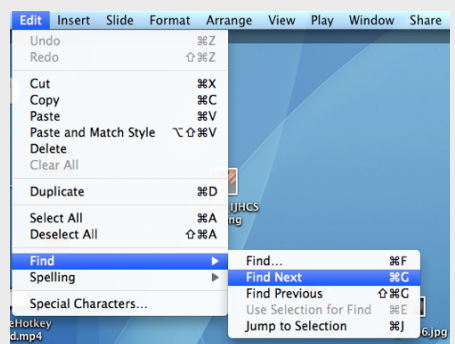
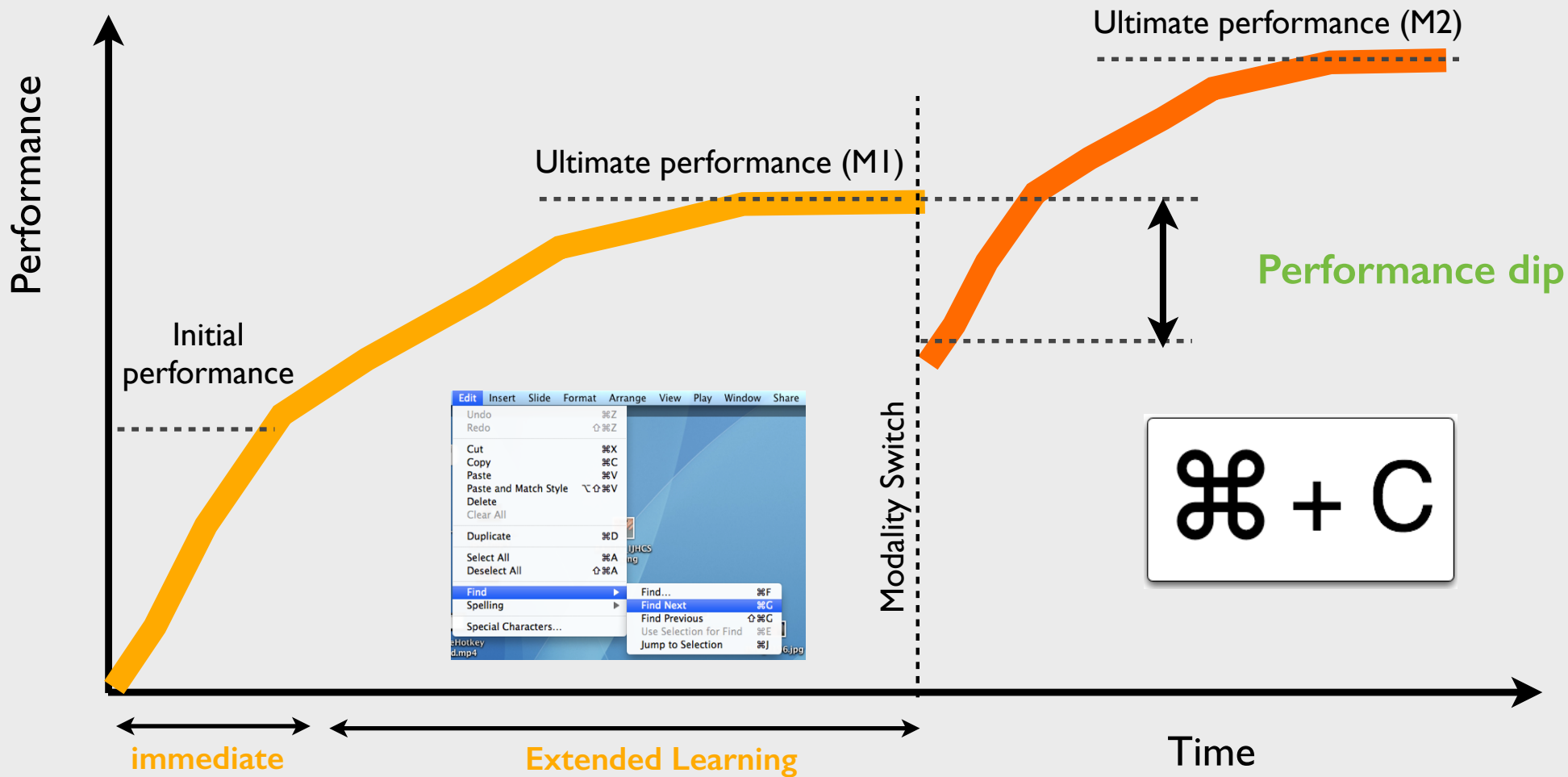
Entrée de texte

- **Nom de la principale mesure d'efficacité**
- WPM (word per minute)
- **Dvorak keyboard**
- Touches fréquentes principalement sur la touche de repos
- alterne main gauche / main droite
- **Qu'est ce qu'une methode de désambiguisation pour l'entrée de texte?**
- une technique pour différencier plusieurs caractères sur une même touche (e.g. le multi-tap)
- **Quel est l'inconvénient du Multi-Tap?**
- certaines lettres fréquentes nécessitent plusieurs actions et réciproquement

Questions

“Simple” Modèle de performance

- **Quels sont les composants clés de ce modèle?**



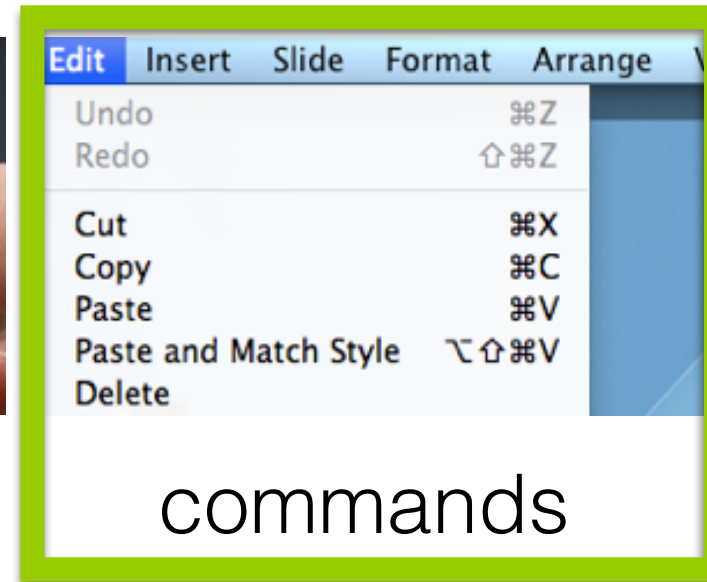
Today



Pointing



Text entry



commands



iPad 2



iPhone



iPod touch



iPod nano



iPod shuffle



iPod classic



MacBook Air



MacBook Pro



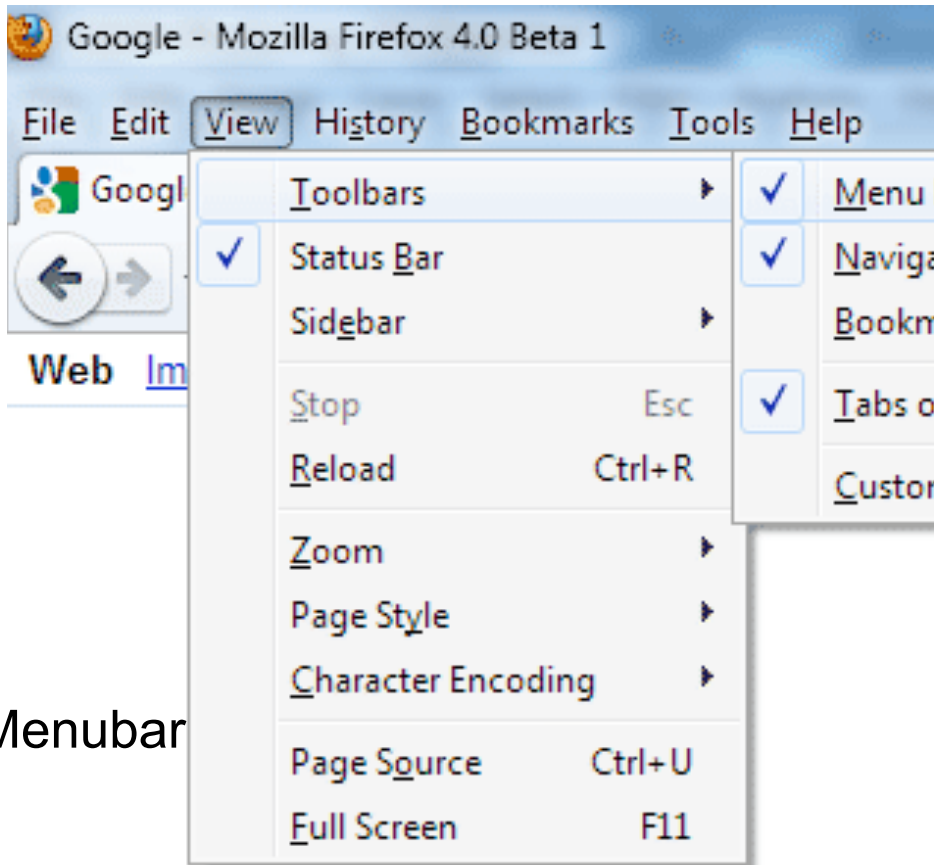
iMac

1. Traditional Interaction Technique
2. Novel Interaction Technique
3. Model of Menu Performance

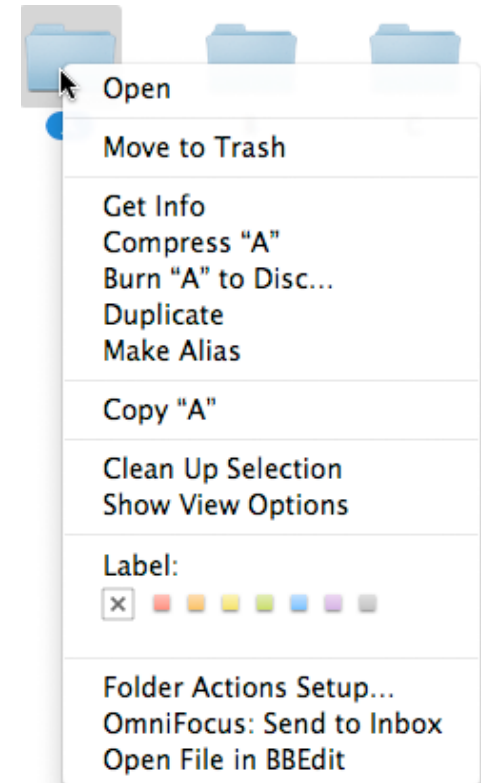
Outline

How?

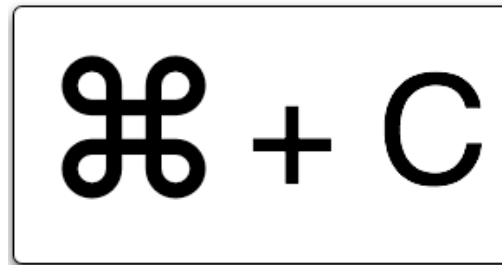
Traditional Interaction Techniques



Toolbox



Context menu



Keyboard shortcuts (hotkeys)

