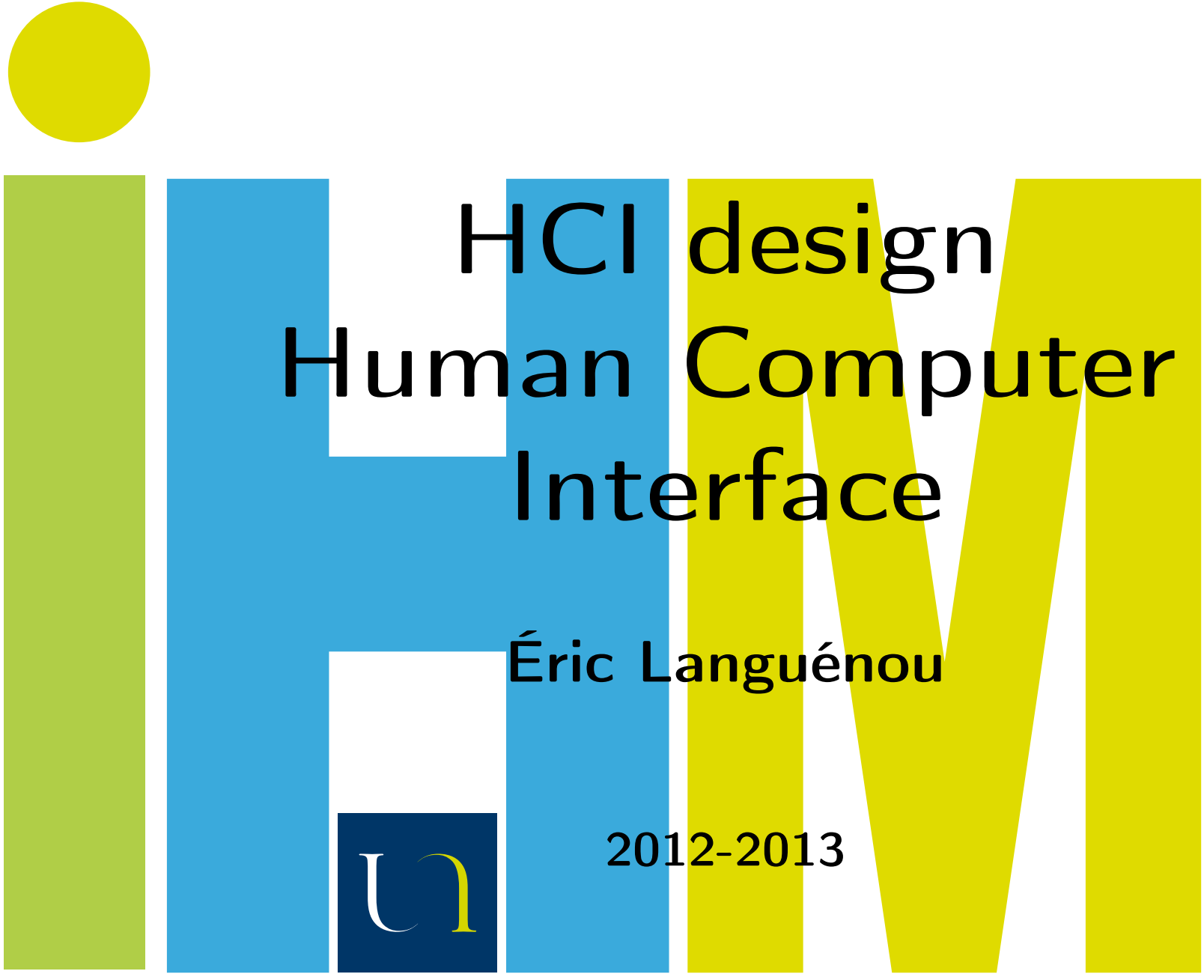

HCI design
Human Computer Interface

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2012-2013

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Motivations

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The screen is the medium

- relevant informations presentation.
- the information organization influences the user mental construction
- a good organization reduces the mental effort
- the task studies directs the interface design

Plan

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Ergonomy Rules

- Information placement
- graphical composants
- colors
- latency (waiting time)

Part I : Information placement

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- choosing the information to be shown
- spatial organization of the information
- a standard must be chosen
- fonts and styles

Choosing the information to be shown

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Only the data needed to the decision task

- usually too many technical data
- the mental load of the user must be taken into account
- the designer has to know the importance of each data in the decision process

Avoid too many data on the screen

- depends on the user class and the type of software
- helping pop-ups can be used

