#### INF03 Expérience Utilisateur

8. Les lois de l'interaction

Aurélien Tabard

- Moore's law
- Buxton's law
- Fitts' law
- Hick's law
- Steering law
- Guiard's Kinematic chain model?
- Murphy's law

# Bilan heuristiques

- 0. Manque encore des réponses
- 1. Respecter le format...
- 2. Des heuristiques à clarifier ?
- 3. Limites des heuristiques ?
- 4. Comment gérer la sévérité ?

- Visibility of system status
- Match between system and <sup>-</sup>
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recal
- Flexibility and efficiency of us
- Aesthetic and minimalist designed
- Help users recognise, diagno and recover from errors
- Help and documentation

#### Why laws?

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#### Moore's law

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"The complexity for minimum component costs has increased at a rate of roughly a factor of two per year... Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least 10 years. That means by 1975, the number of components per integrated circuit for minimum cost will be 65,000. I believe that such a large circuit can be built on a single wafer."

[Moore, Gordon E. (1965). "Cramming more components onto integrated circuits". Electronics, Volume 38, Number 8, April 19, 1965.]

#### Moore's law illustration

Microprocessor Transistor Counts 1971-2011 & Moore's Law



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#### Moore's law implications

Don't worry too much about:

- computing power
- storage capacity
- screen resolution
- device size
- weight
- battery life (?)

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#### Fitts' law

The time to acquire a target is a function of the distance to and width of the target.



#### Fitts' law





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#### Fitts' law

Movement 
$$\longrightarrow MT = a + b \log_2(\frac{D}{W} + 1) \longrightarrow \text{Index of}$$
  
Time (MT)  $\longrightarrow \text{Difficulty (ID)}$ 

- Time to position mouse proportional to Fitts' Index of Difficulty ID.
   i.e. how well can the muscles direct the input device
- Therefore speed limit is in the Intercept (a) eye-hand system, not the mouse.



ID



# Implications of Fitts' law

Larger targets are easier to hit -> maximize button size

List of Invoice

 Archive Delete Copy Print Send Enter Payment Pay Online
 Invoice 
 Client Name Description Date

Movement time increases (logarithmically) with distance -> minimize distances -> no movement is even better!

Infinite targets:-> leverage screen borders-> leverage corners



# Bigger Is Not Always Better

# Movement direction to target



Logarithmic improvements with size



#### Fitts' law application to menu selection



Back Forward Reload Page Open in Dashboard...

View Source Save Page As... Print Page...





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#### Quiz

Microsoft Toolbars offer the user the option of displaying a label below each tool. Name at least one reason why labeled tools can be accessed faster. (Assume, for this, that the user knows the tool and does not need the label just simply to identify the tool.)

You have a palette of tools in a graphics application that consists of a matrix of 16x16-pixel icons laid out as a 2x8 array that lies along the left-hand edge of the screen. Without moving the array from the left-hand side of the screen or changing the size of the icons, what steps can you take to decrease the time necessary to access the average tool?

A right-handed user is known to be within 10 pixels of the exact center of a large, 1600 X 1200 screen. You will place a singlepixel target on the screen that the user must point to exactly. List the five pixel locations on the screen that the user can access fastest. For extra credit, list them in order from fastest to slowest access.

Microsoft offers a Taskbar which can be oriented along the top, side or bottom of the screen, enabling users to get to hidden windows and applications. This Taskbar may either be hidden or constantly displayed. Describe at least two reasons why the method of triggering an auto-hidden Microsoft Taskbar is grossly inefficient.

Explain why a Macintosh pull-down menu can be accessed at least five times faster than a typical Windows pull-down menu. For extra credit, suggest at least two reasons why Microsoft made such an apparently stupid decision.

What is the bottleneck in hierarchical menus and what techniques could make that bottleneck less of a problem?

Name at least one advantage circular popup menus have over standard, linear popup menus.

What can you do to linear popup menus to better balance access time for all items?

The industrial designers let loose on the Mac have screwed up most of the keyboards by cutting their function keys in half so the total depth of the keyboard was reduced by half a key. Why was this incredibly stupid?

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#### Steering law

W

h

Format Arrange	View Window	v Help		
Font Text Table Chart Shape		Hide Fonts Bold Italic Underline Outline	ЖТ ЖВ ЖI ЖU	
Copy Style Paste Style	<b>℃#C</b> ∖€#V	Bigger Smaller	₩+ ₩—	
Mask Mask With Shape Reapply Master t Advanced	☆೫M o Selection ▶	Kern Ligatur Baseline	•	Use Default Use None Use All

$$T_n = \underbrace{a + b \frac{nh}{w}}_{\text{w}} + \underbrace{a + b \frac{w}{h}}_{\text{h}}$$
  
=  $2a + b(\frac{n}{x} + x)$  with:  $x = \frac{w}{h}$ 

#### Steering law on curved paths

C is the path parameterized by s:

average time to navigate through the path

$$\begin{array}{c} \downarrow \\ T = a + b \int_{C} \frac{ds}{W(s)} \leftarrow \quad \text{width of the path at s} \\ \uparrow \quad \uparrow \quad \uparrow \quad \end{array}$$

experimentally fitted constants

# Steering Law applications

- Early work focused on car driving scenarios and models with straight tunnels
- · Various example tunnel shapes have been explored



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#### Hick's law



#### Hick's law



Number of alternative stimuli

#### Hick Law Examples

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http://www.hier-luebeck.de/wp-content/uploads/2010/09/StartMenueWindows7.jpg



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#### In another context...



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#### A human capability



From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

"Under standard conditions, the spontaneous writing speed of adults is **reduced** by some **20%** when instructions **prevent the non-preferred hand** from manipulating the page"

Non-dominant hand provides a frame of reference for the dominant hand

- Non-dominant hand operates at a coarse temporal and spatial scale;
- Dominant hand operates at a fine temporal and spatial scale

#### Two handed-interaction at the desktop



From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

# Application - how do people hold tablets?



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# "Whatever can go wrong, will go wrong."

[Edward Aloysius Murphy Jr., 1949]

"If there's more than one possible outcome of a job or task, and one of those outcomes will result in disaster or an undesirable consequence, then somebody will do it that way."

#### Implications of Murphy's law

#### Prepare for human errors, wrong input etc.

- do sanity checks in dialogs
- provide useful defaults
- make serious mistakes hard
- When building stuff, provide extra time for:
  - mistakes in manufacturing
  - non-functioning tools
  - faulty material
  - misunderstandings

#### Semaines à venir

04 avril 2017 : Steven Houben

11 avril 2017 : Banalisé projet

25 avril 2017 : Présentation des projets

- 25 minutes d'exposé
- ► ~10-15 minutes de présentation
- ►~10-15 minutes de discussion

05 mai 2017 : Examen écrit