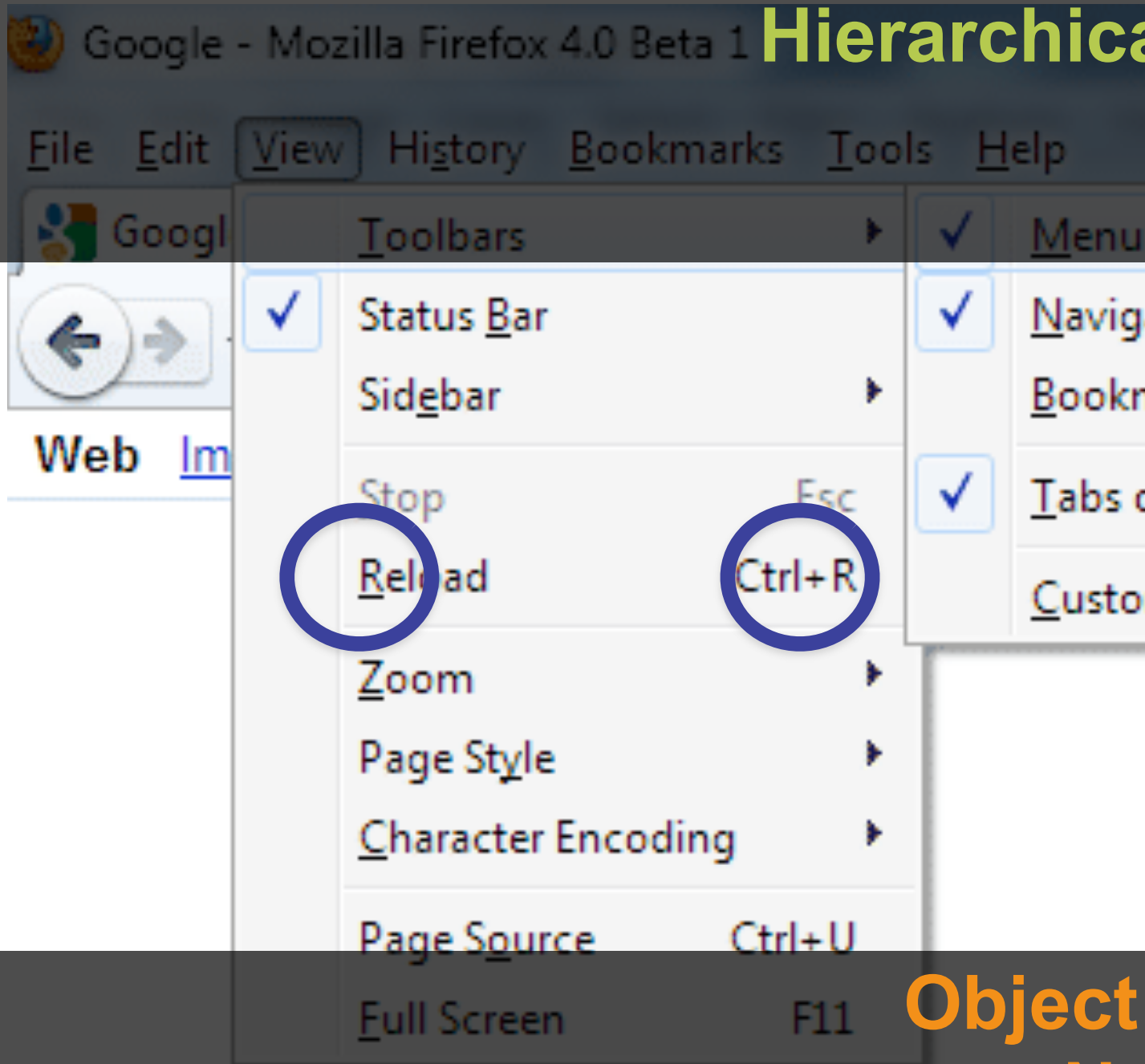
Brainstorming (30s) Pros & Cons

Several modalities

Hierarchical organization

Exploration

Flexibility

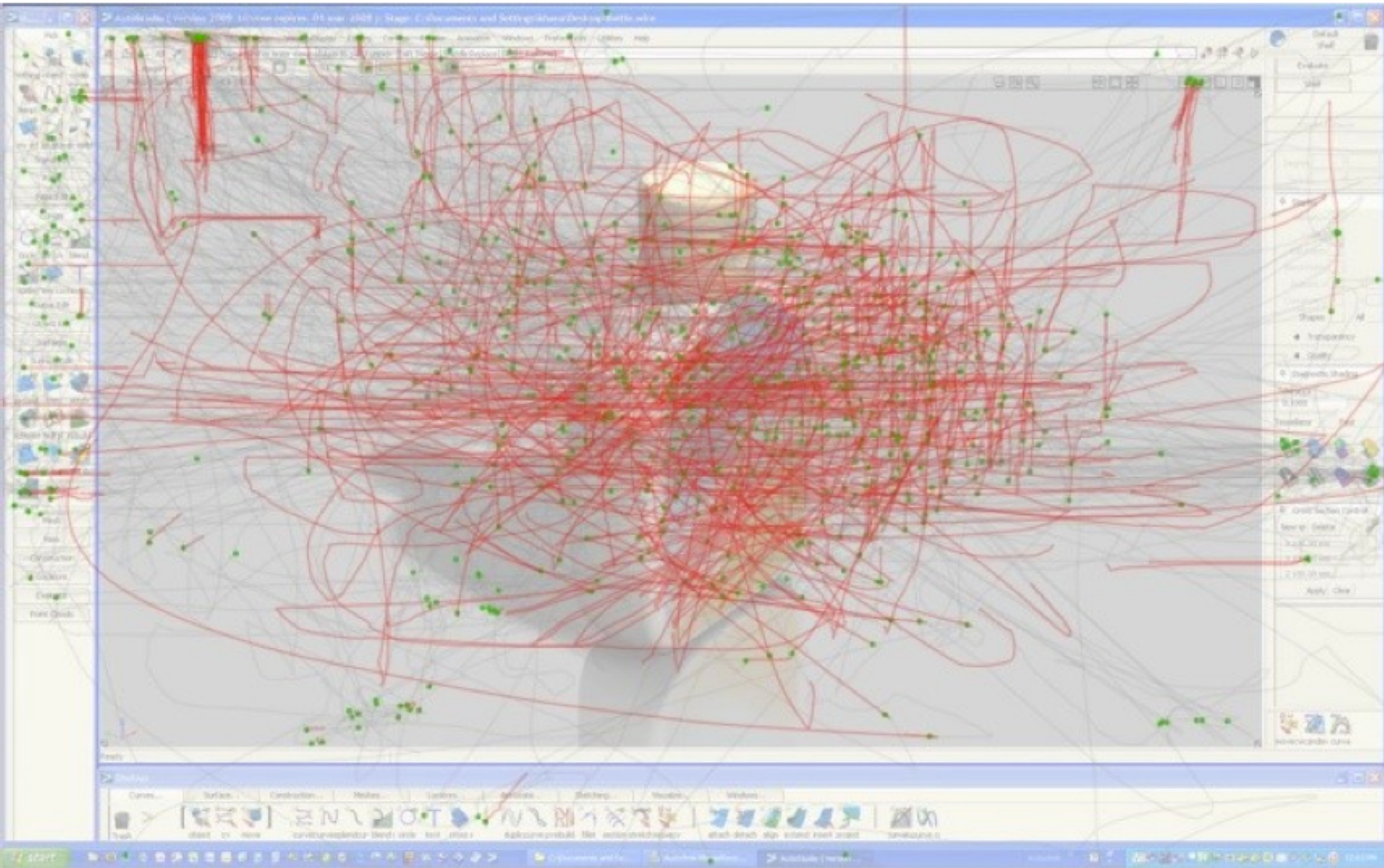


Object <-> Command
No direct access



**Visible
Modal commands**

**Object <-> Command
Small Target
No text Label
Occlusion (content area)
No organization**

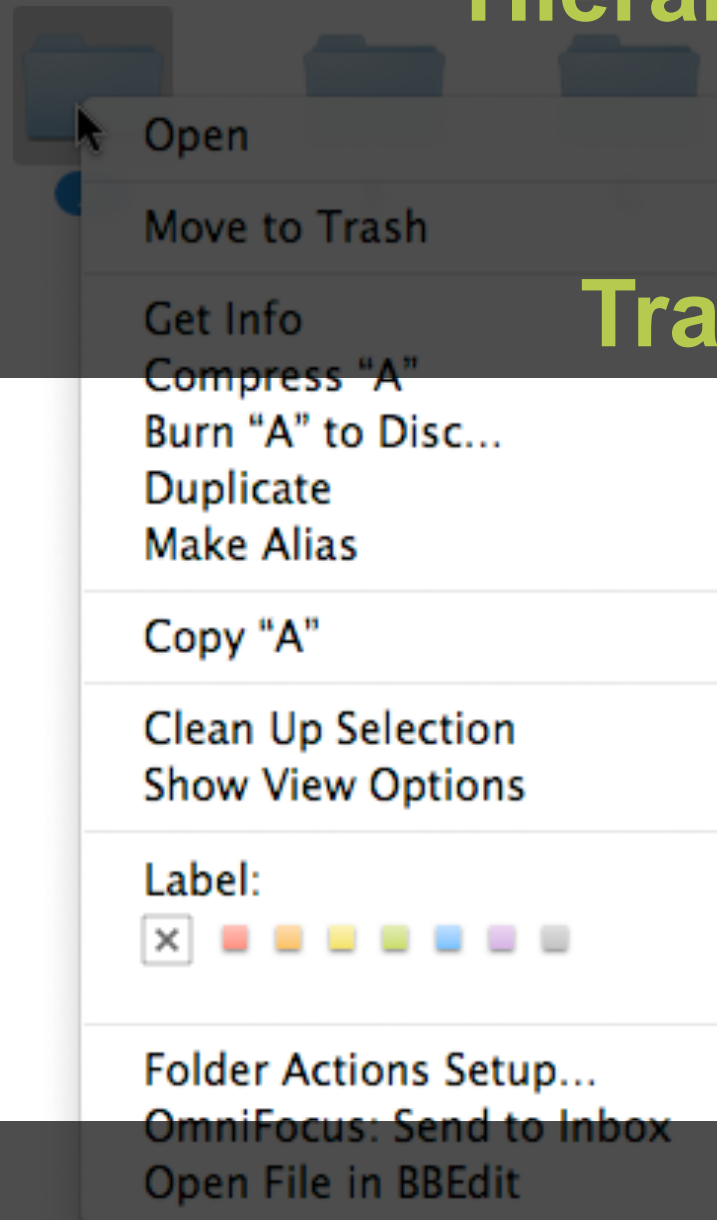


Hierarchical organization

In place

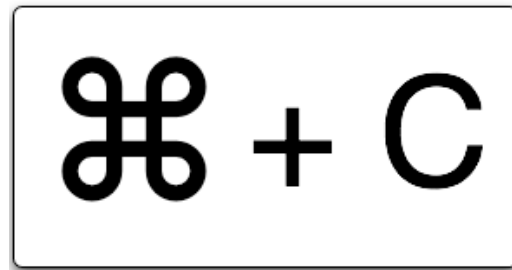
Contextual

Transient visualization

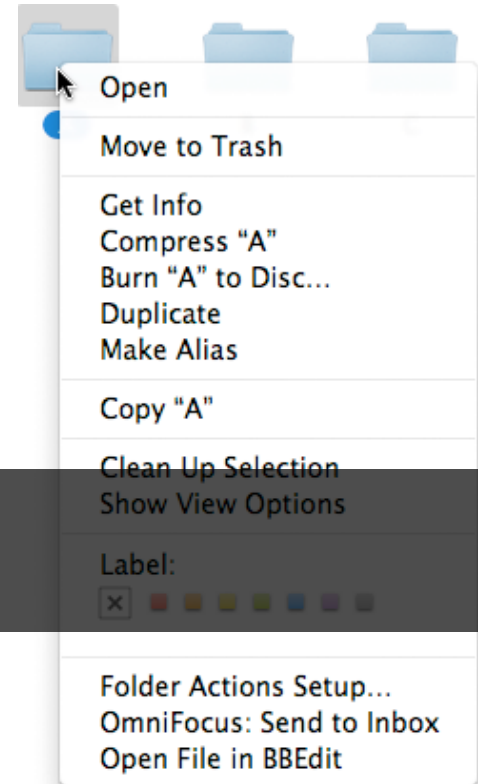
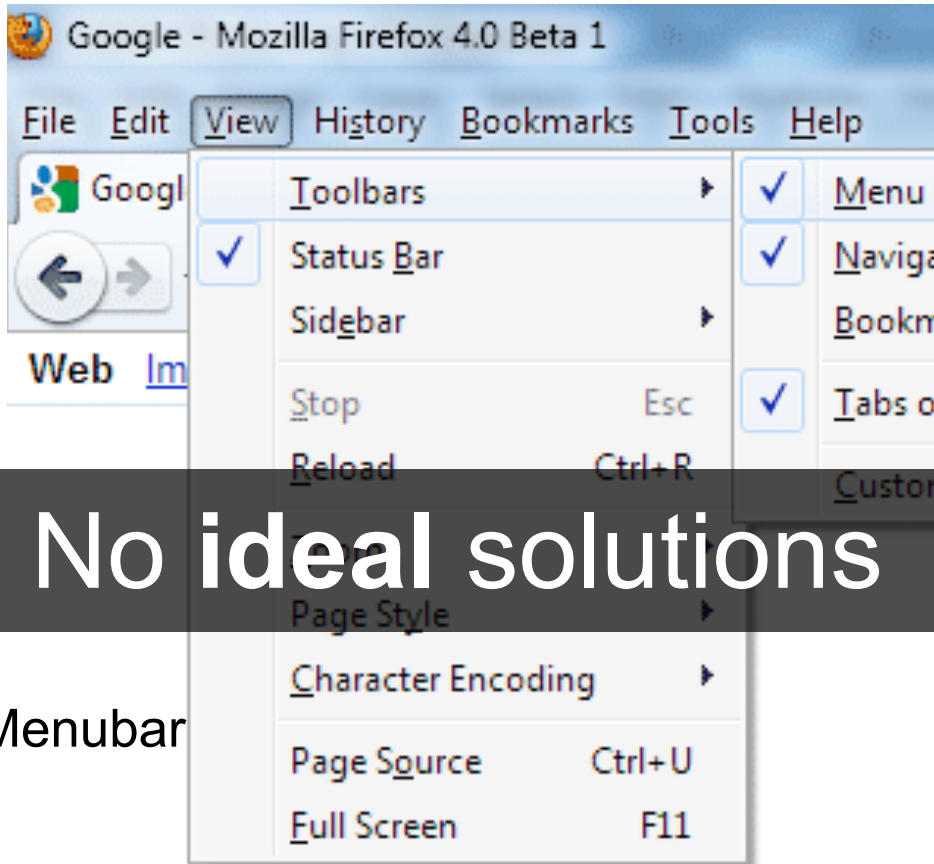


Activation
Touch screen?

Direct access (fast)
Left Hand
No [keyboard Mouse] transition



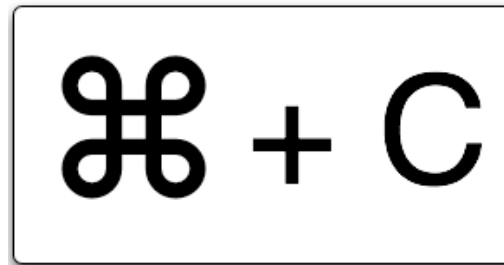
Recall rather recognition
Collision & Arbitrary mappings
Finger coordination
Require a keyboard
Focus of attention



No ideal solutions

Toolbox

Context menu



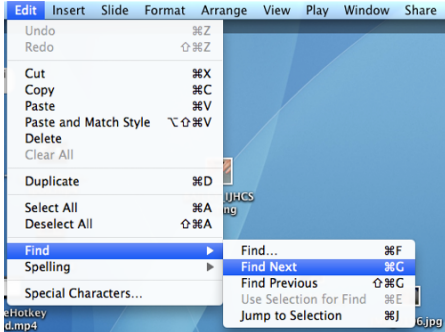
Keyboard shortcuts

Menubar

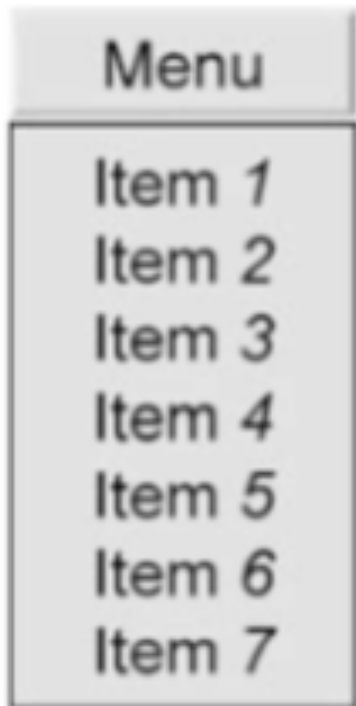
How?

“Novel” Interaction Techniques

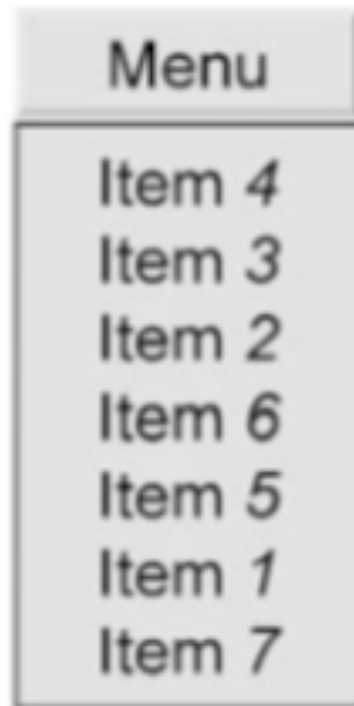
Strategies

<p>First modality</p> 	<p>Dimension</p> <p>Item</p>
<p>Second modality</p> <p>⌘ + C</p>	<p>Menu</p> <p>Menu System</p> <p>Expert mode</p>

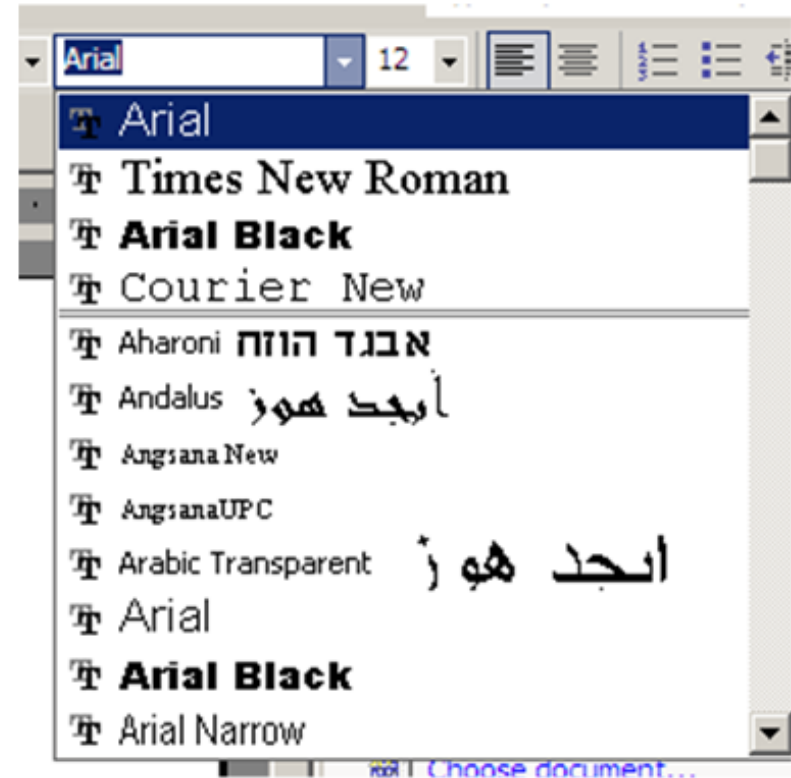
Item: geometry



Frequency Ordered menus

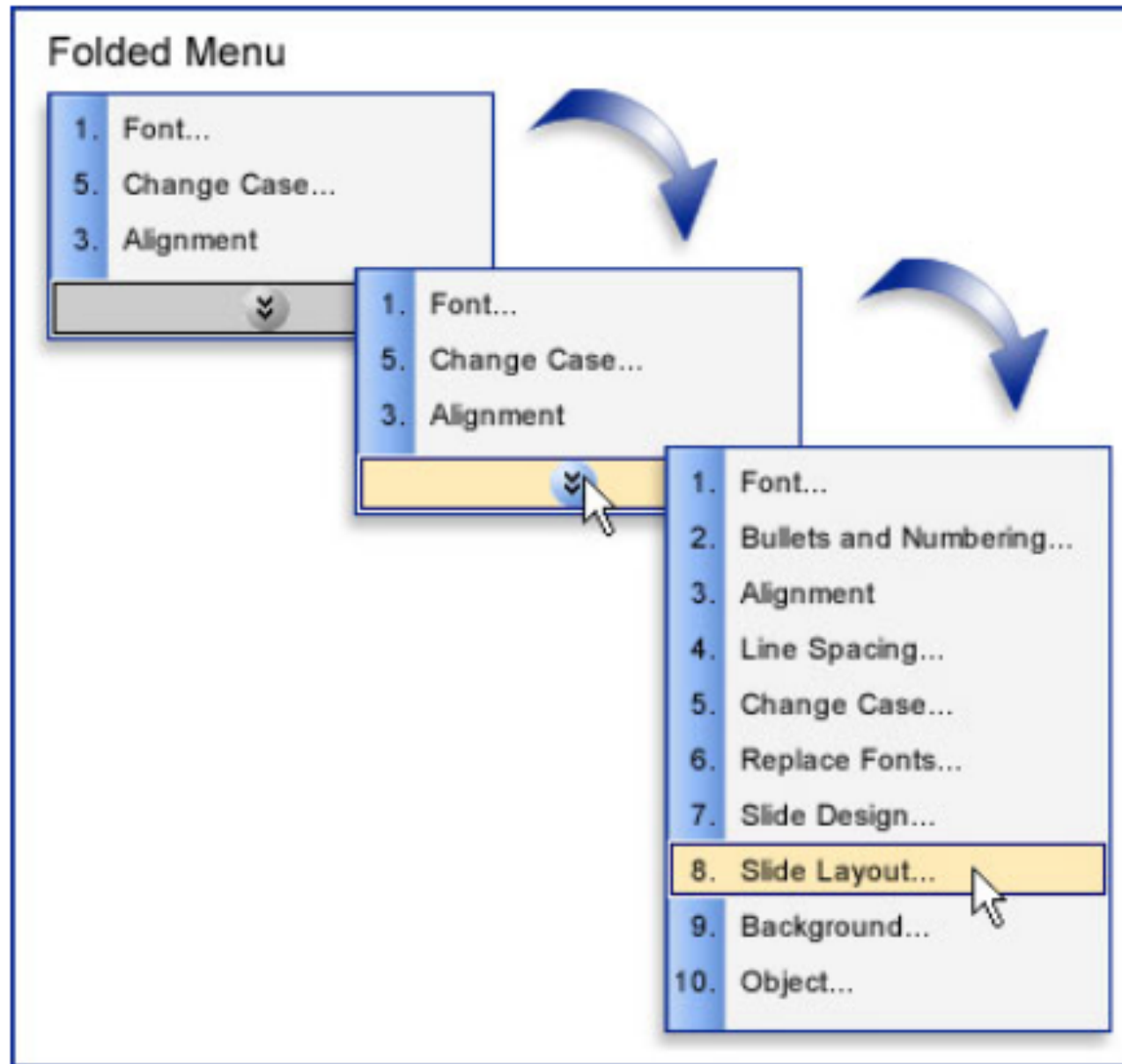


Split menus



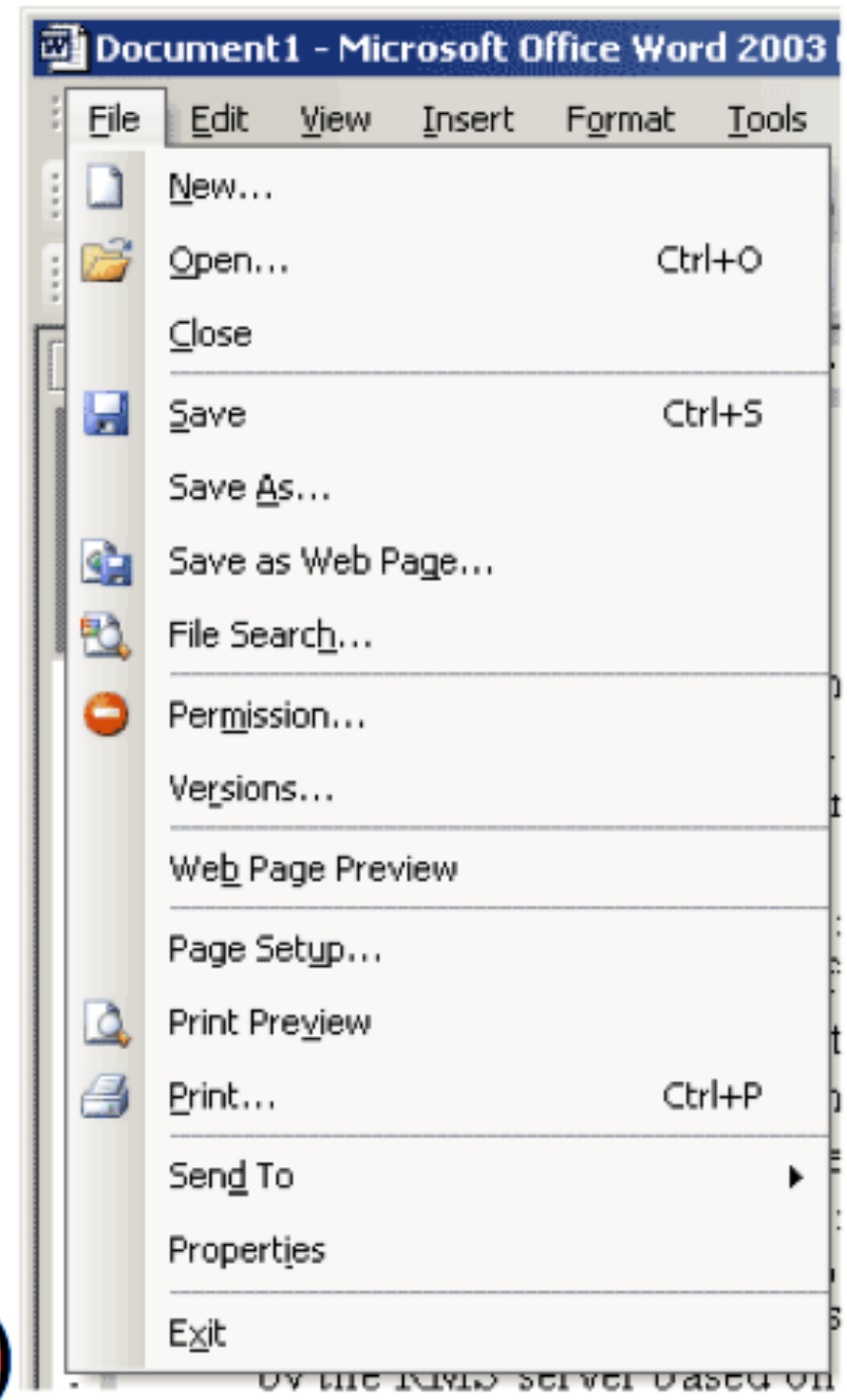
Item: geometry

Folded Menus



Item: Visual cues

icons



Item: Visual cues

Temporal Menu

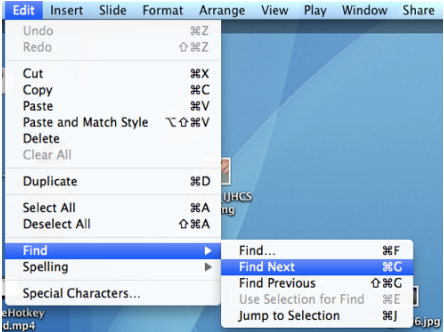
1. Font...
3. Alignment
6. Replace Fonts...
7. Slide Design...
8. Slide Layout...
9. Background...



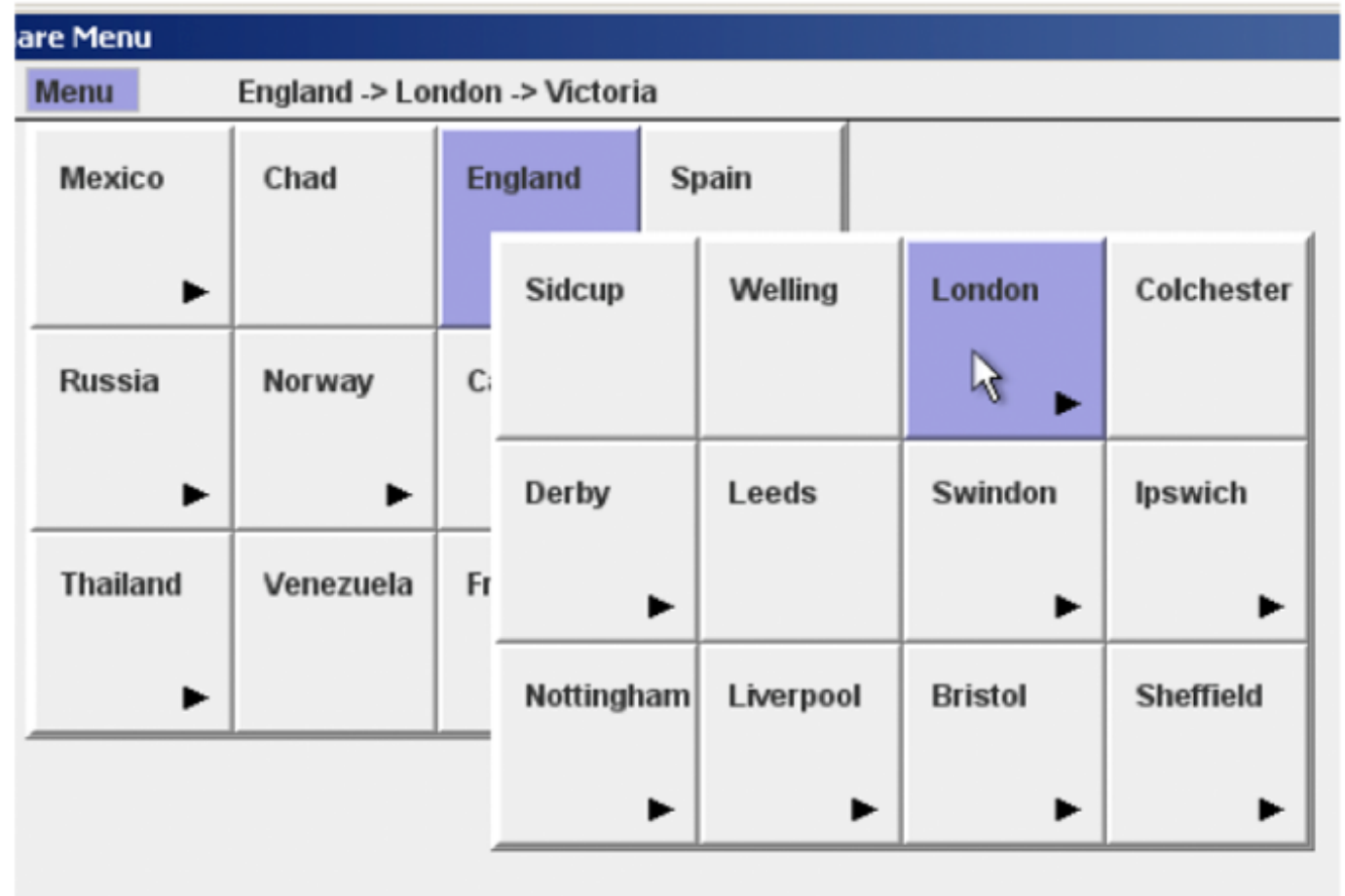
1. Font...
2. Bullets and Numbering...
3. Alignment
4. Line Spacing...
5. Change Case...
6. Replace Fonts...
7. Slide Design...
8. Slide Layout...
9. Background...
10. Object...