Choosing the information : more

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All the data needed for the decision process

- each screen must be :
  - self-sufficient
  - dedicated to an idea or a specific task

Avoid back and forth between screens

- the fullfillment of a task must be done without the help of another screen
- usually, a change of screen is mentaly associated with a the fullfillment of a task (*closure Gestalt*)
- the human short-term memory is emptied after a change of screen
- avoid the need for the user to memorize the previous screen

Choosing the information : more

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Error messages

- must be complete (provide all necessary data)
- easily understood(not too technical)

```
IO Error 22
```

- do not need a manual

```
Error W1409
```

- help the user to fix the error

```
file name too long
-> file name must not exceed 8 characters
```

Arrangement / design of controls

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the upper-left corner of the screen is read first

- searching for important data in a diagonal reading process (western writing culture specific)

Entity logical grouping

- reasonable number of entities per group and reasonable size of entity
- reasonable number of groups

Symetry and balance are important

- use space filling between groups
- use centering

Devising an Interface standard for all the screen

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A common design for the screens

- fonts
- buttons
- borders
- colors
- menu positioning/ status messages/ errors messages

Be faithful to your standard

- usually, a generic screen is devised.
- then, the specific screens are derived from the generic screen

Fonts and styles

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Limit yourself to a single font or two

- a font must be associated with a meaning (e.g. Courrier for filenames, Helvetica for button name)
- avoid funny fonts (no "comic sans ms", never...)
- avoid serif fonts (to many details which make the reading uneasy), prefer "sans serif fonts" (Helvetica, Arial...)

Avoid change of font style

- avoid switch between black, italic, underscore,
- avoid switch in caractere

Avoid capitals

- associated with scream
- uneasy to read
- restricted to titles and groups
- SMALLCAPS can be used instead

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Graphic entities

- text
- nombers
- buttons
- menus

Text display

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What kind of use

- icon description, command description, function description
- system messages, status messages
- instructions
  - drives the user
  - is sometimes interactive
  - usually, related to the manual

Rules

- avoid acronyms (prefer the whole word)
- prefer a left justify text
- do not right justify labels columns

Numbers display

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- integers must be right justified (easiest comparison)
- commas must be aligned for real values
- avoid meaningless zeros
- big numbers must be grouped by three digits

Labels and Input Fields

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Information entities (labels) and input fields must be visibly different (e.g. using a cursor display)

Using various

- style
- constrast
- color
- intensity

Buttons

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Large enough buttons

- reduce the duration to perform the action (Fitts law)

Keep a same size across the interface

- various button sizes are associated with various meaning and thus generate questions
- the variation is allowed for specific use : buttons rows, important frequency of use

Buttons grouping

- by function similarity
- by modal dialog box (that forces the user to answer before anything else)

buttons : more

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- Use a Capital as first character of the word
- Use small non ambiguous terms
- The chosen location for important buttons (OK, cancel) is crucial
- those places must remain the same on all screen
- invalidate inactive buttons (grey label, grey button)

Menus

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- organized according to corresponding tasks
- stay coherent with the terminology of the software (and the manual)
- use dots at the end of the word to inform the user of the necessary to add information in the following actions (save as...)
- invalidate inactive menus (grey words, grey label)
- do not hesitate to use check boxes and radio boxes in the menus
- no more than two levels of imbrication in the menu or else :
  - too complicated
  - hide some choices
  - hard to manipulate
- use (and inform the user about) shortcuts

Part III : colors

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Use of colors in order to:

- focus attention (e.g. on a warning)
- differentiate parts (e.g an element of a group, a particular status)
- group together (e.g. similar properties or functionalities)

Mauvais exemple :

Bon exemple :

Color Ergonomy

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Number of colors per screen (Post, 1997)

- depends on the kind of colors and of the associated tasks
- the use of too many colors implies a harder perception. The important entities are no more highlighted
- reduce the use of various colors (depending on the kind of software)

how many colors ?