Ephemeral menus
[Findlater et al. 09]

Strategies

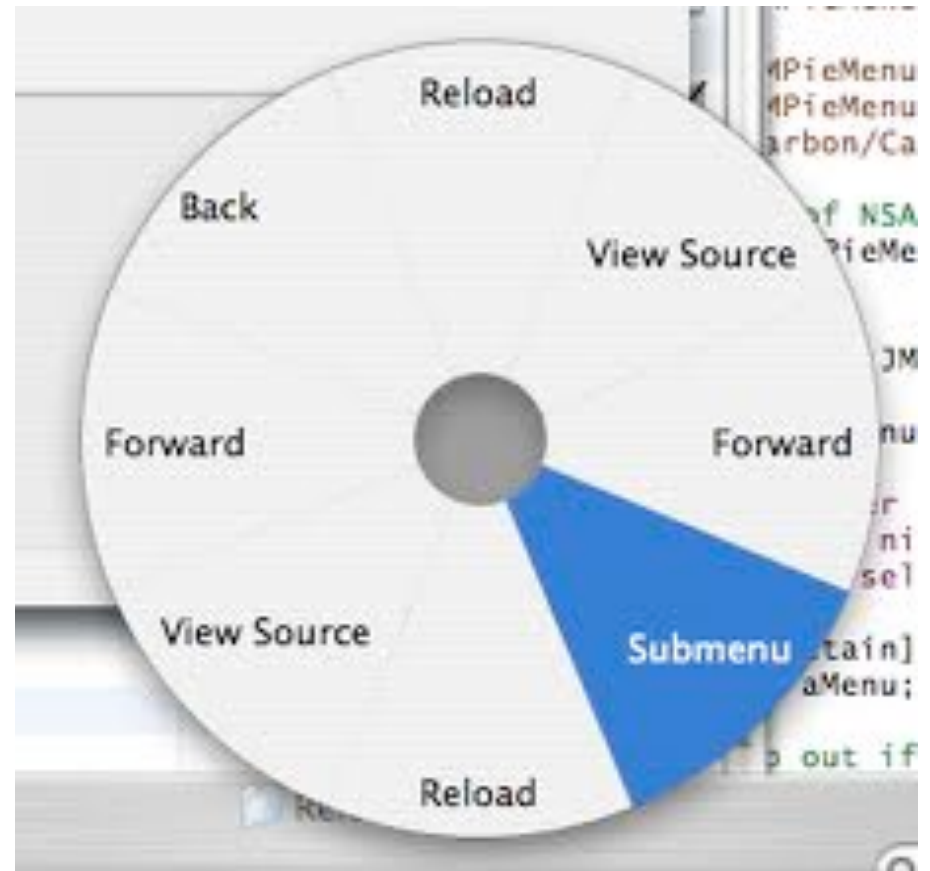
<p>First modality</p>  <p>The screenshot shows a menu bar with 'Edit', 'Insert', 'Slide', 'Format', 'Arrange', 'View', 'Play', 'Window', and 'Share'. The 'Edit' menu is open, listing options like Undo, Redo, Cut, Copy, Paste, Delete, Duplicate, Select All, and Deselect All. The 'Find' option is selected, opening a submenu with 'Find...', 'Find Next', 'Find Previous', 'Use Selection for Find', and 'Jump to Selection'.</p>	<p>Dimension</p> <p>Item</p> <p>Menu</p> <p>Menu System</p>
<p>Second modality</p> <p>⌘ + C</p>	<p>Expert mode</p>

Menu: Layout



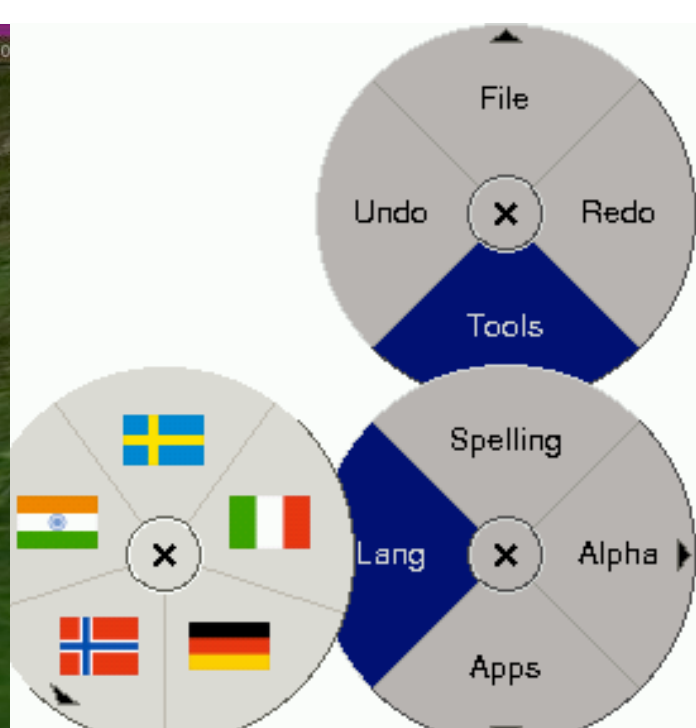
Square menus (grid layout)
[Ahlstrom et al. 10]

Menu: Layout

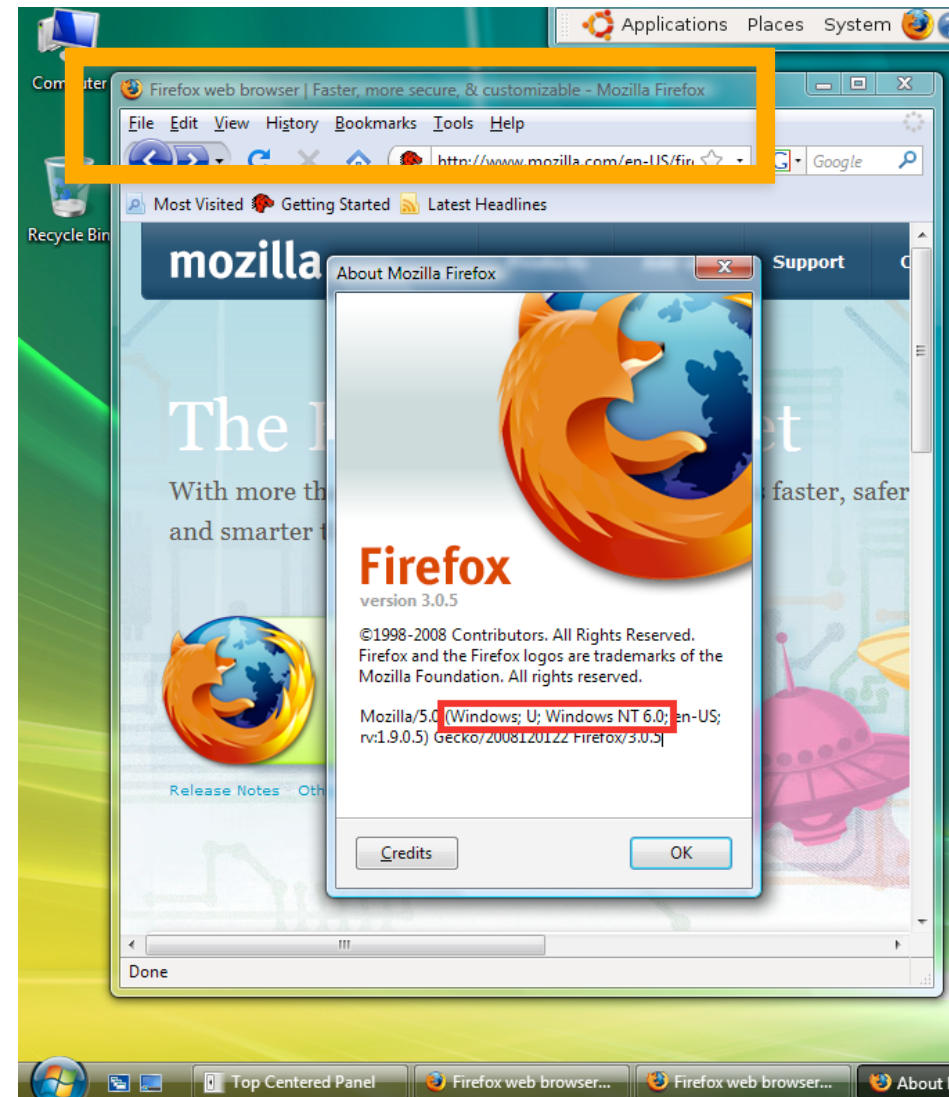
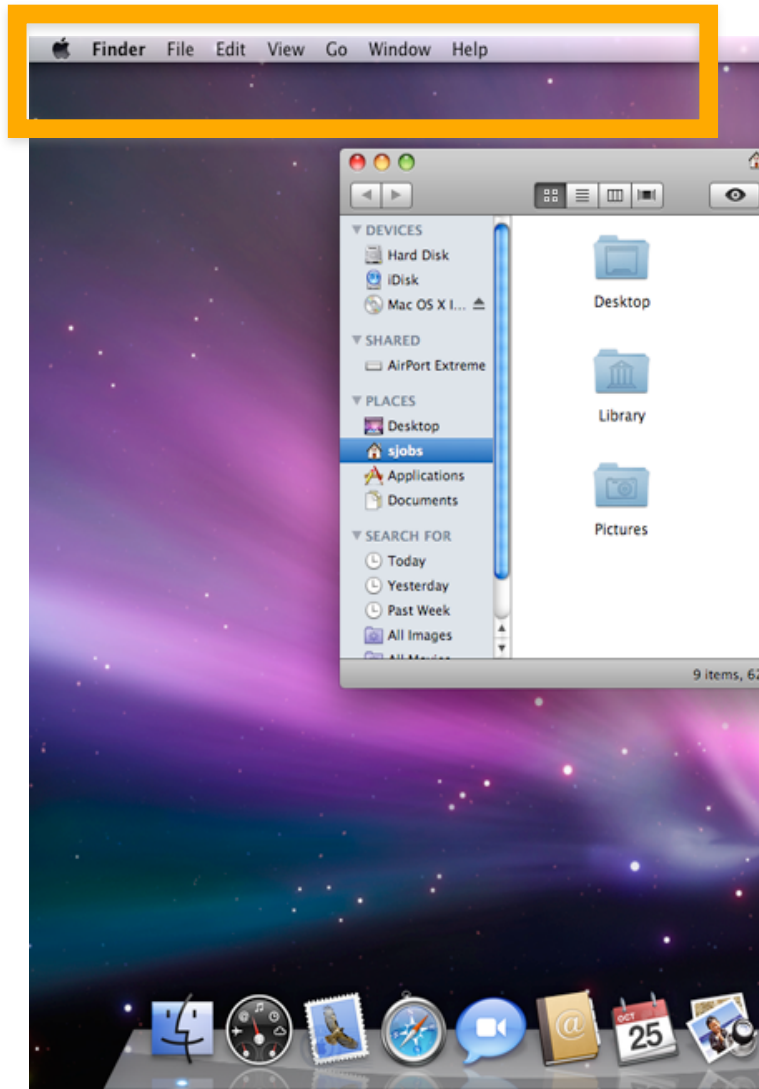


[Callahan et al. 08]

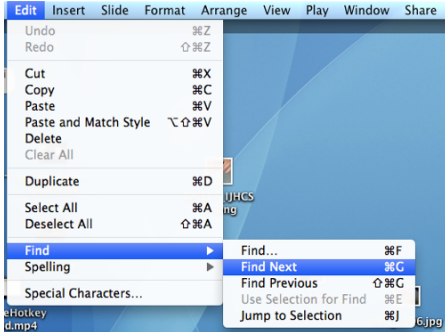
Pie Menus



Menu: Geometry



Strategies

<p>First modality</p>  <p>The screenshot shows a menu bar with options: Edit, Insert, Slide, Format, Arrange, View, Play, Window, Share. The 'Edit' menu is open, listing: Undo (⌘Z), Redo (⇧⌘Z), Cut (⌘X), Copy (⌘C), Paste (⌘V), Paste and Match Style (⇧⇧⌘V), Delete, Clear All, Duplicate (⌘D), Select All (⌘A), Deselect All (⇧⌘A), Find (with submenu: Find... (⌘F), Find Next (⌘G), Find Previous (⇧⌘G), Use Selection for Find (⌘E), Jump to Selection (⌘J)), Spelling, and Special Characters... The background shows a blue abstract graphic.</p>	<p>Dimension</p>
<p>Second modality</p> <p>⌘ + C</p>	<p>Item</p>
<p>Menu System</p>	<p>Menu</p>
<p>Expert mode</p>	<p>Menu System</p>

Edit Insert Slide Format Arrange View Play Window Share

Undo ⌘Z
Redo ⇧⌘Z

Cut ⌘X
Copy ⌘C
Paste ⌘V
Paste and Match Style ⇧⇧⌘V
Delete
Clear All

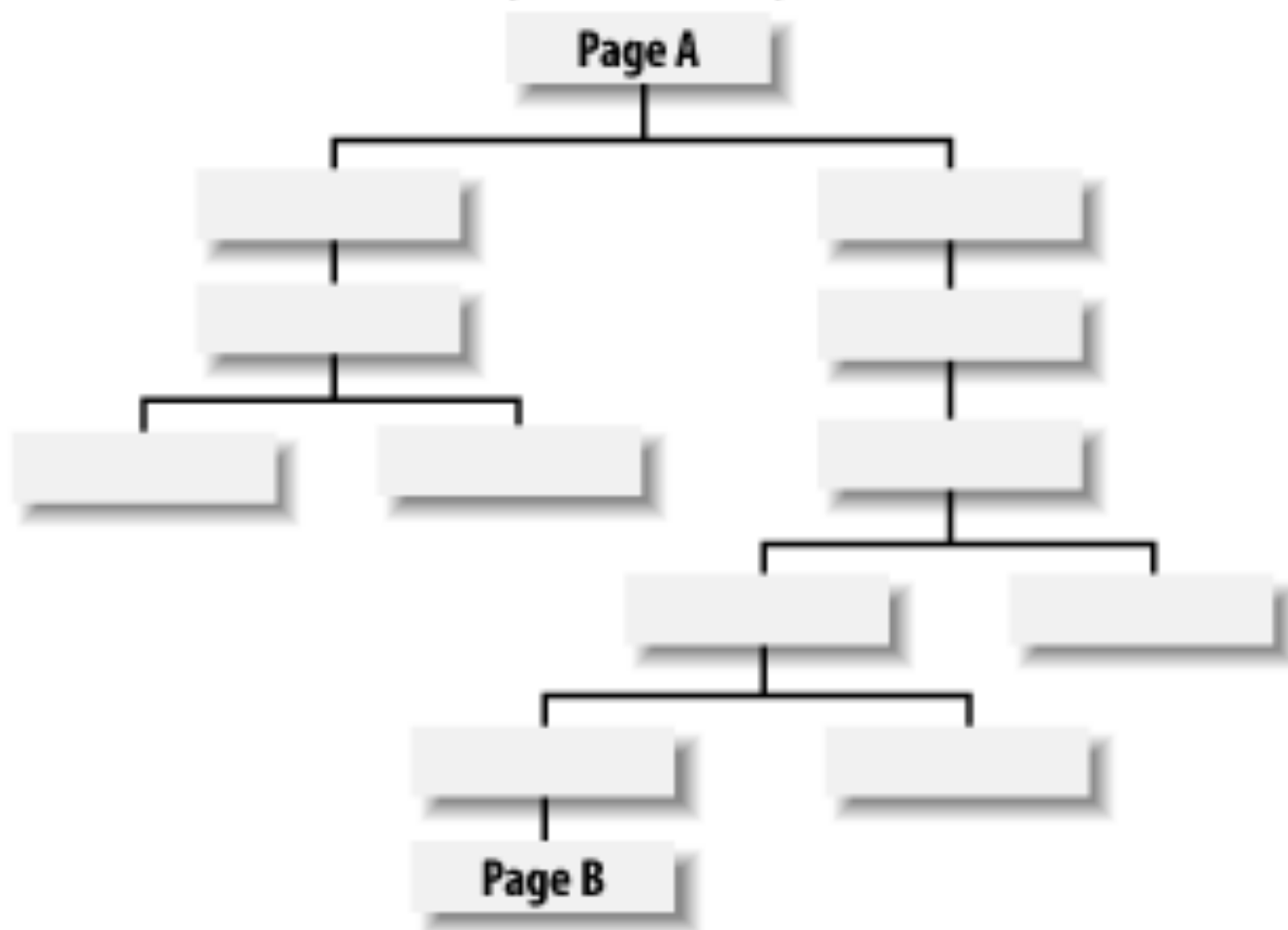
Duplicate ⌘D
Select All ⌘A
Deselect All ⇧⌘A

Find ▶
Spelling ▶
Special Characters...

Find... ⌘F
Find Next ⌘G
Find Previous ⇧⌘G
Use Selection for Find ⌘E
Jump to Selection ⌘J

narrow and deep

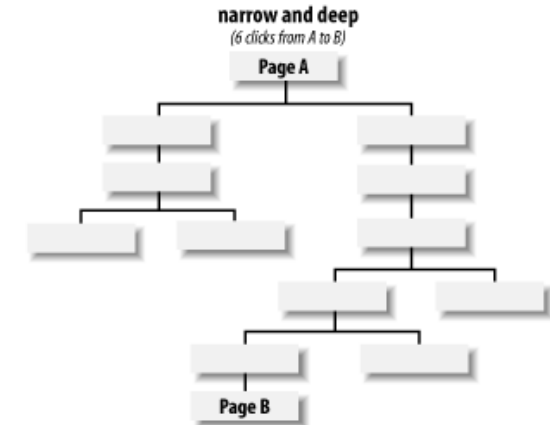
(6 clicks from A to B)



broad and shallow

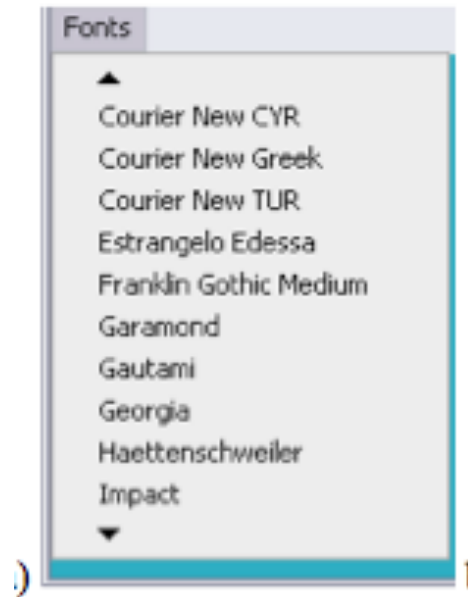
(10 main page options for 10 content items)



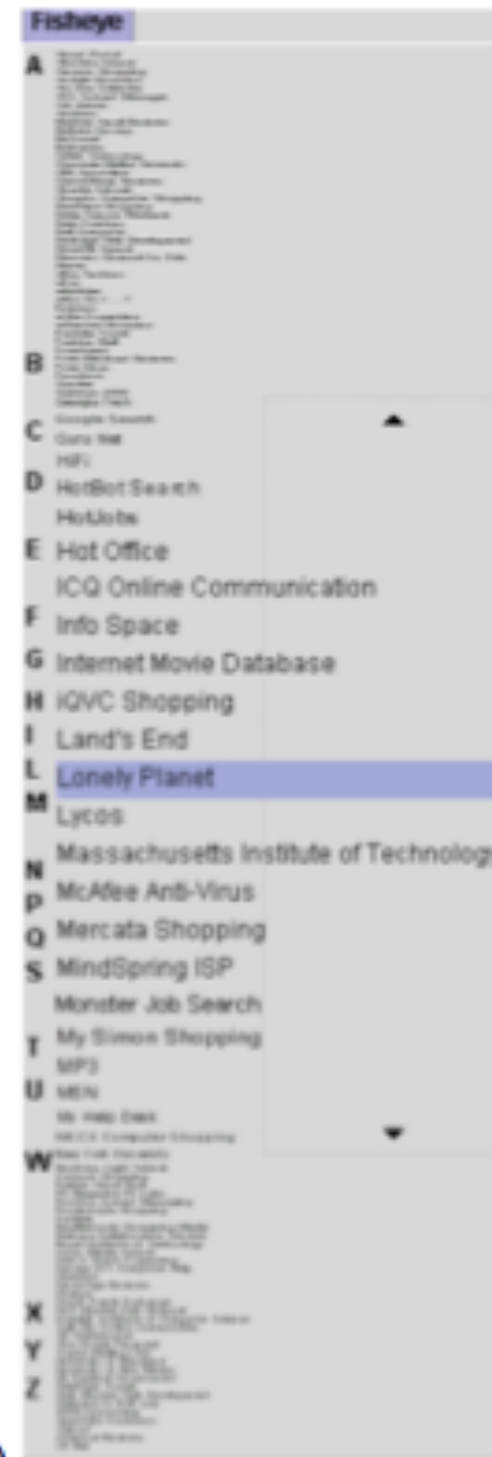
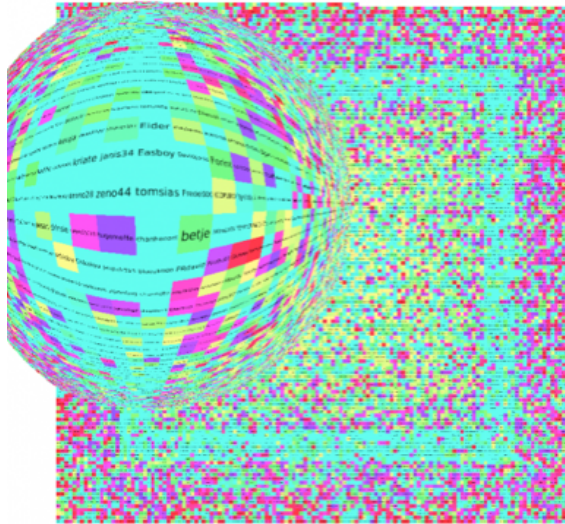


	Avantage d'une structure en largeur	Avantage d'une structure en profondeur
Recherche visuelle	Balayage des items plus facile	Réduction du nombre d'items à lire
Sélection d'un item	Chemin plus court	
navigation	Réduction du nombre de branches visitées par erreur	
précision		Geste plus précis pour les menus circulaires
Charge cognitive	Noms des sous-menus moins abstraits	Réduction du nombre d'alternatives
Apprentissage	Construction plus facile d'une représentation mentale de la hiérarchie	
Espace écran		Moins d'items affichés simultanément

Menu: Large number of items

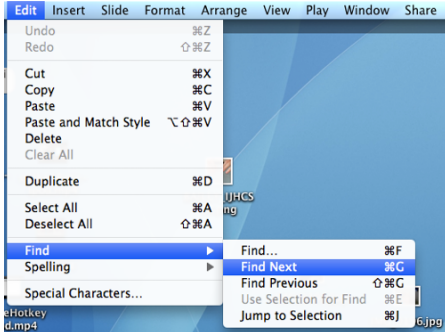


Menu: Large number of items



Fish-eye menus

Strategies

<p>First modality</p>  <p>The screenshot shows a menu with the following items: Undo (⌘Z), Redo (⇧⌘Z), Cut (⌘X), Copy (⌘C), Paste (⌘V), Paste and Match Style (⇧⇧⌘V), Delete, Clear All, Duplicate (⌘D), Select All (⌘A), Deselect All (⇧⌘A), Find (⌘F), Spelling (⌘G), and Special Characters... The Find submenu is open, showing Find..., Find Next (⇧⌘G), Find Previous (⇧⇧⌘G), Use Selection for Find (⌘E), and Jump to Selection (⌘J).</p>	<p>Dimension</p>
<p>Second modality</p> <p>⌘ + C</p>	<p>Item</p>
<p>Menu</p>	
<p>Menu System</p>	
<p>Expert mode</p>	

Spelling and Grammar... ⌘⌥L

Thesaurus... ⌘⌥R

Hyphenation...

Dictionary...

Language...

Word Count...

AutoCorrect...

Track Changes ▶

Merge Documents...

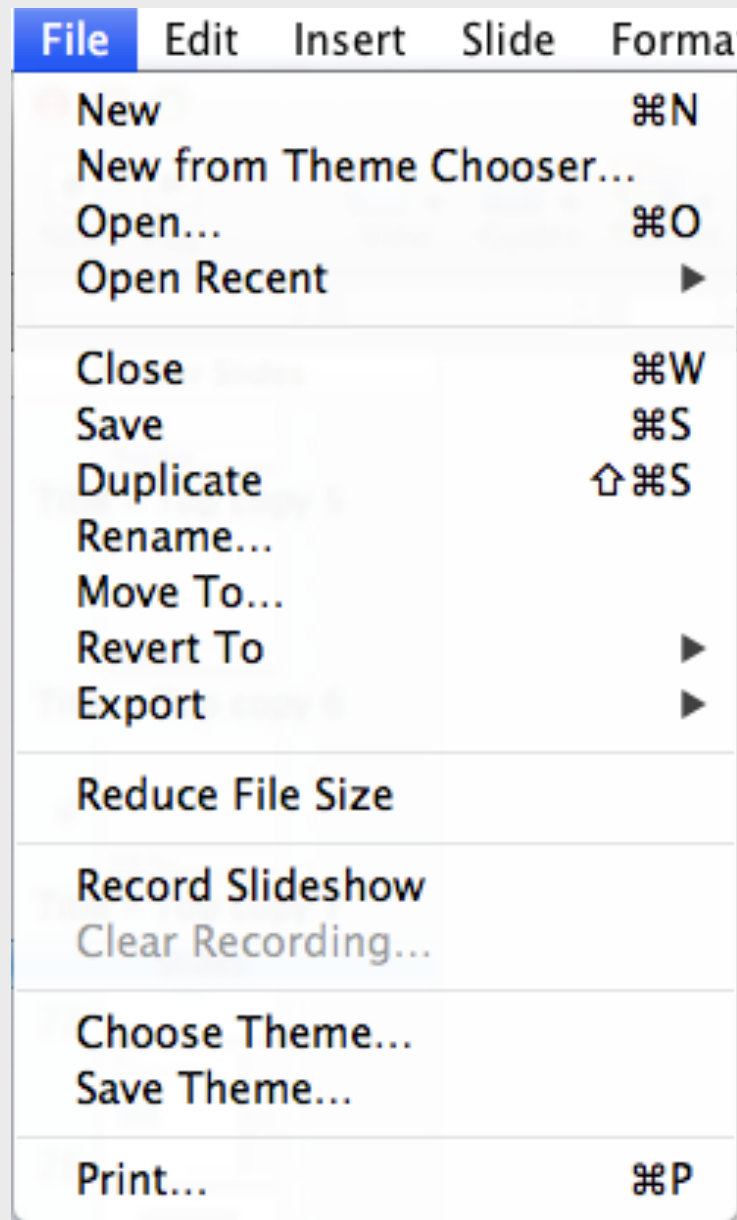
Block Authors

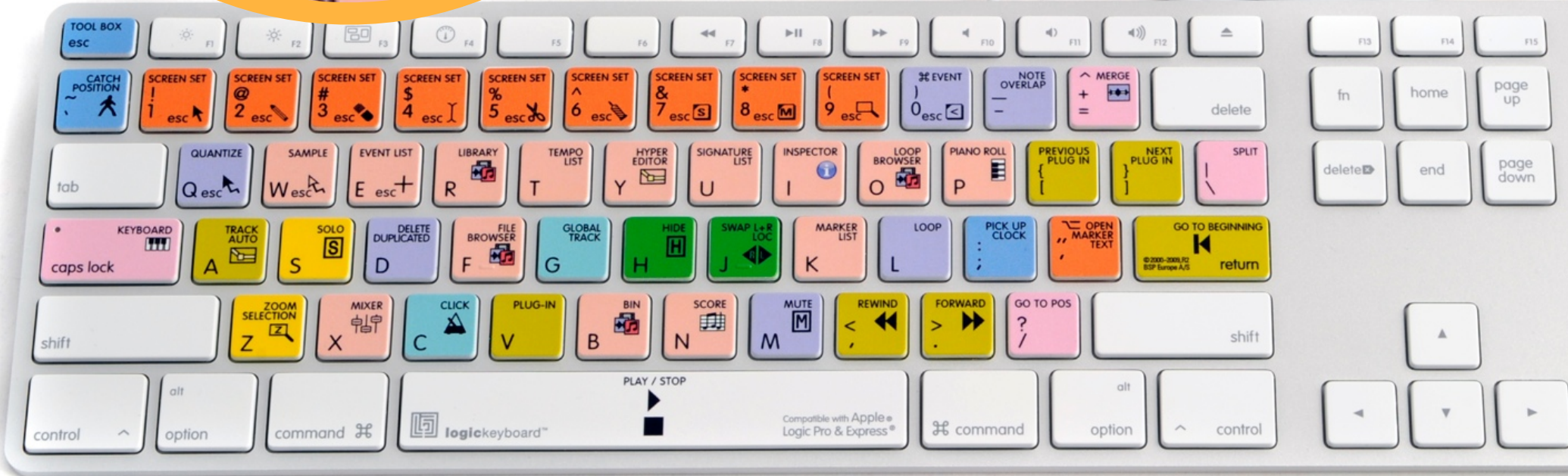
Unblock All My Blocked Areas

Protect Document...

Flag for Follow Up...

Expert Mode: Mapping

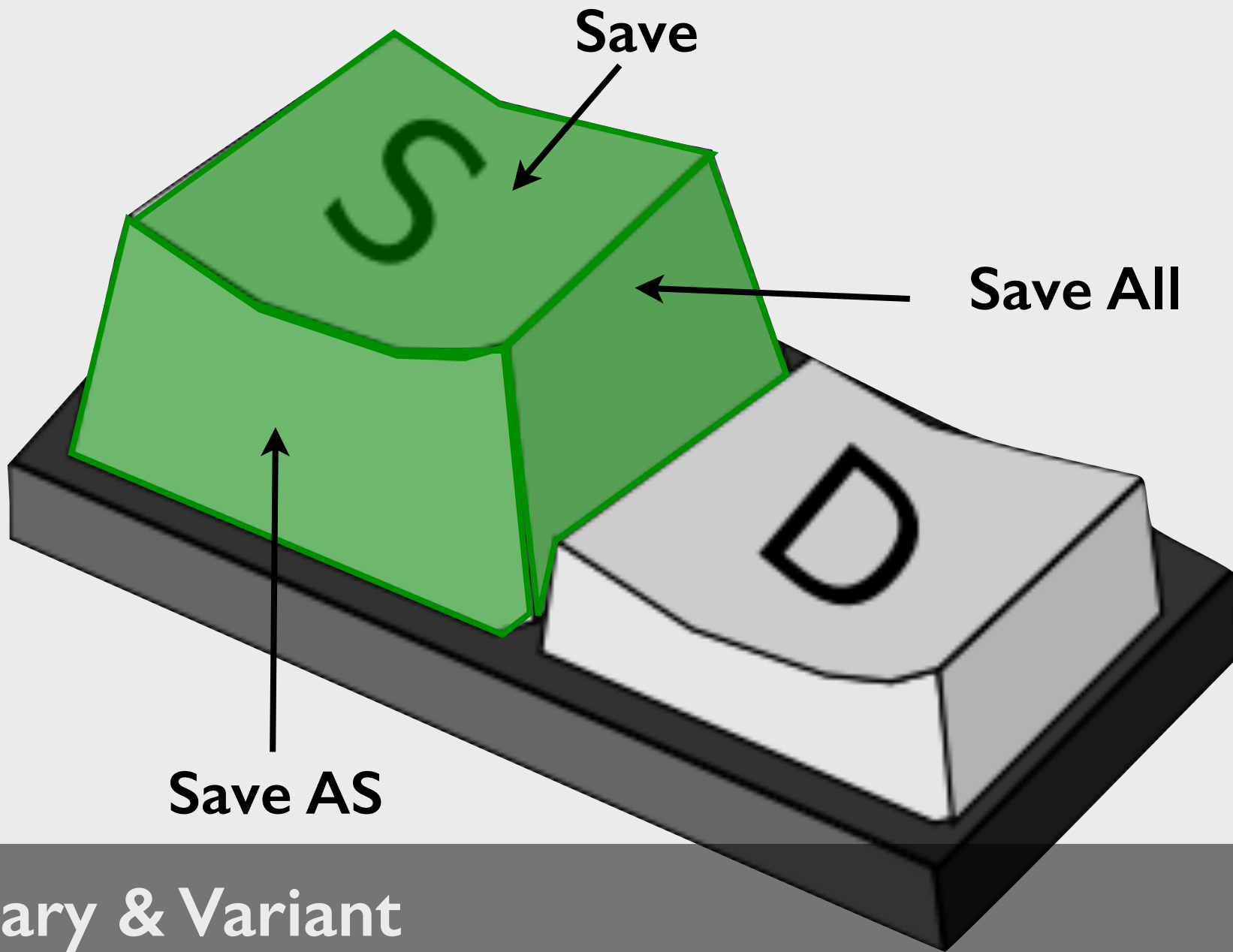






Optimus Keyboard

Métamorphe



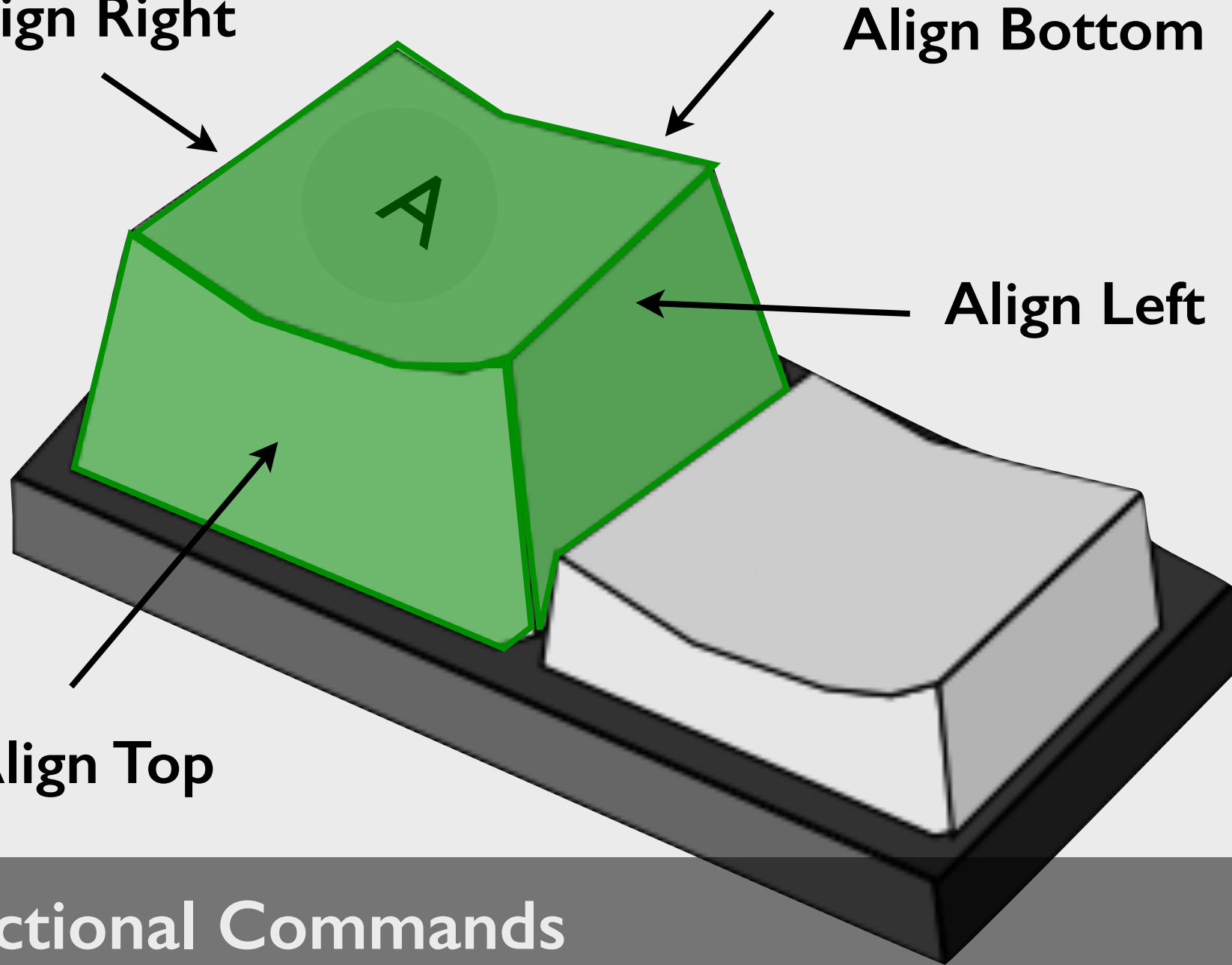
Primary & Variant

Align Right

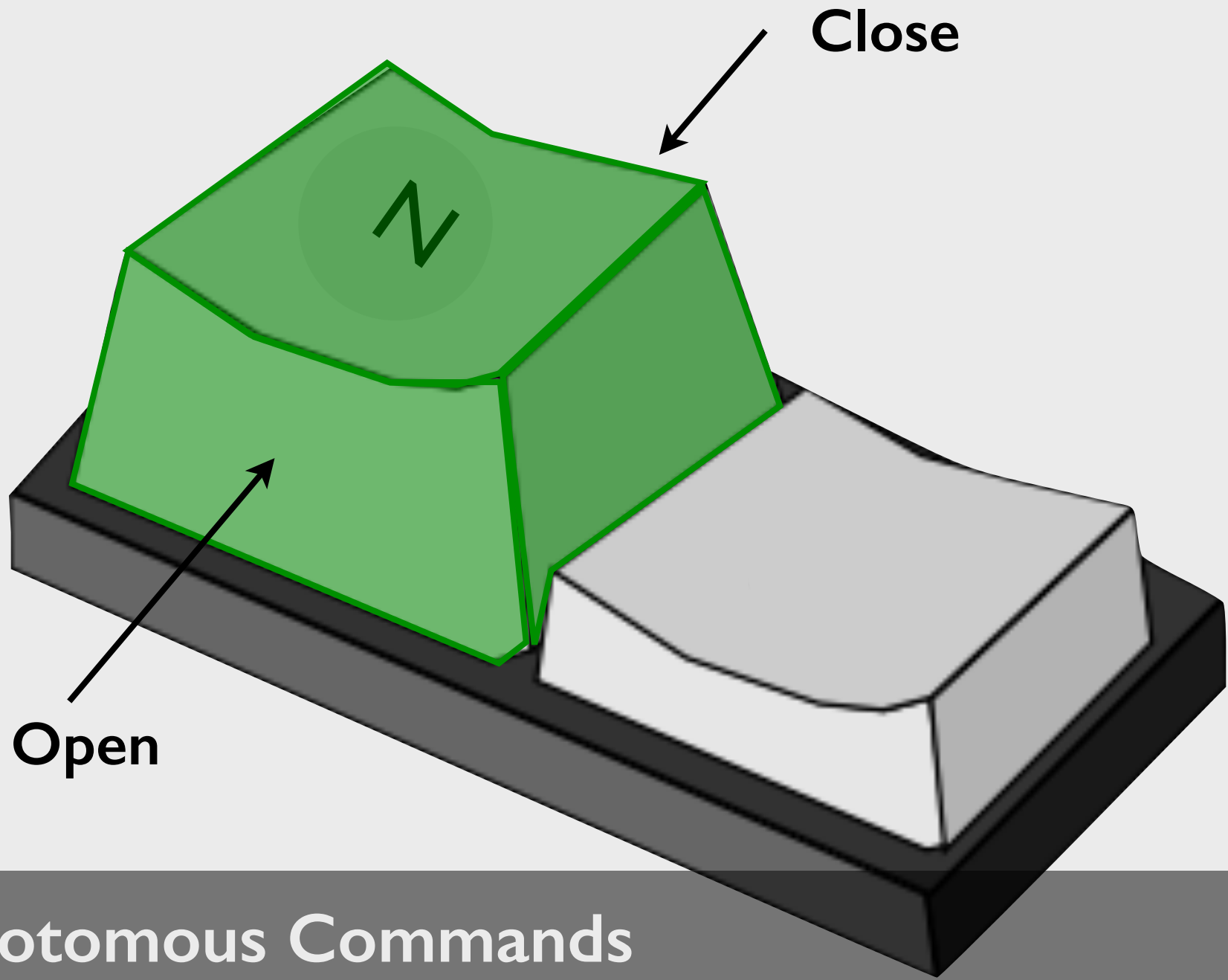
Align Bottom

Align Left

Align Top

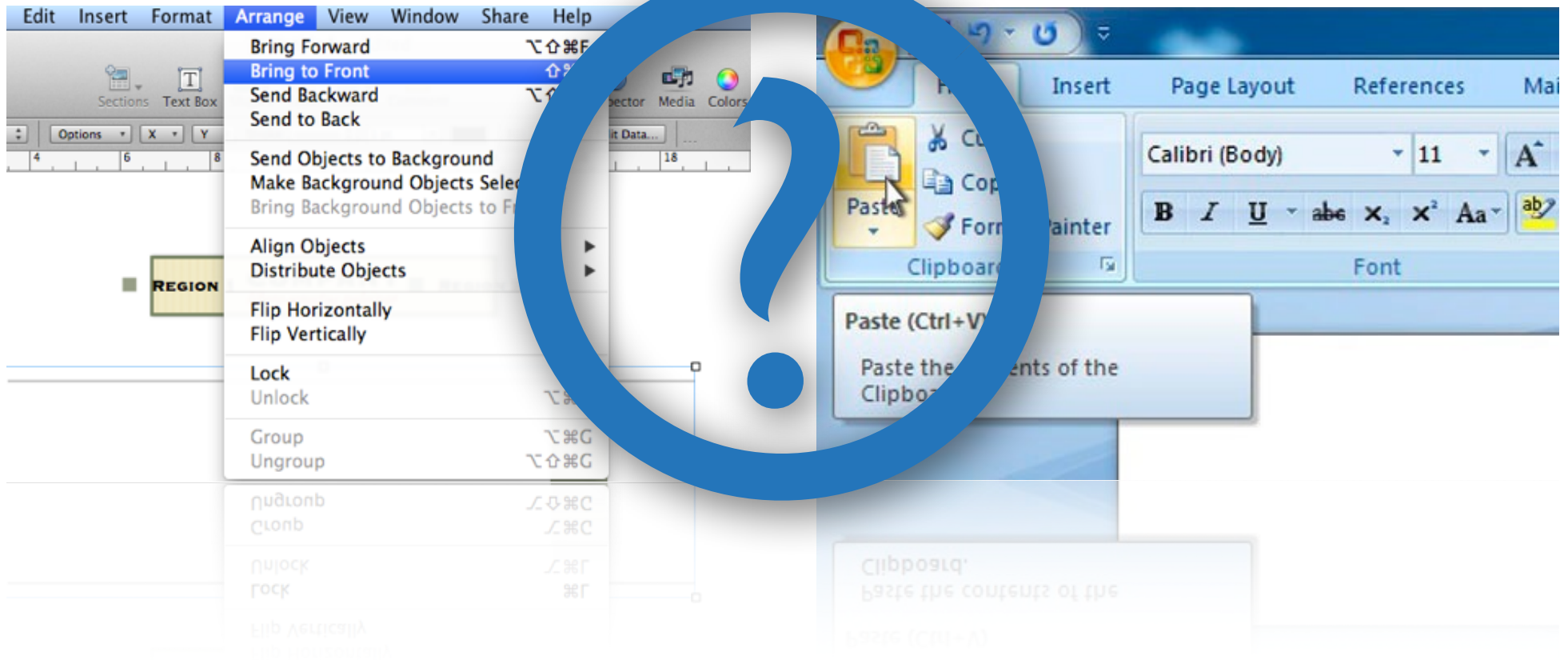


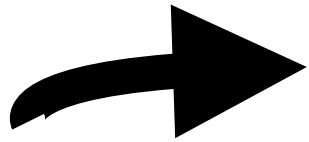
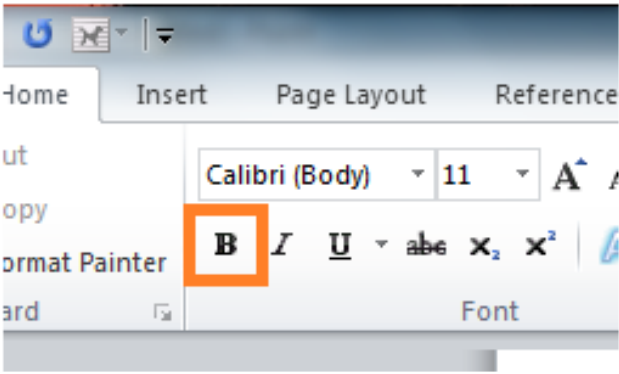
Directional Commands



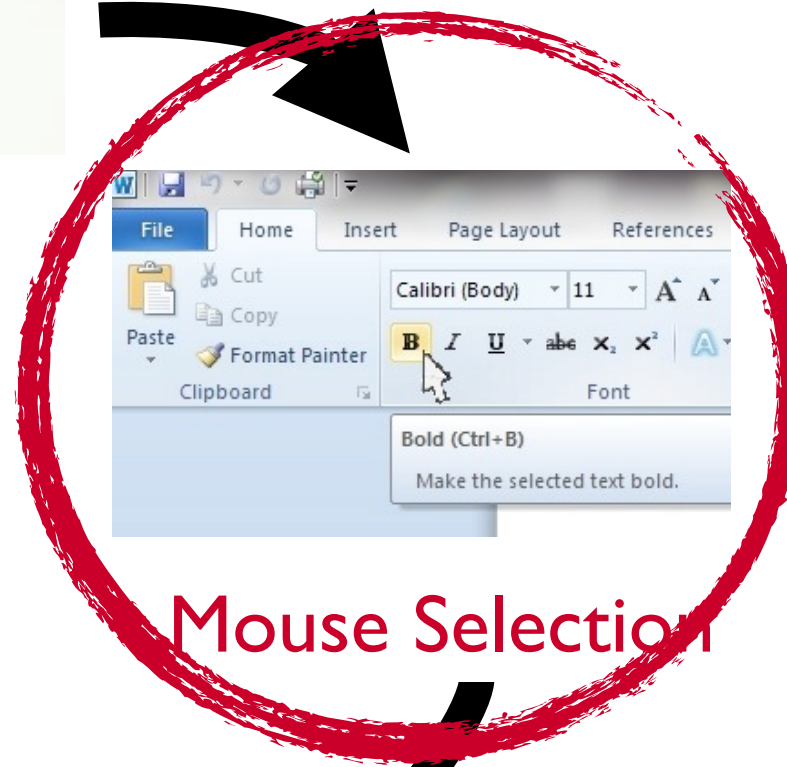
Dichotomous Commands

Why are hotkeys underused?