- text editor : 3 colors (Van Nes, 1986)
- identification by color : no more than 6 colors (AFNOR, 1997)
- use an explanation screen if more than 6 colors
- use colors which are distant in the visual spectrum
- beware of blue (the fovea is less sensible to blue)

Color Ergonomy

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what about images

- color images must be placed on a grey background (black,grey or white)
- grey images on colored background

in order to provide :

- better contrast
- better entity detection

Color Ergonomy

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Distance and view angle influence perception (norme ISO 9241) :

- avoid red and green if view angle is $>$ 40 degrees
- avoid yellow if $>$ 40 degrees
- avoid blue if $>$ 60 degrees
- avoid saturated colors and high muminance for a distance $>$ 60 cm
- avoid saturated colors on dark background for a distance $>$ 60 cm

Color Ergonomy

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Nom	Numéro	Date limite	Reçu
Smith, J.	183-678	25/06/01	Oui
Mayhew, D.	253-860	15/07/01	Non
Jones, R.	143-898	25/06/01	Non
Booker, P.	432-751	15/07/01	Non
Murphy, L.	333-761	25/06/01	Non

illust : Bastien

Task : select persons who did not suscribe before end of june

- reading and select within two colums (date limite and reçu)

Color Ergonomy

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Nom	Numéro	Date limite	Reçu
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Murphy, L.	333-761	25/06/01	Non

Task : select persons who did not suscribe before end of june

- green : payment receipt
- red : time exceeded
- white : no time exceeded no payment receipt

Task: who did not subscribe ?

Color ergonomy

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Allow color parameterization

- to prevent problem related to bad color perception ("colorblind")
- to follow user habits
- to adapt with working environment (lighting conditions)

Inconvenients related to full parameterization

- time consuming
- ergonomy issues

Alternative : allow a choice within a verified subset of colors

- together with an expert mode
- time consuming

Color Ergonomy

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	Chinese		American	
Concept	Color	%	Color	%
Safe	Green	62.2	Green	61.4
Cold	White	71.5	Blue	96.1
Caution	Yellow	44.8	Yellow	81.1
Go	Green	44.7	Green	99.2
On	Green	22.3	Red	50.4
Hot	Red	31.1	Red	94.5
Danger	Red	64.7	Red	89.8
Off	Black	53.5	Blue	31.5
Stop	Red	48.5	Red	100.0

SOURCE: Courtney, A.J. (1986). Chinese population stereotypes: Color associations. *Human Factors*, *28*(1), 97-100.

Concept-color association

Chromostereo Effect

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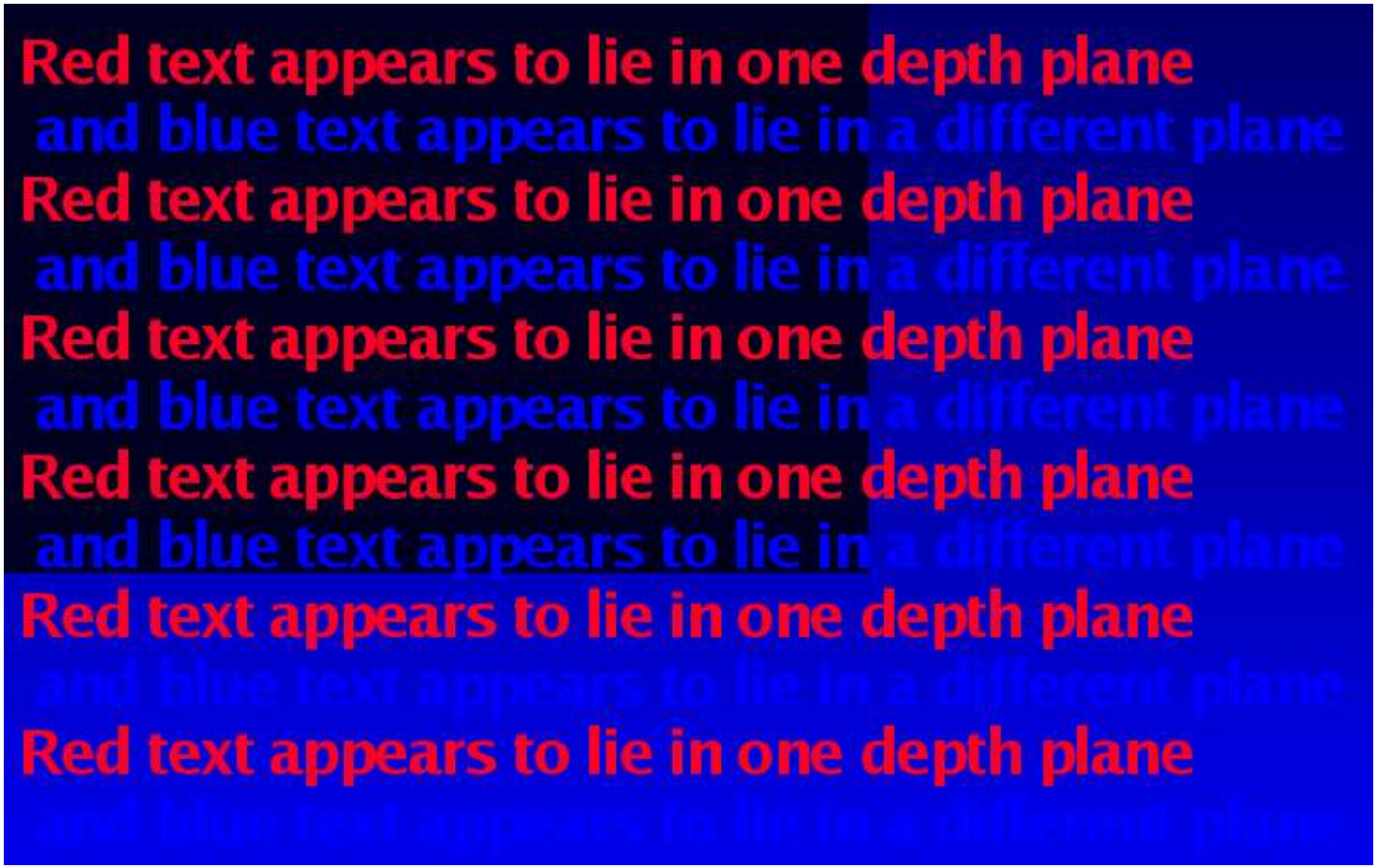