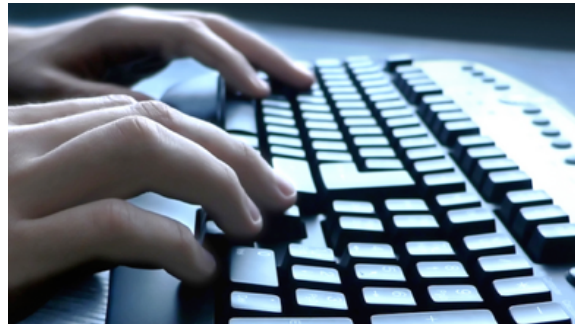




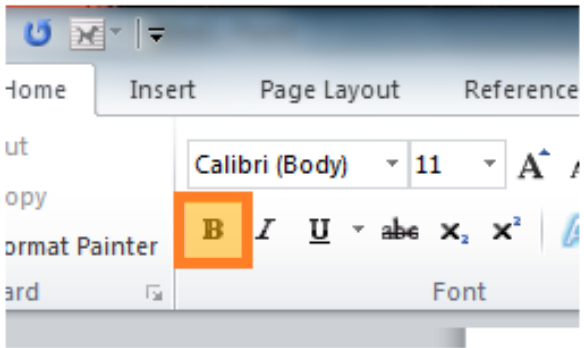
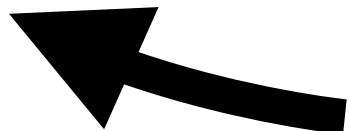
Mouse



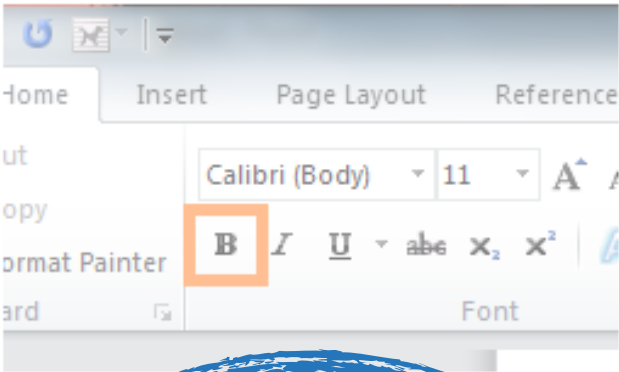
Mouse Selection



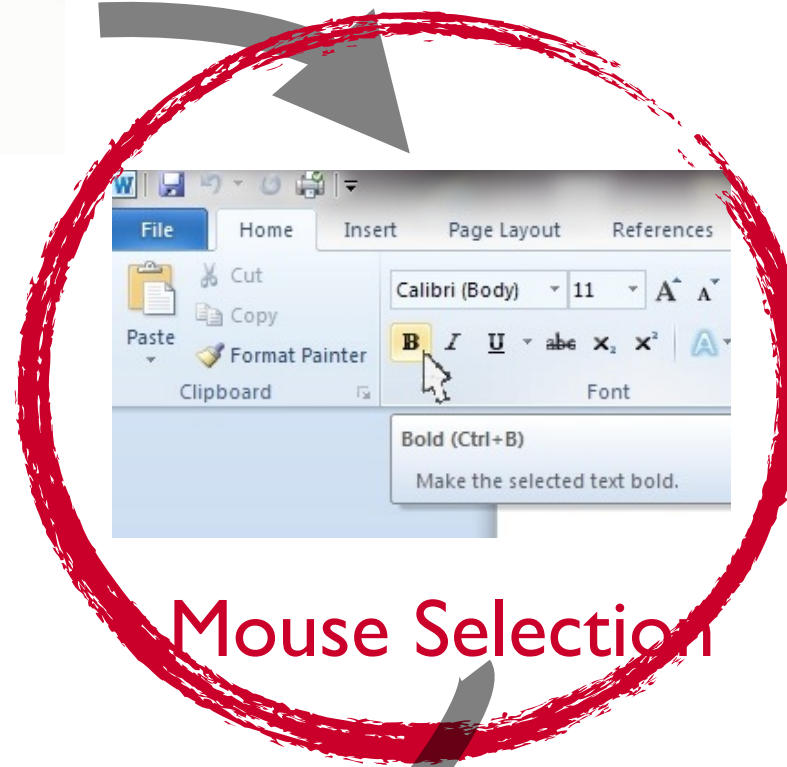
Keyboard



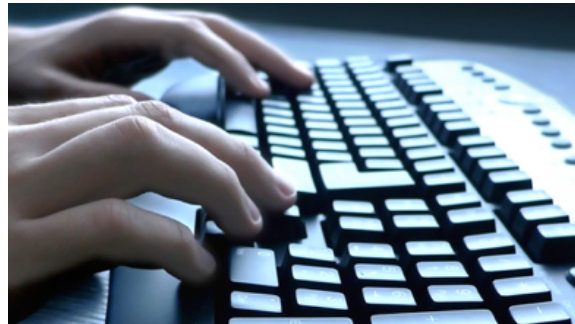
Keyboard Selection



Mouse



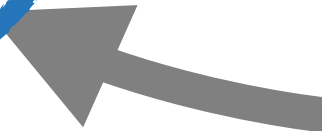
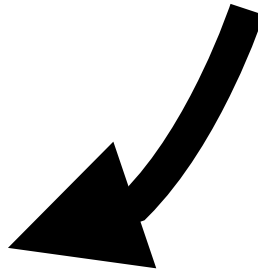
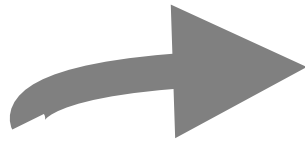
Mouse Selection



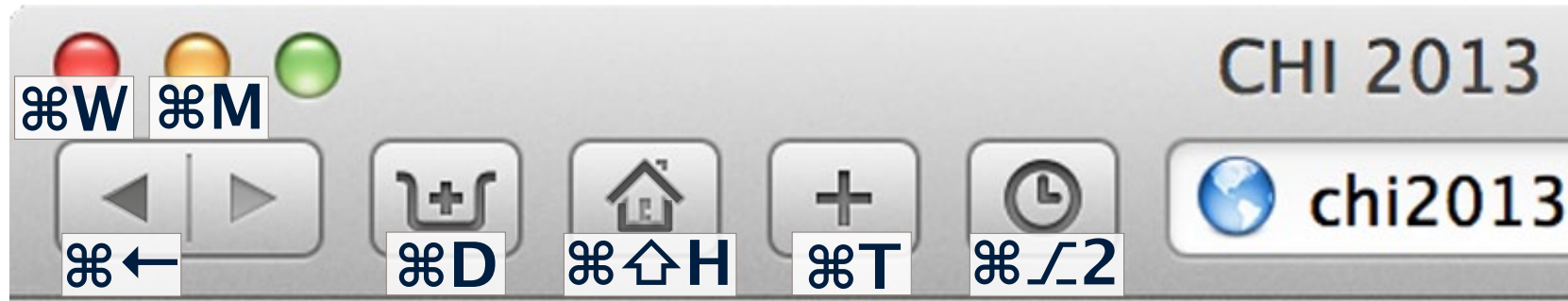
Keyboard



Expose and Keyboard Selection



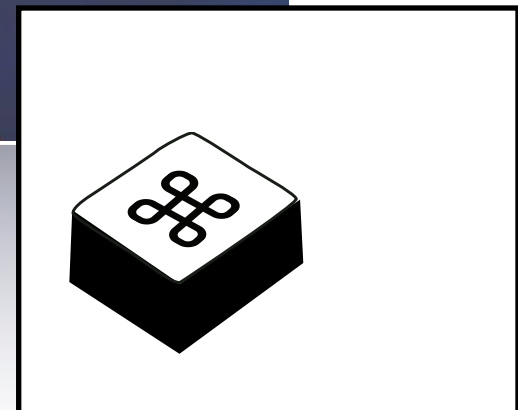
ExposeHotkey (EHK)



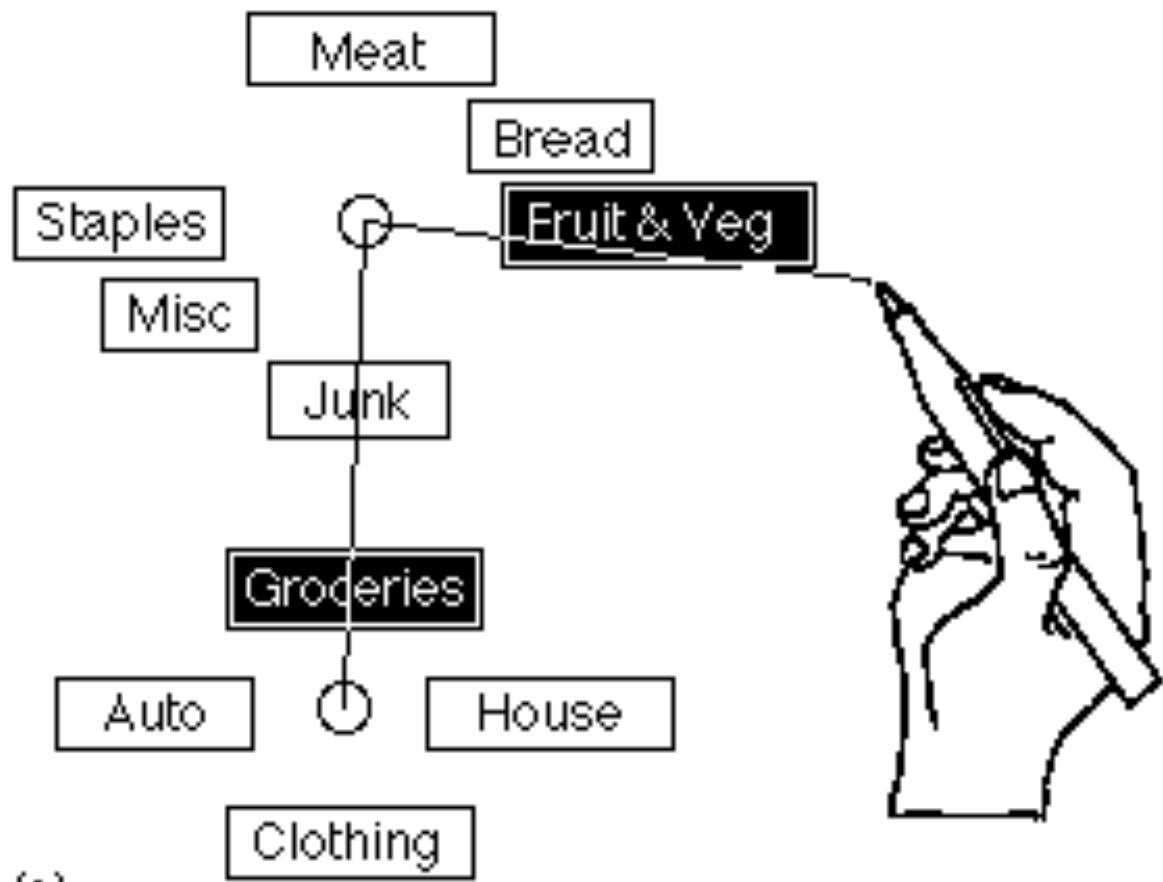
Welcome

Program

Attending



Gestural Menu Techniques



(a)

(b)

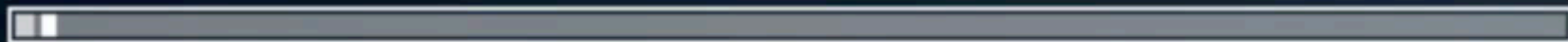
[Kurtenbach et al. 91]

Marking menus

Demo of Marking Menus Versus Linear Menus

Autodesk Research

00:00

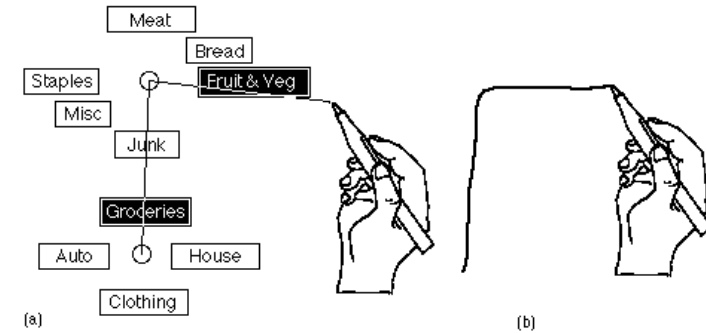


Speed & Accuracy

Learning & Memorization

Satisfaction

Other?



Brainstorming (2 minutes)
Pros & Cons & Properties (why)

Speed & Accuracy

- Circular design (decrease the average distance)
- Scale independence (the size of the marks does not matter)
- Expert mode (direct access)

Learning & Memorization

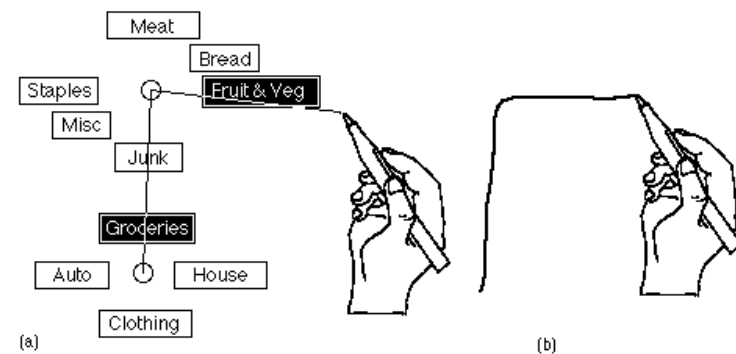
- Spatial memory (orientation)
- Muscular memory (fluid transition)
- Semantic relationship (open / close)

Satisfaction

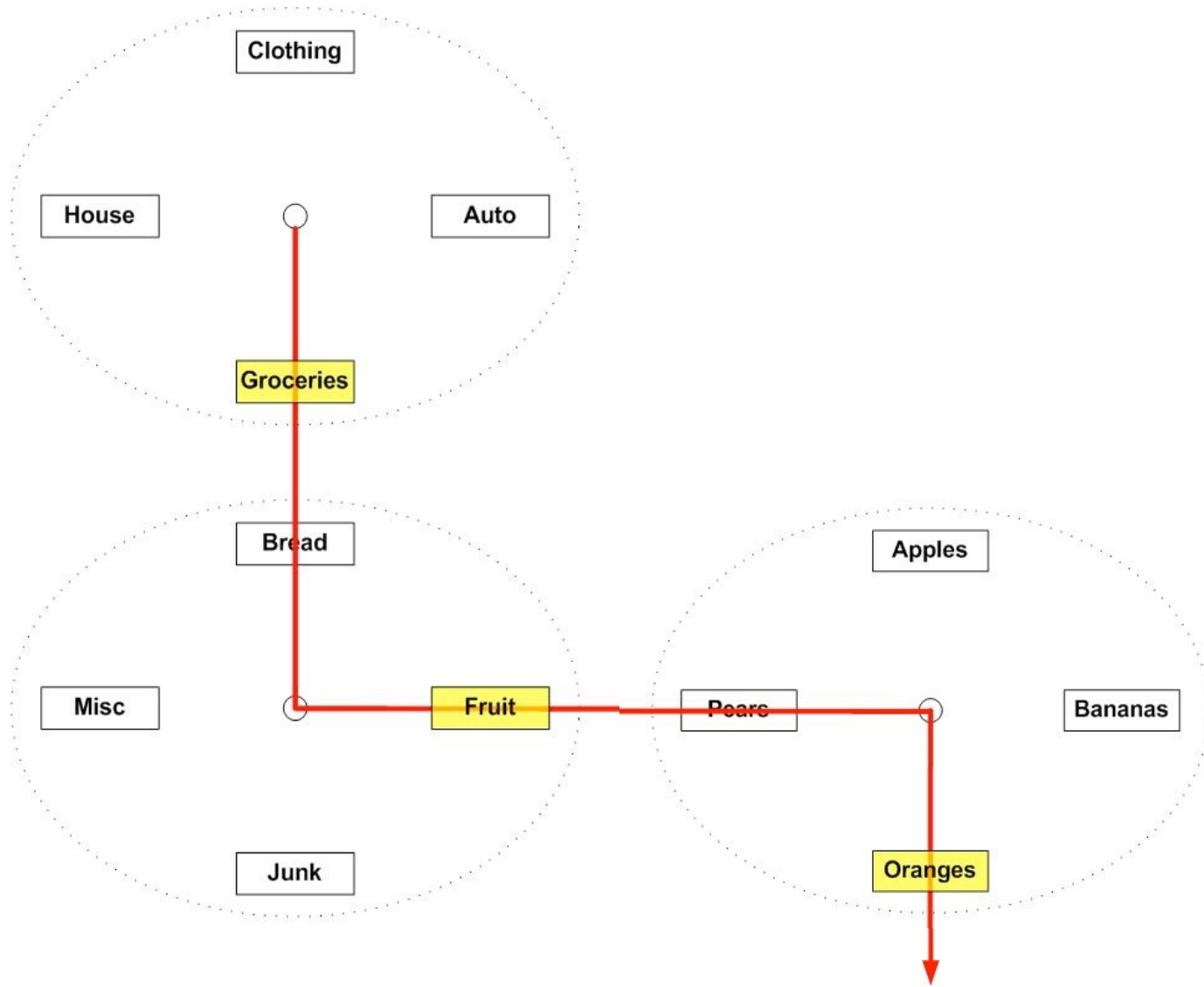
- Gestural interaction

Software adequacy

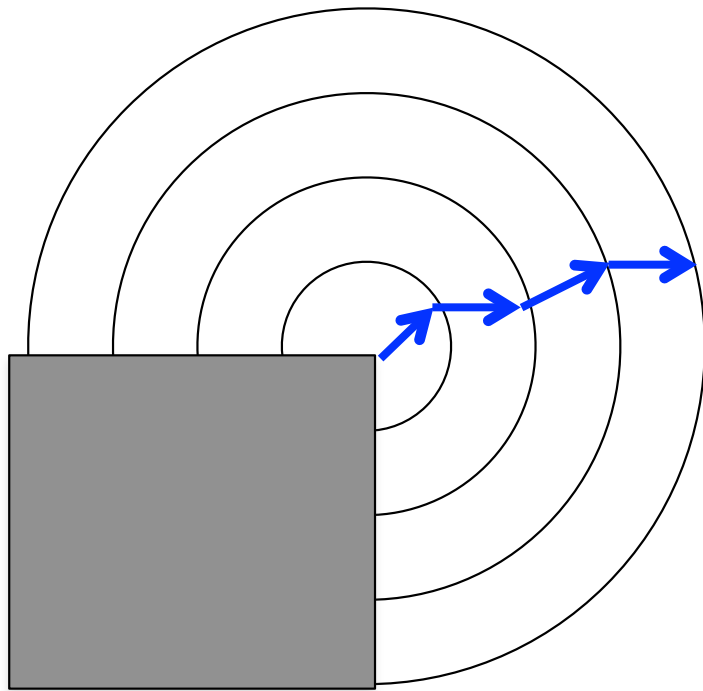
- In place
- Eyes-free selection (do not require visual control)
- **Number of commands (menu depth:3 / menu breadth: 8)**
- **require space**



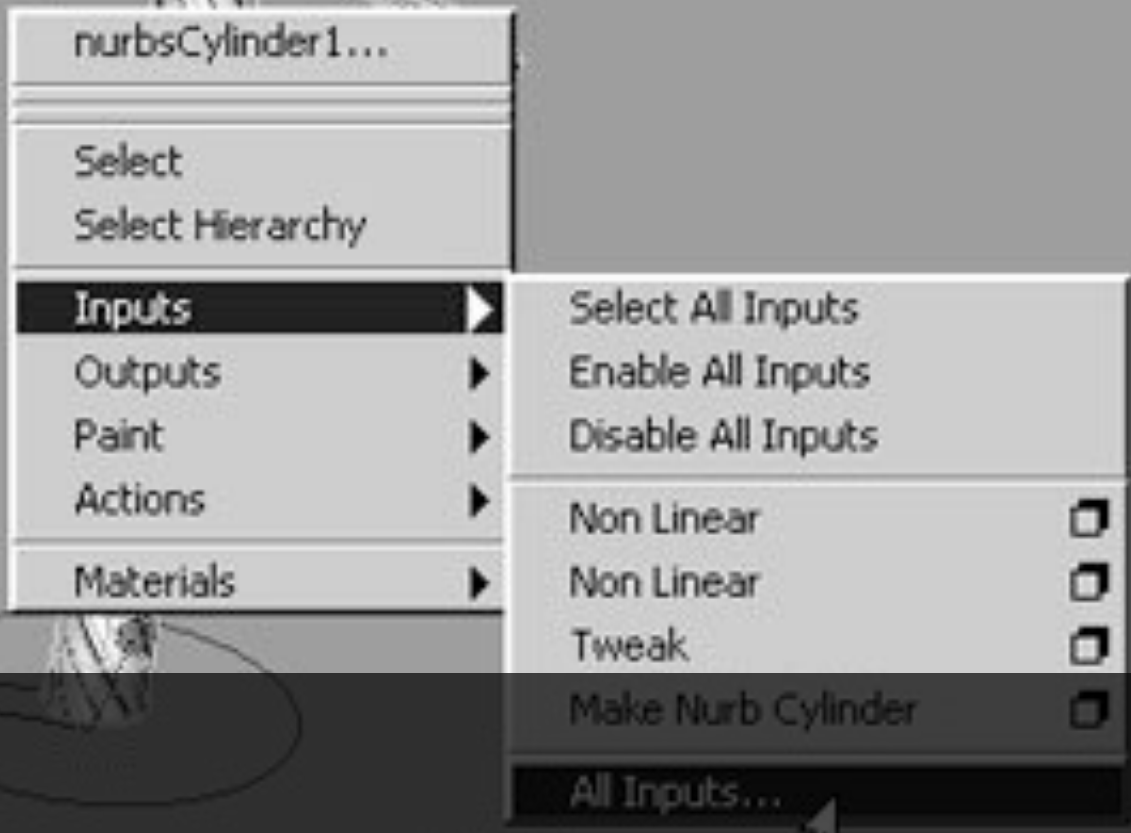
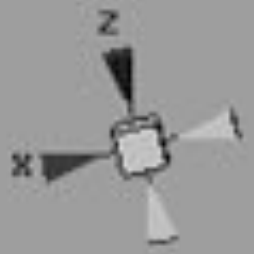
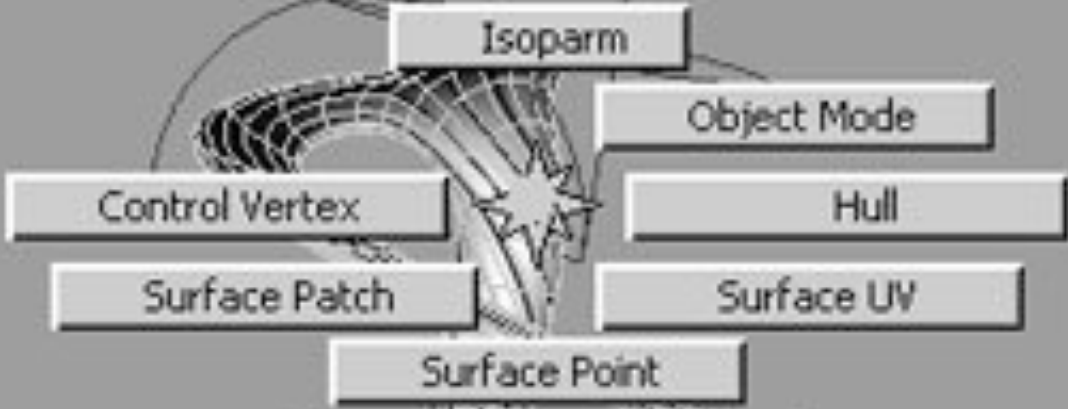
Compound marks



Limitations of Hierarchical Marking



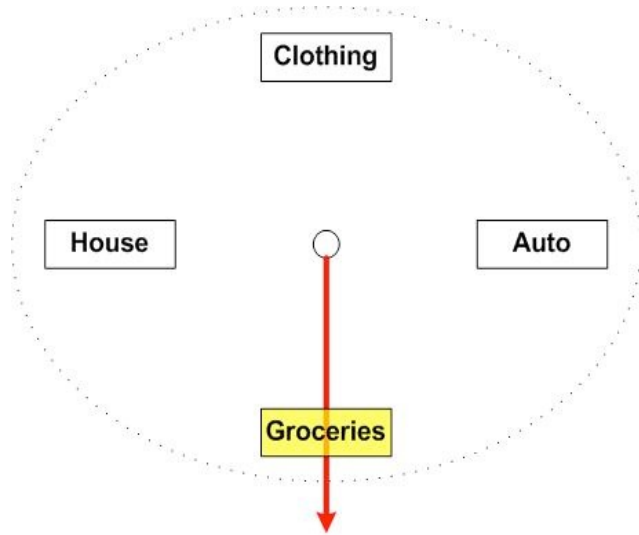
NE-E-NE-E



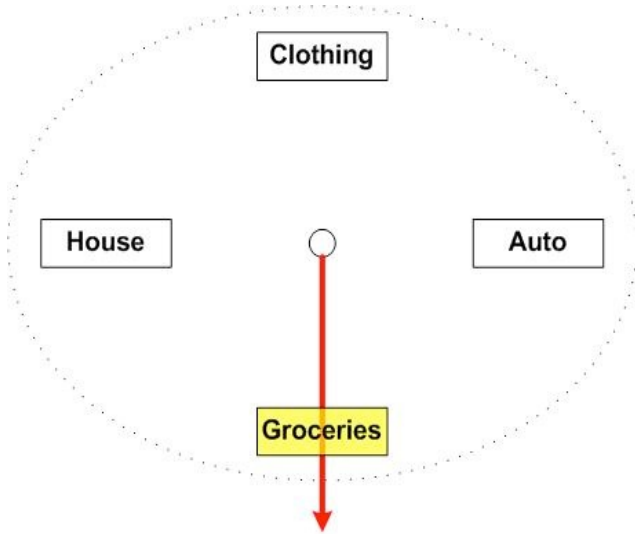
Maya

Marking menus with Linear portions

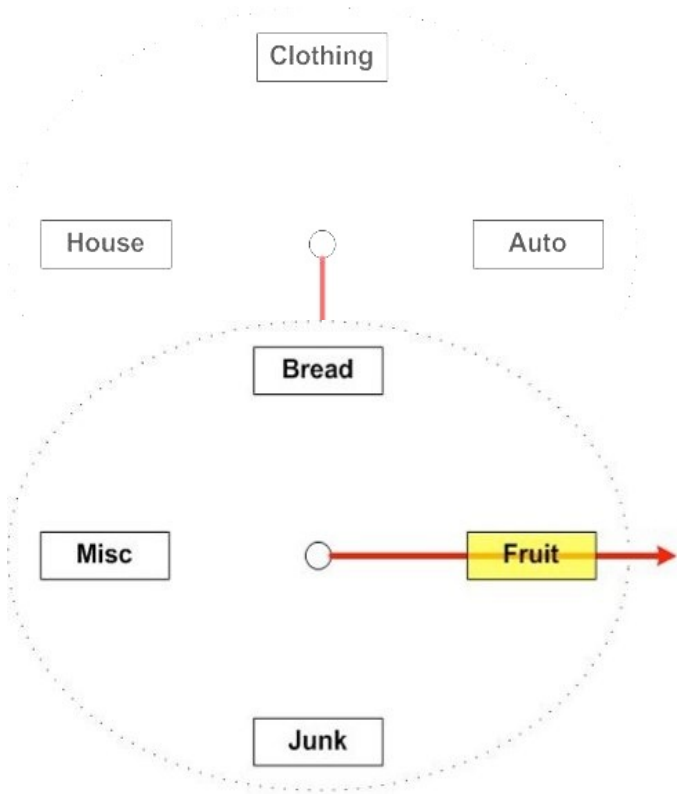
Simple marks (Menu depth)



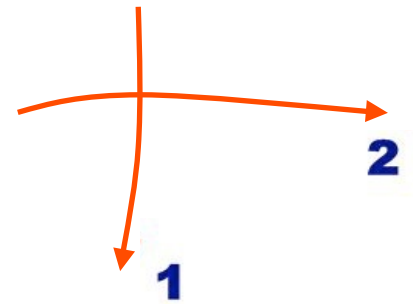
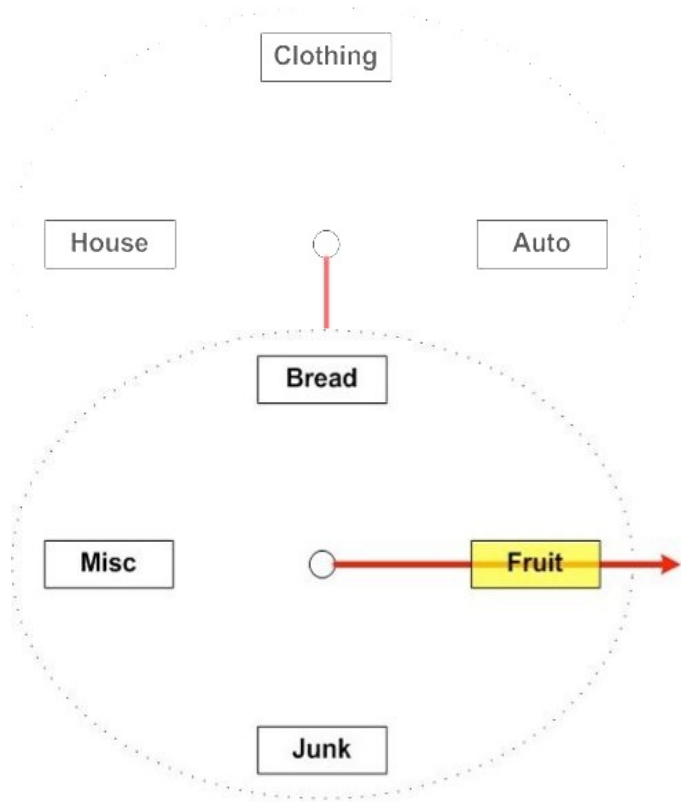
Simple marks



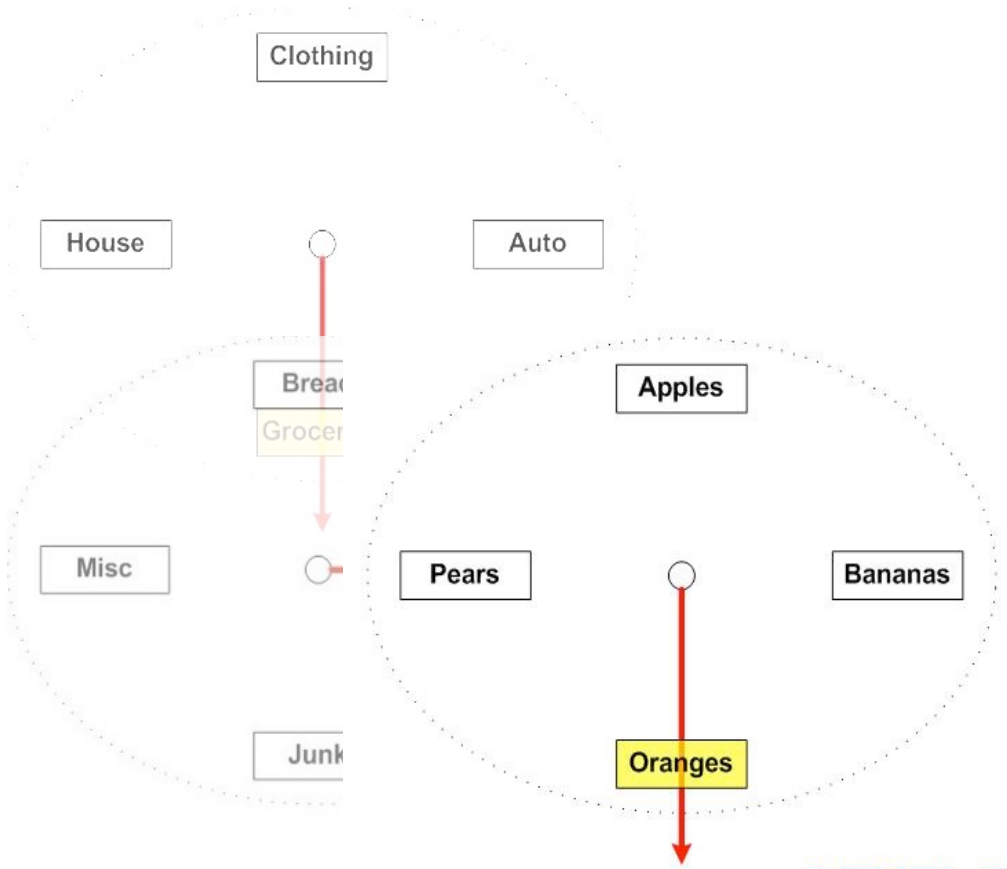
Simple marks



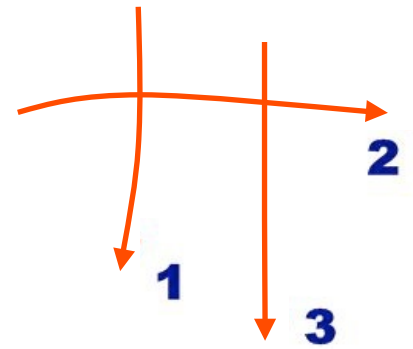
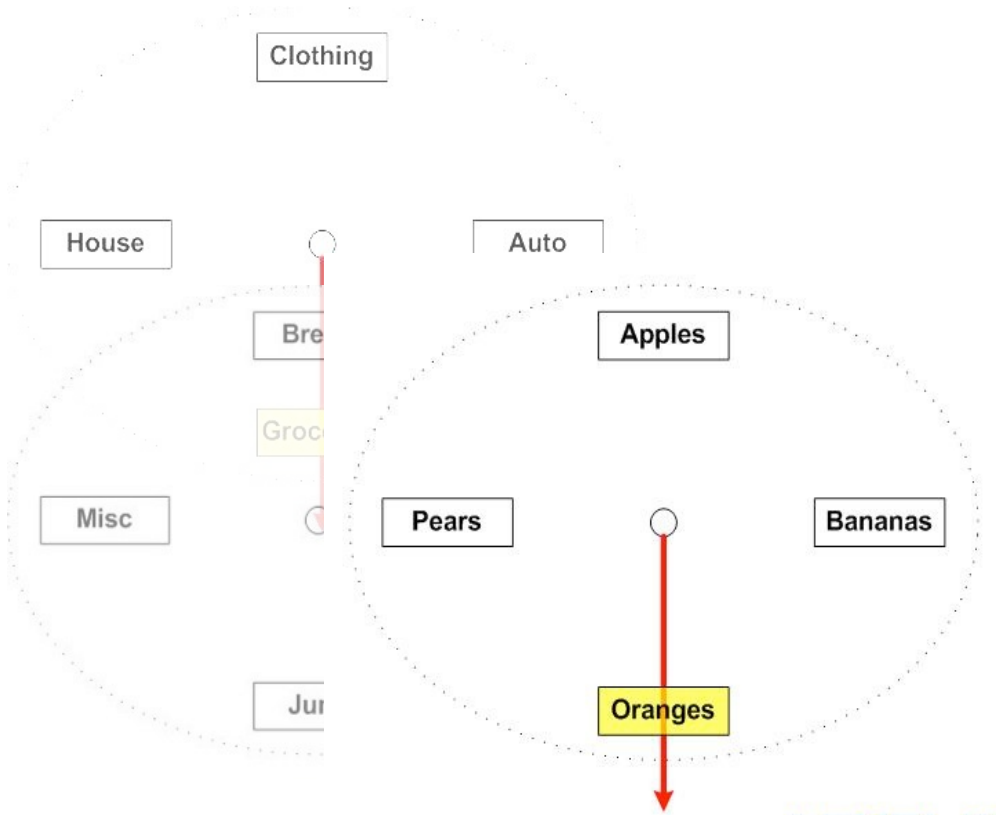
Simple marks



Simple marks



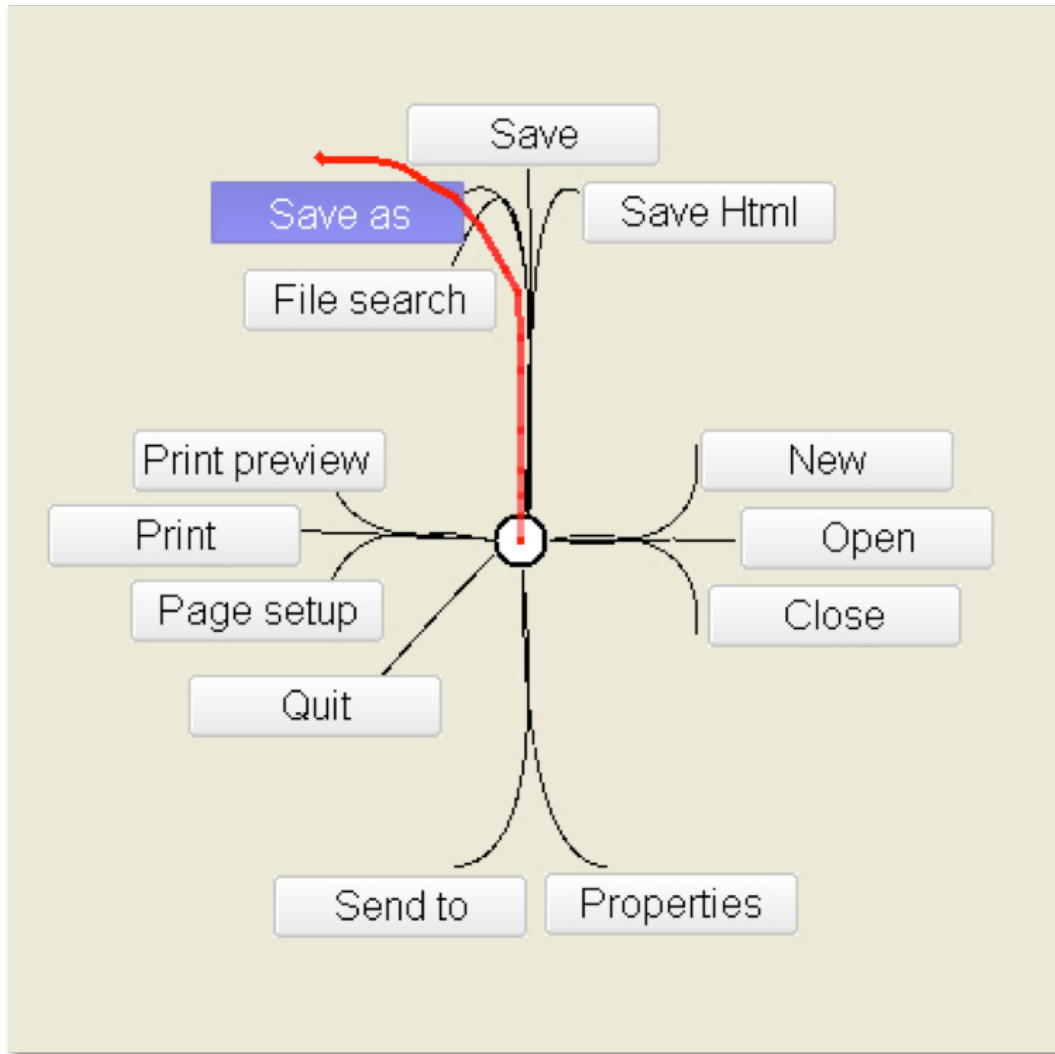
Simple marks

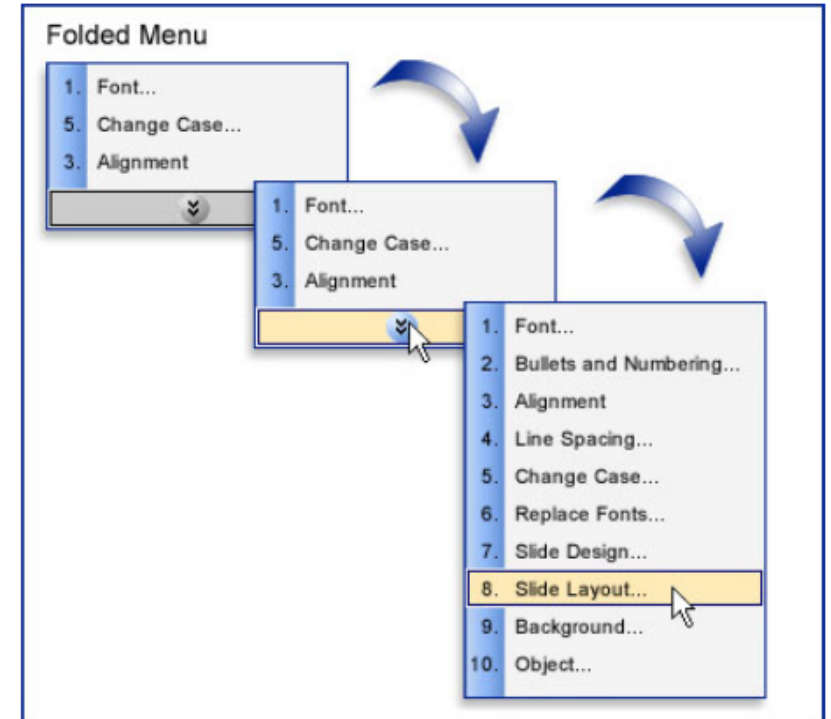
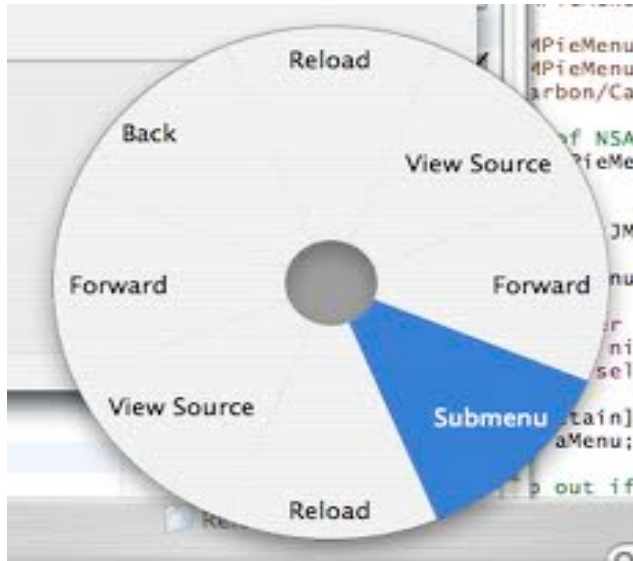


Limitation of simple marks?