Advises for interface design

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- start with a black and white concept
- only use colors when the interface ergonomy is improved
- use colors to organize and show relationships
- use colors to improved the search task (within la ist)
- use colors to focus attention
- promote a redundant design (color/symbol)
- do not use colors without a corresponding specific meaning

Part IV : latency management

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Objectives :

- to show that the user waiting time is taken into account
- offer solutions

Time is important

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- soft architecture, algorithms, data structures influence latency
- sometimes, the latency is part of the application life cycle (optim/real time)
- waiting generates stress

Real time and perceived time [Bickford, Apple]

- measured time (universal time)
- user perceived time : no framework, depends on the cognitive load

Illustration : copy of a bunch of files

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option 1 : frozen interface (no information on the progression)

- less measured time
- greater perceived time
- no cognitive task, waiting attitude (with no information on the duration)

option 2 : progress bar

- slower task (HCI dialog with the system, progress bar upgrade
- smaller perceived duration (associated with a flexibility/speed notions)
- cognitive task : controlling the progress, other tasks

Ergonomy tests

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The tests are conducted using a direct designation (keyboard, mouse, trackball) and feedback (the button is shown pressed)

Results

- If latency is greater than 200ms
  - error rate increase
  - perturbed use
  - inefficiency feeling
- If latency is greater than 8 sec, serious questions about stability
- perceived latency depends on the perceived complexity of the task

Which consequences on HCI ?

- a small latency for the interaction is crucial
- inform the user about the state (frozen) of the app

Technics related to the waiting period

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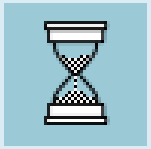
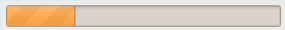
- sandglass as cursor



- progress bar



- descriptive task list progress

Sandglass as cursor

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- inform the user about the still running status
- no information about the duration
- suitable to short duration (1 to 10 secondes)
- no abort status

Implementation

- the mouse works using a software interrupt
- the mouse is continuously drawn

Progress Bar

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Progress bar

- allows an estimation of the waiting duration (and to self organize accordingly)
- is suitable for duration > 10s

Always allow the user to interrupt the task

- because the task has been chosen by mistake
- because the progress bar indicates that the duration will be too large

Consequences of a task interruption

- the app must return in the previous state
- this could be very difficult in some case (network, etc...)

Progress Bar : implementation

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The critical problem of the progress bar upgrade

the event loop must be continuously executed in order to refresh the windows

- or else the task must be cut into micro sub-tasks, and the interface is upgraded after each sub-task(paint/update)
- problem : some tasks are not cuttable
- modularity principle is broken

or parallelization

- by fork/thread concept
- communication between processus
  - critical sections of codes must be known
  - synchronization mechanisms

Stop or Abort of a task

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taking into account from the beginning of the problems related to IHM

- foreseen the undo process, getting back to a stable state or in the previous state
- some tasks are not stoppable : the user must be warn

Ergonomy - Conclusion

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Good organization of information and of the tasks

- choices
- locations
- groups
- colors
- fonts

Coherency between each screen

- fonts
- appearence
- border
- colors

Good error handling

- understandable error messages
- advise the user instead of critics