- forget that I have a mark already → **error**
- (they are “**modal**”)

Flower Menu (curved gestures)



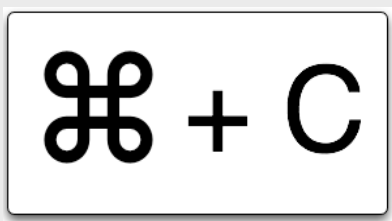
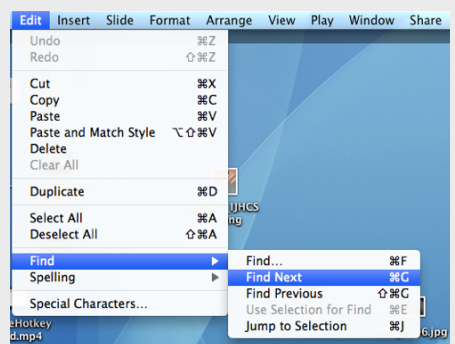
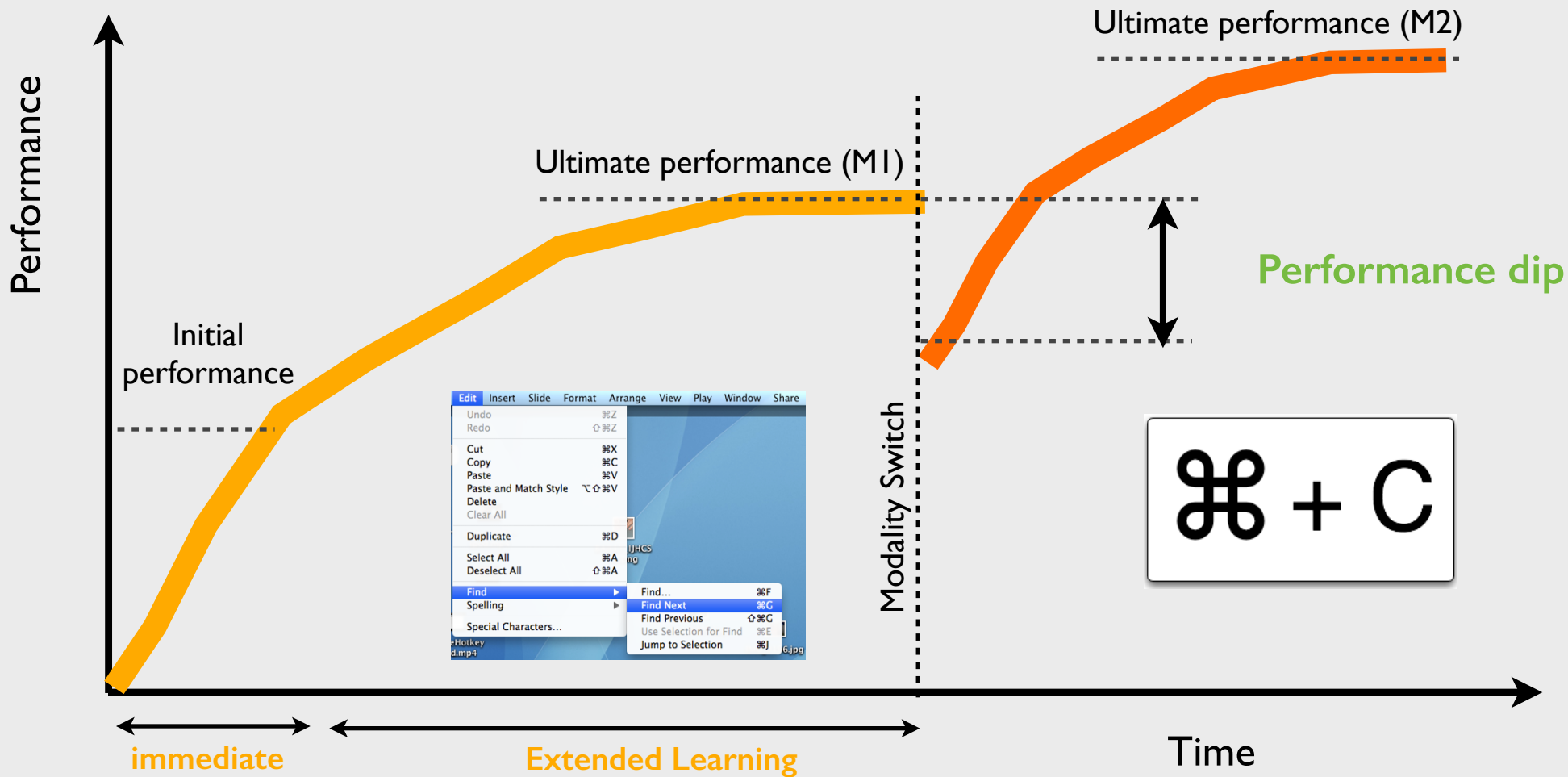


Fame or Shame?

How to predict whether a novel menu technique will be efficient?

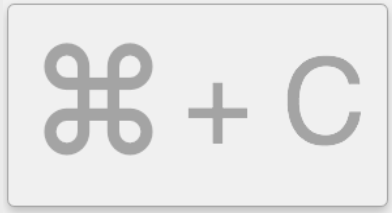
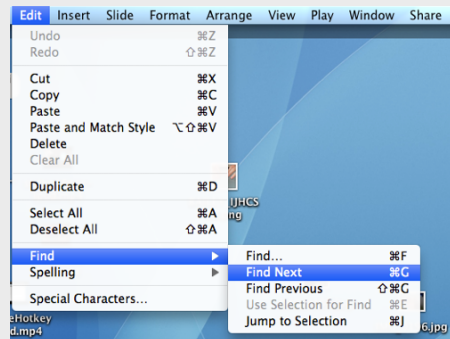
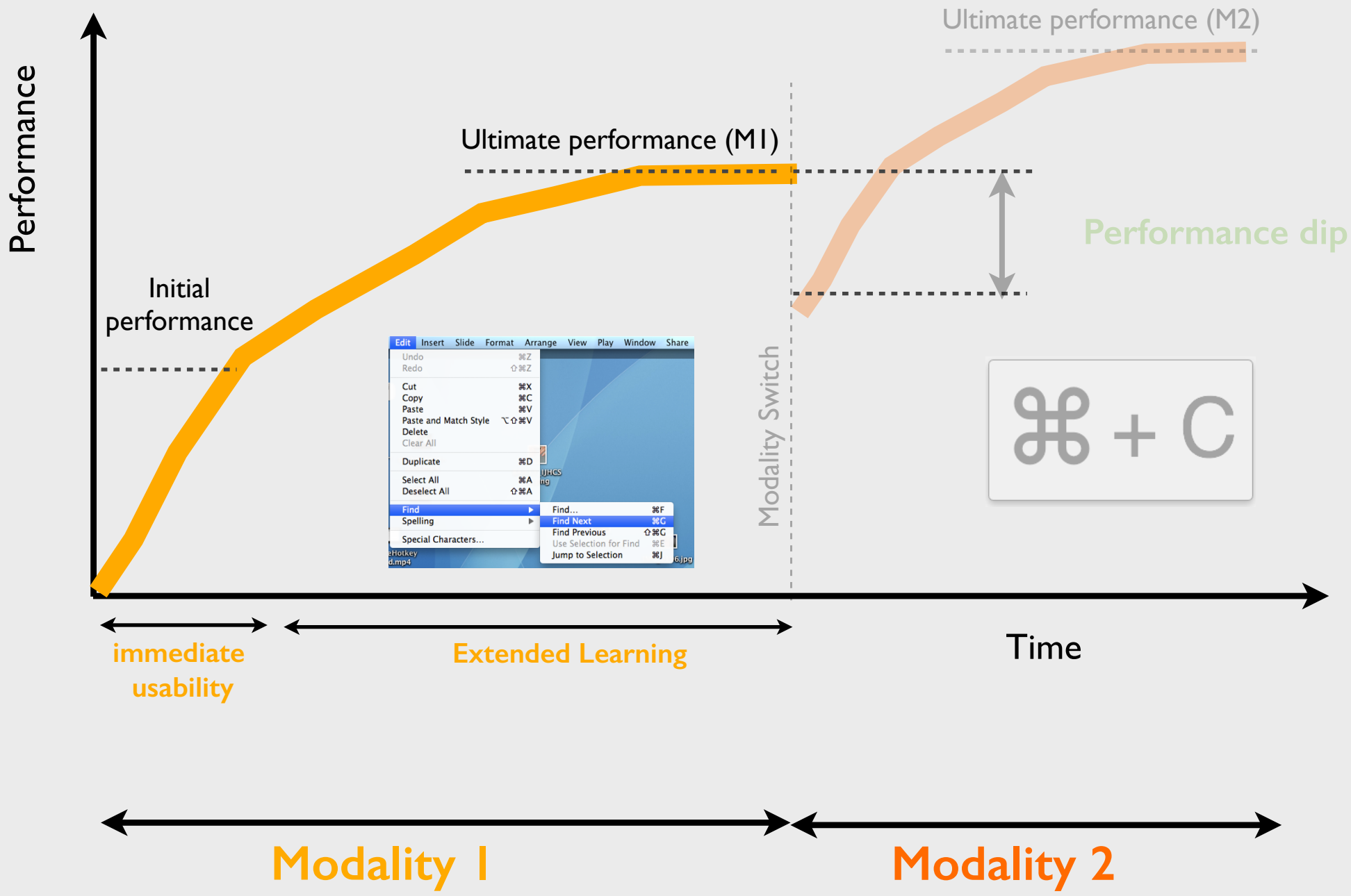
Model of Menu Performance

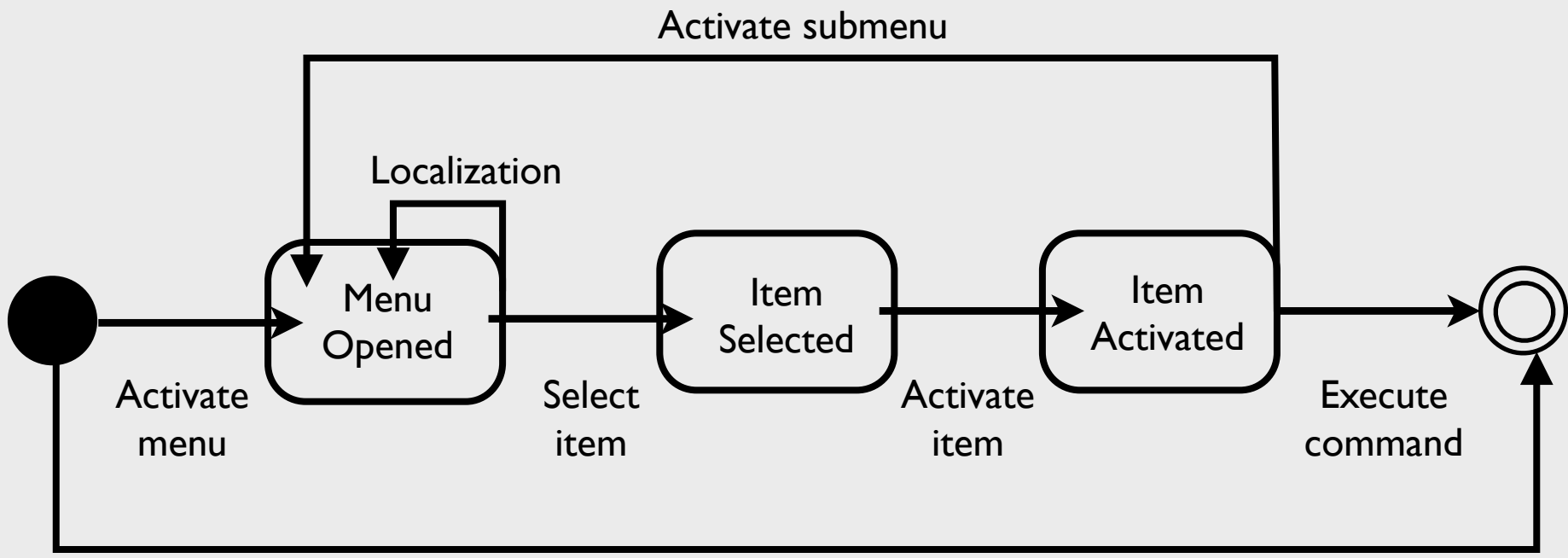
Cockburn, A., Gutwin, C. and Greenberg, S. (2007)
A Predictive Model of Menu Performance.
ACM CHI'07. ACM Press, pages 627-636



Modality 1

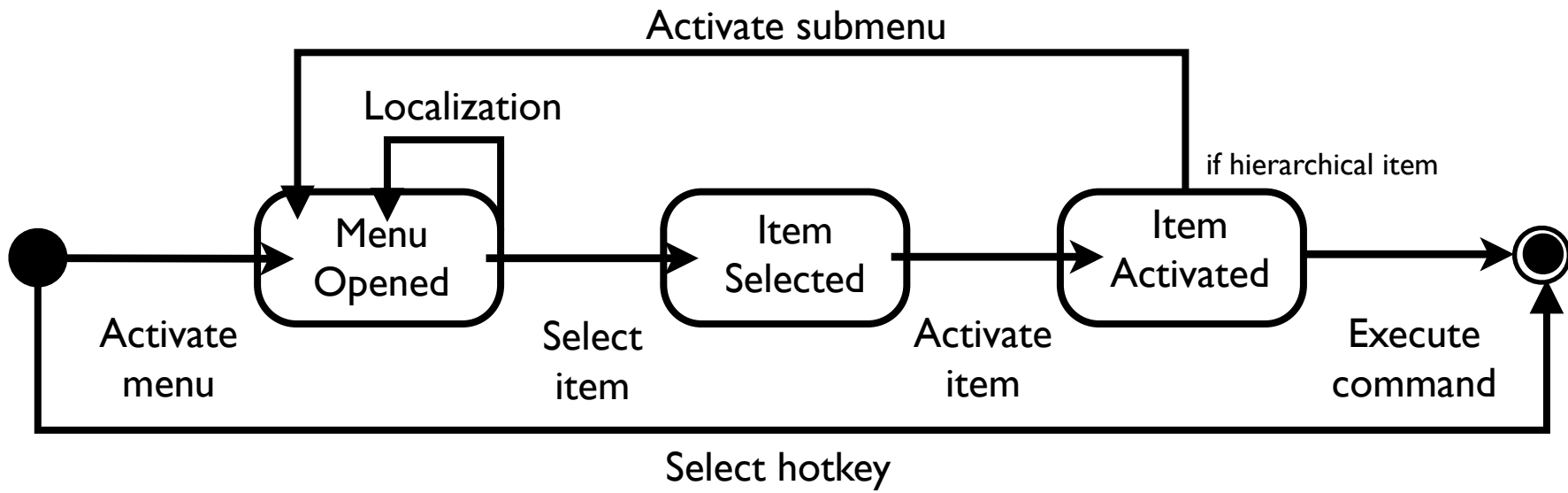
Modality 2





Select hotkey





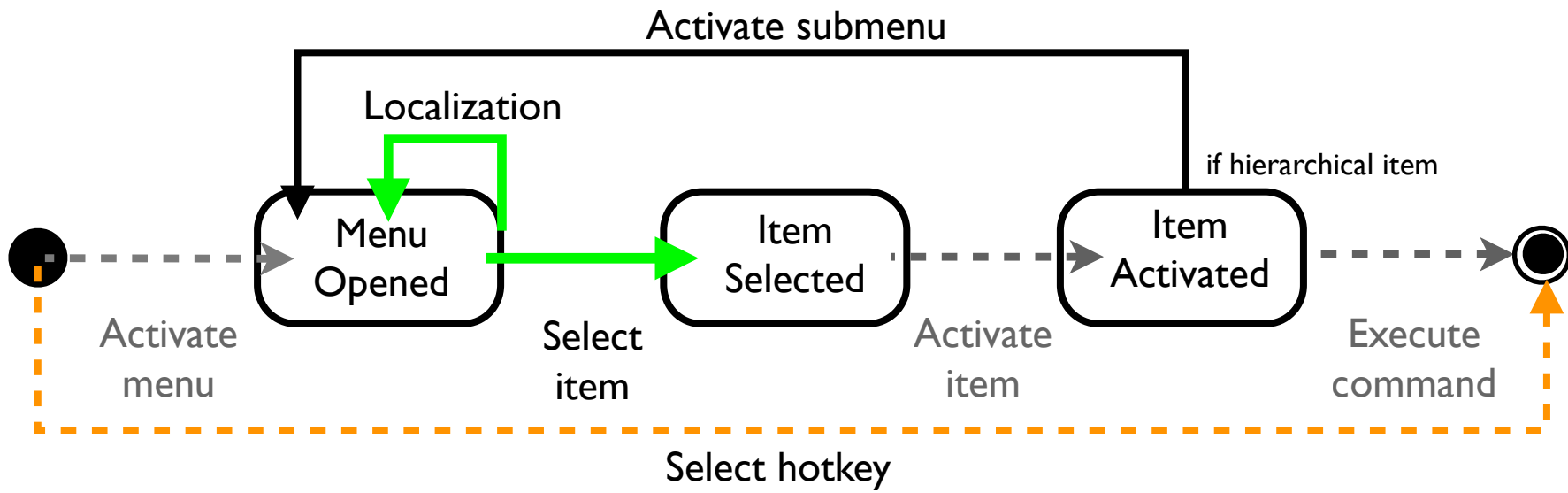
● Start state

⊙ Accept state

▭ State



Transition

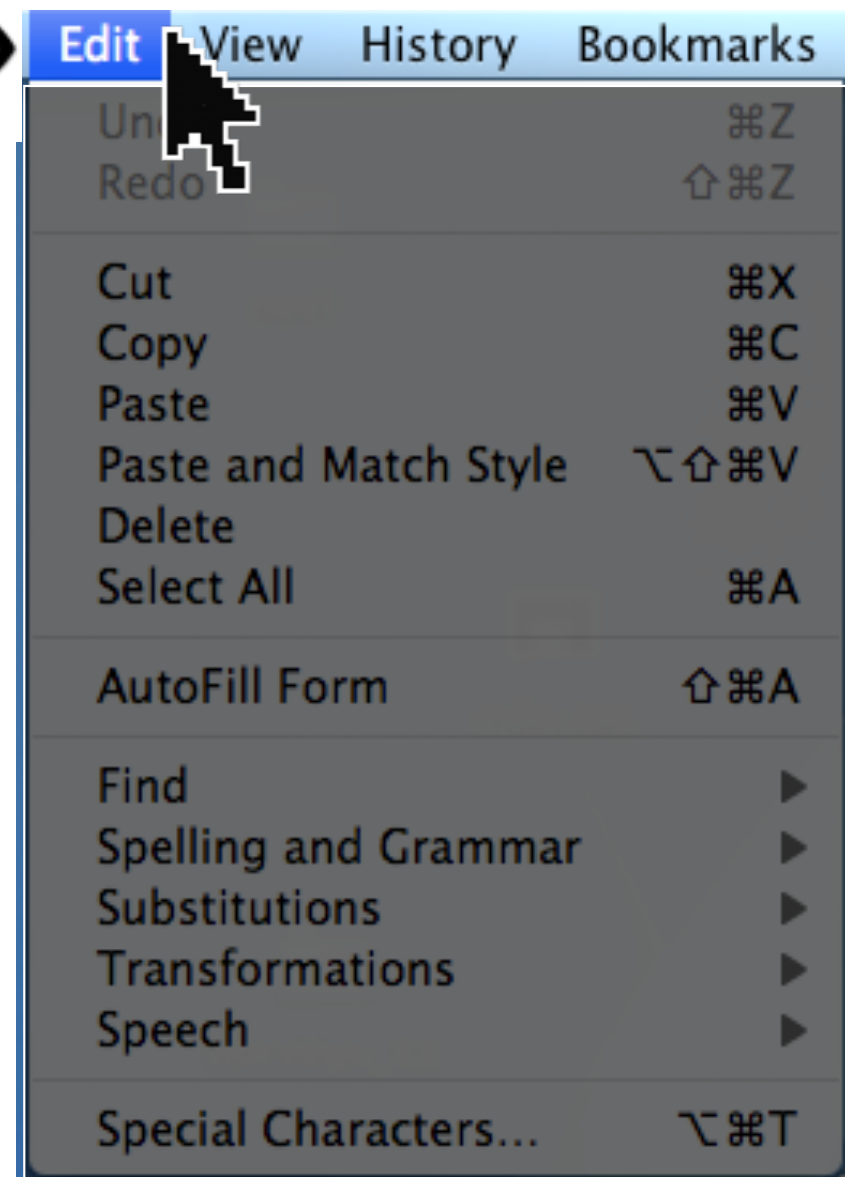


Goal:

Select the command “**Find**”

Novice Users

- 1) Localization: Visual search
- 2) Pointing task



Goal:

Select “Find”

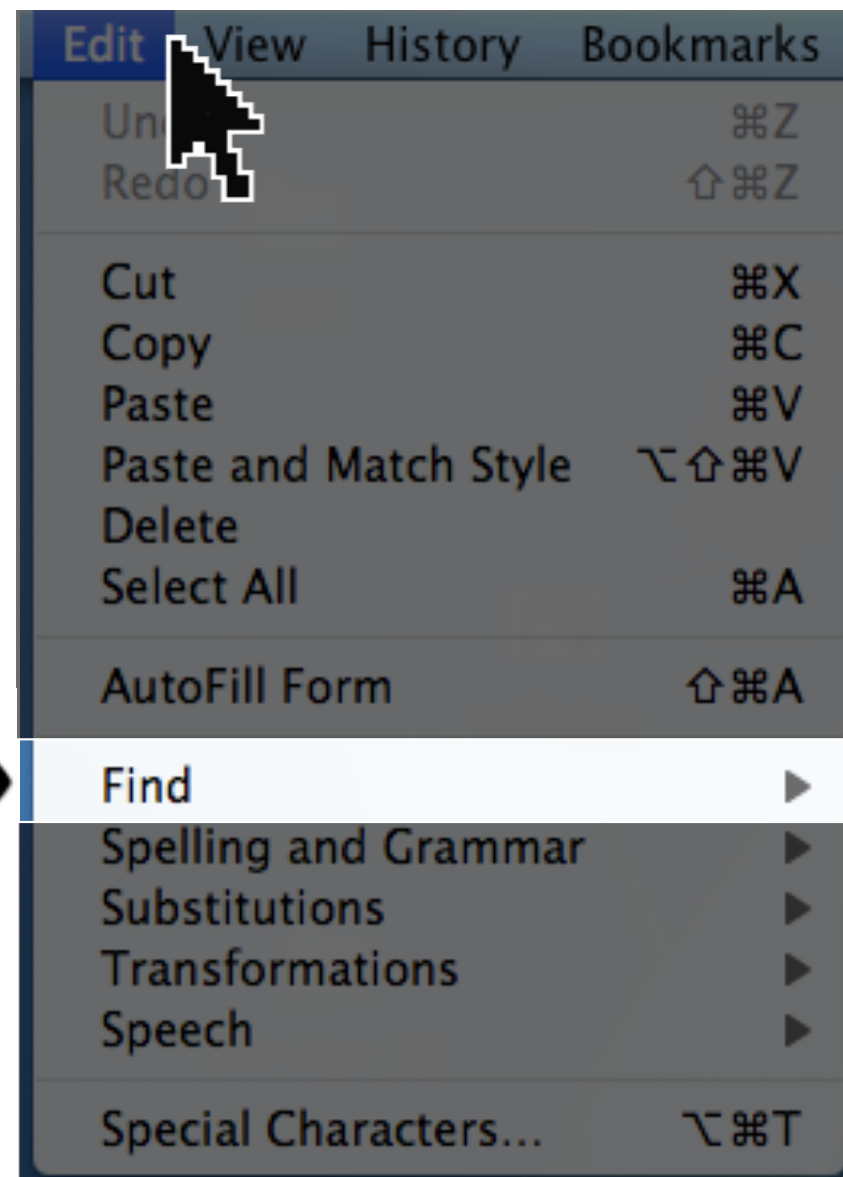
Novice Users

- 1) Localization: Visual search
- 2) Pointing task

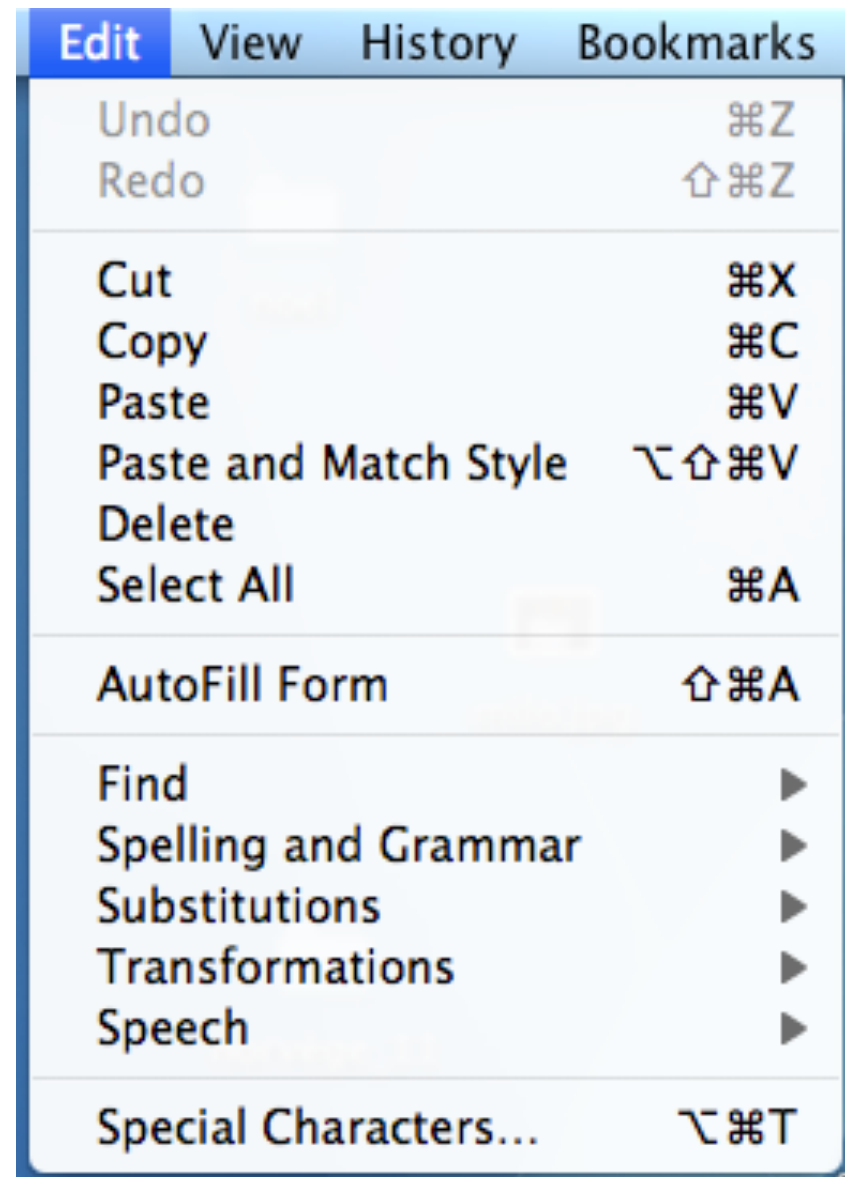


Expert Users

- 1) Localization: Decision time
- 2) Pointing task



- a) Visual search
- b) Decision time
- c) Pointing task
- d) Learning



Fitts' Law (Pointing task)

$$T = a + b \log_2(1 + D/W)$$



$$T = a + b \log_2(1 + n \cdot h / h)$$

$$T = a + b \log_2(1 + n)$$

n: the number of items

h: item height



Edit	View	History	Bookmarks
Undo			⌘Z
Redo			⇧⌘Z
Cut			⌘X
Copy			⌘C
Paste			⌘V
Paste and Match Style			⇧⇧⌘V
Delete			
Select All			⌘A
AutoFill Form			⇧⌘A
Find			▶
Spelling and Grammar			▶
Substitutions			▶
Transformations			▶
Speech			▶
Special Characters...			⇧⌘T

Localization: Novice

Visual search

$$T = a + b * n$$



Edit	View	History	Bookmarks
Undo			⌘Z
Redo			⇧⌘Z
Cut			⌘X
Copy			⌘C
Paste			⌘V
Paste and Match Style			⇧⇧⌘V
Delete			
Select All			⌘A
AutoFill Form			⇧⌘A
Find			▶
Spelling and Grammar			▶
Substitutions			▶
Transformations			▶
Speech			▶
Special Characters...			⇧⌘T

Localization

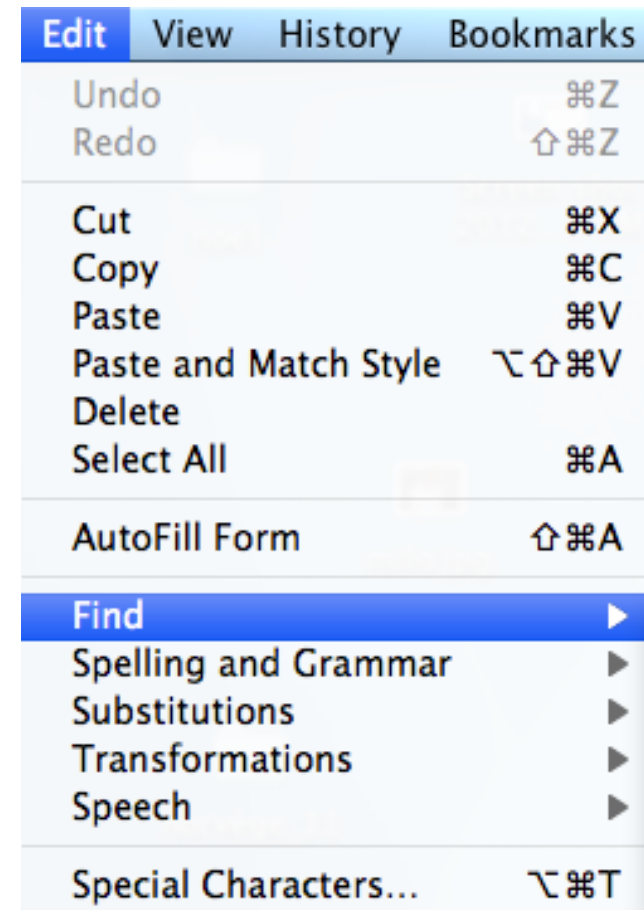
Novice: Visual search

$$T = a + b * n$$

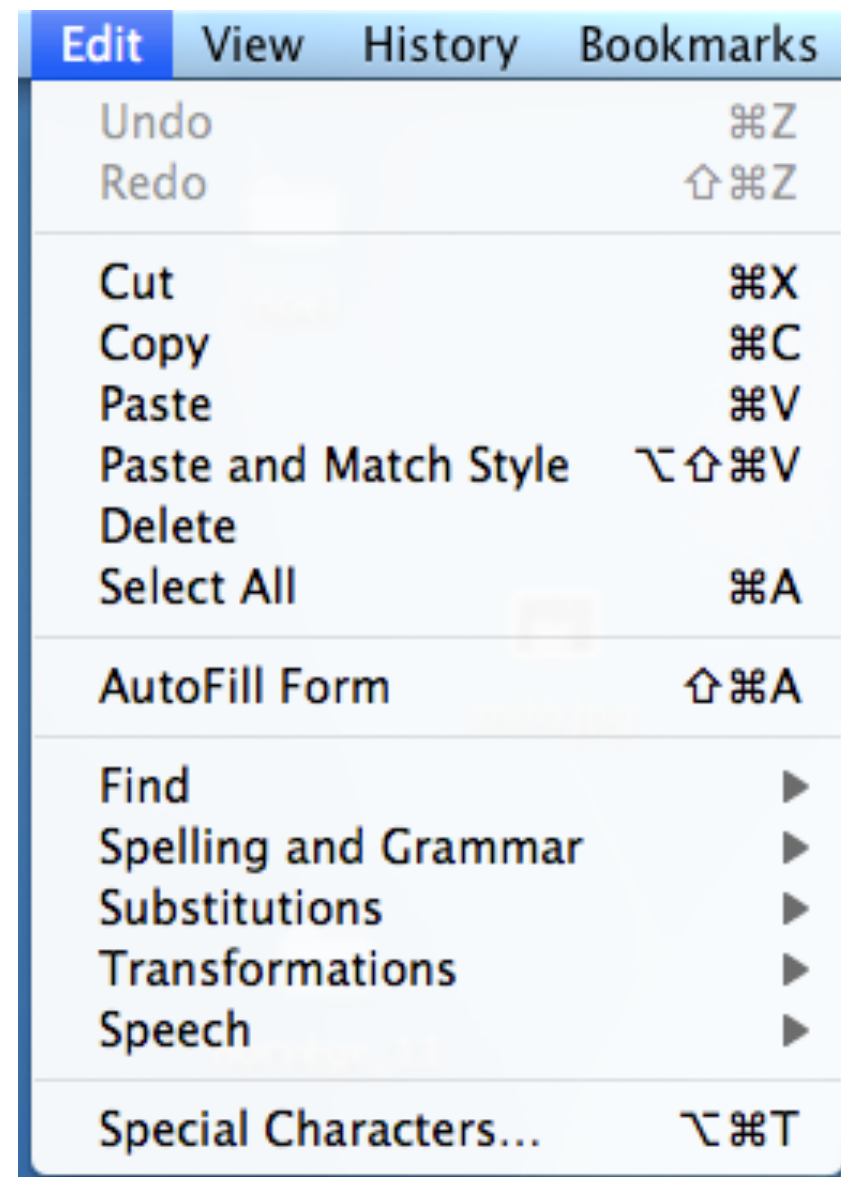
Expert: Decision Time (Hyck-Hyman Law)

$$T = a + b \log_2(1/p_i)$$

P_i : probability of the event



- a) Visual search
- b) Decision time
- c) Pointing task
- d) Learning



$$Tl = (1-e) * T_{vs} + e * T_d$$

Novice: $e=0$
(visual search)

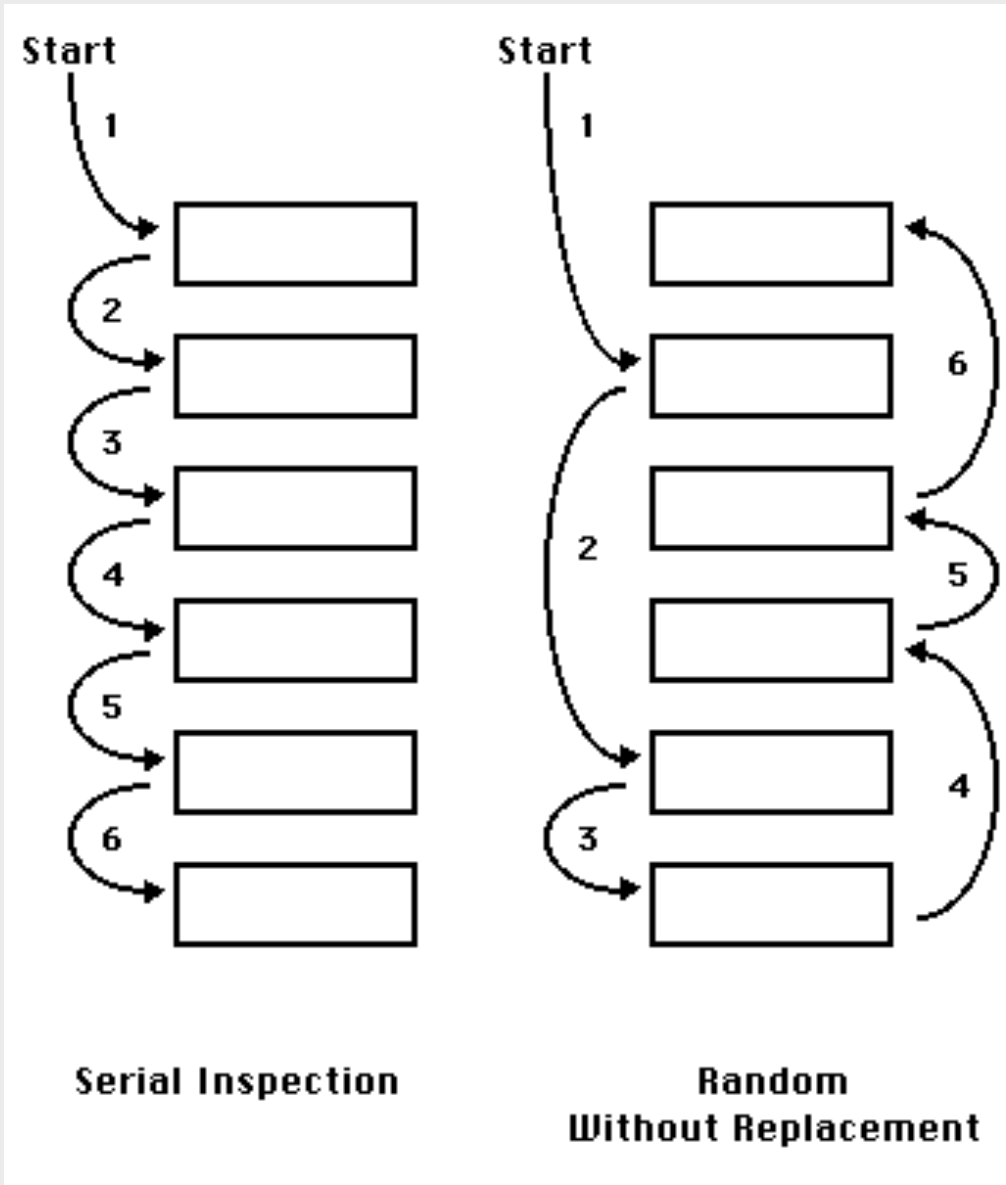
$$T_{vs} = a_{vs} + b_{vs} * n$$

Expert: $e=1$
(decision time)

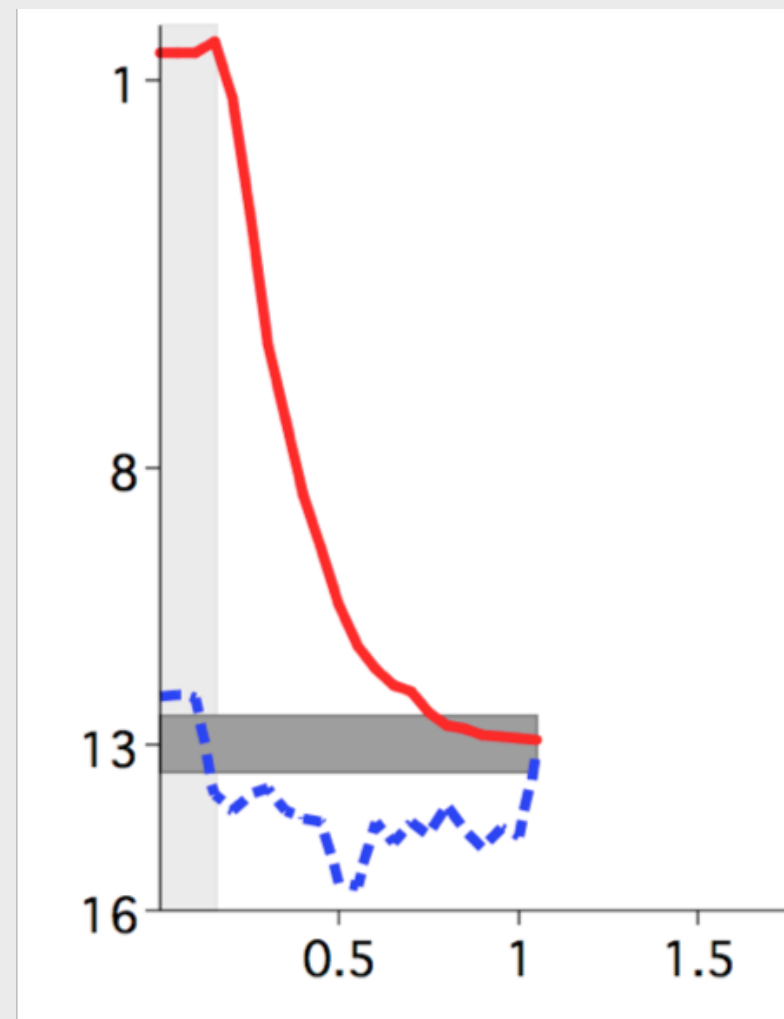
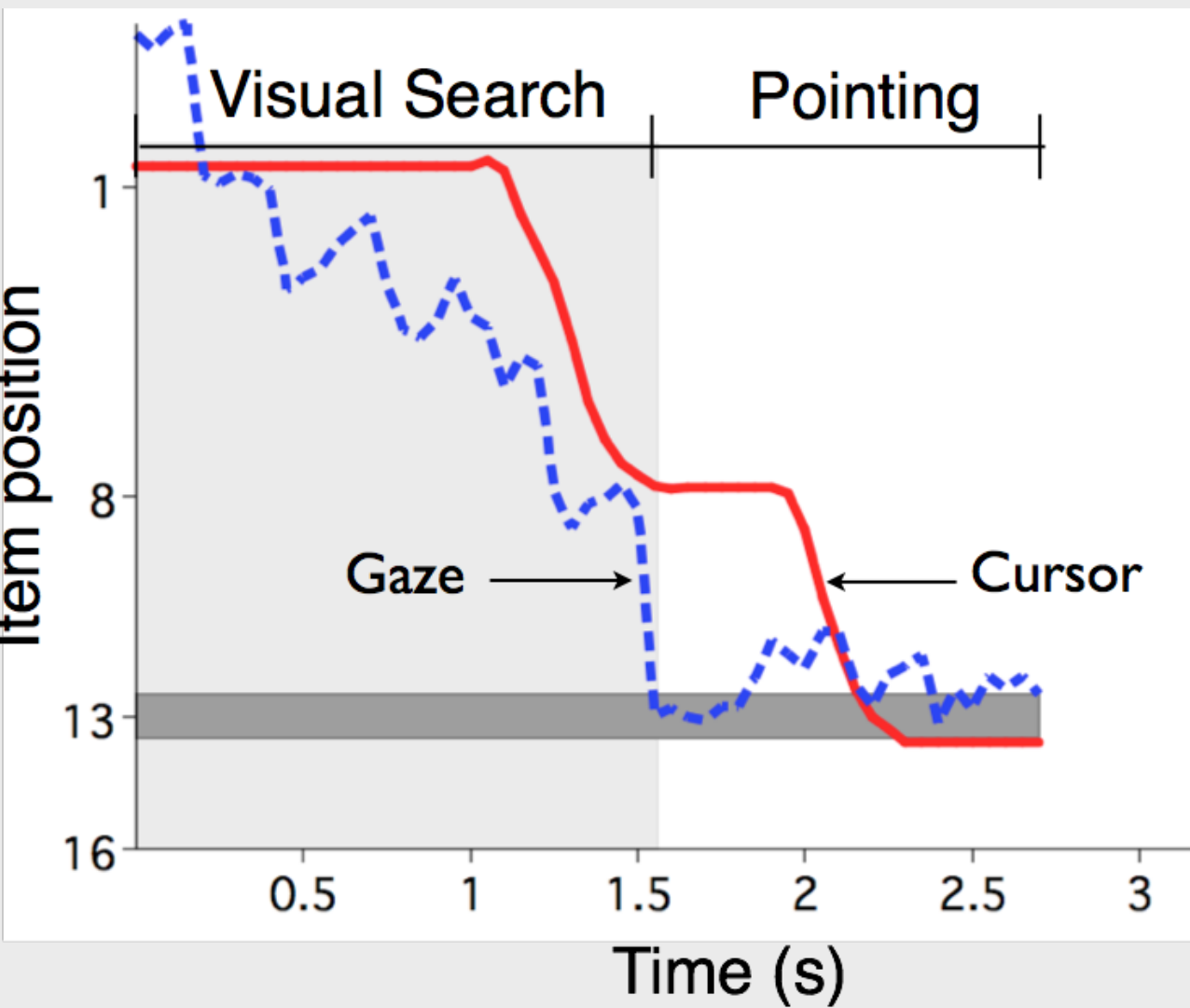
$$T_d = a_d + b_d * \log_2(I/Pi)$$

Brainstorming (30s)

Limitations & Possible Improvements



Inspection



Pointage

Label 1

Label 2

Label 3

 Label 4

Label 5

Label 6

Label 7

Label 8

Label 9

Saliency



Label 1

Label 2

Label 3

Label 4

Label 5

Label 6

Label 7

Label 8

Quit

Groups



Label 1

Label 2

Label 3

Label 4

Label 5

Label 6

Label 7

Label 8

Quit

Groups

Where is **Save As?**

Label 1
Label 2
Label 3
Save
Label 4
Label 6
Label 7
Label 8
Label 9

Semantic

Where is **Save As**?

Label 1
Label 2
Label 3
Save
Save As
Label 6
Label 7
Label 8
Label 9

Semantic

Command Selection

Gilles Bailly

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Telecom ParisTech