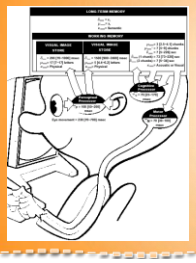
Universidade de Aveiro
Departamento de Electrónica, Telecomunicações e Informática



The user

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deti departamento de electrónica telecomunicações e informática — universidade de aveiro

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Outline

- Human Information Processing System (HIPS)
  - Senses
    - Sight, Hearing, Touch, Smell, Taste
  - Memory
  - Perceptual sub system
  - Cognitive sub-system

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Introduction

- Humans have different capabilities that might be considered when designing interactive systems
- Information is received through various I/O channels
- Information is stored in memory
- Emotions might influences capabilities
- Users share commons characteristics but with difference that cannot be ignored

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User profile

- Human Information Processing System (HIPS)

- Knowledge and experience
- Work and task
- Physical characteristics
- Environment
- Tools

Variable among users

There are many user models to be used in the design of Interactive systems

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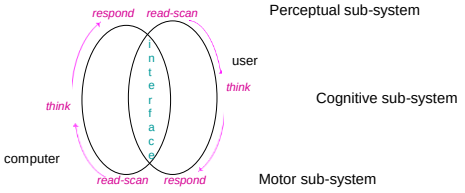
Human Information Processing System (HIPS)

Dialog in an interactive system



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Human Information Processing System (HIPS)

Sensorial sub-systems — Senses

Perceptual sub-system
- memory – perceptual buffer (iconic, echoic, …)
- process – pattern recognition

Cognitive sub-system
- memory
  - short term/working memory (STM)
  - long term memory (LTM)
- processes
  - selective attention
  - problem resolution
  - learning
  - …

HIPS bottleneck

Motor sub-system

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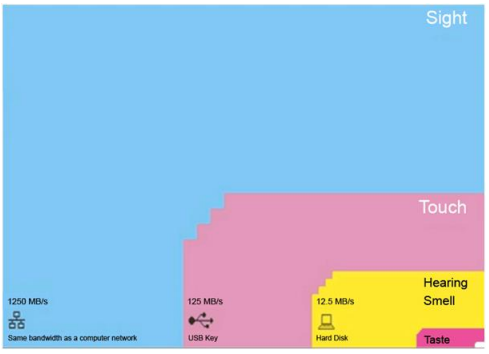
Sensorial sub-system – I/O

- Input: 5 senses
  - Some more relevant than other
  - For HCI, vision is preferred
- Output: communication system
  - vocal, movements, lips,…

Why vision is preferred



Danish Physicist - Tor Nørretranders

0.7% we are aware of

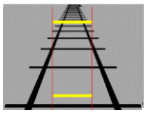
Vision

- Relevant for HCI
  - Compensate movements and illumination changes
  - Context used to solve ambiguities
  - May be tricked: Visual illusion came from excessive compensation.

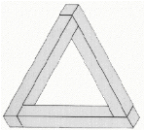
Visual Illusions

Visual Illusions illustrate that what we see does not depend only of the stimulus

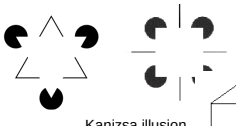
- bring out particular good adaptations of our visual system to standard viewing situations
- under some artificial manipulations can cause inappropriate interpretations of the visual scene



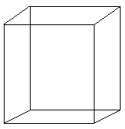
Ponzo illusion



Pennrose triangle: Impossible object?

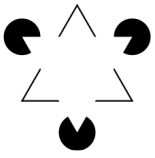


Kanizsa illusion



Necker cube

Visual Illusions



Kanizsa illusion:

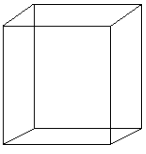
Although there are no actual triangles a sort of pattern recognition phenomenon is triggered and the image is interpreted as two overlapping triangles (simple explanation)

https://en.wikipedia.org/wiki/Illusory_contours

Necker cube:

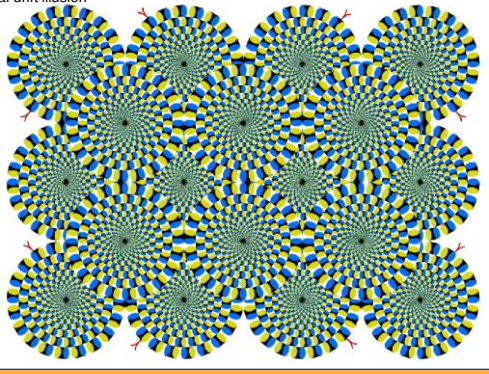
Cube with no visual cues as to its orientation; it can be interpreted to have either the lower-left or the upper-right square as its front side

https://en.wikipedia.org/wiki/Necker_cube



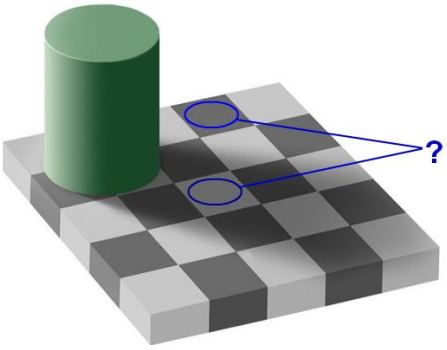
Visual Illusions - Movements

Peripheral drift illusion



Ilusões visuais - Contraste

Adelson's "Checker-shadow illusion"



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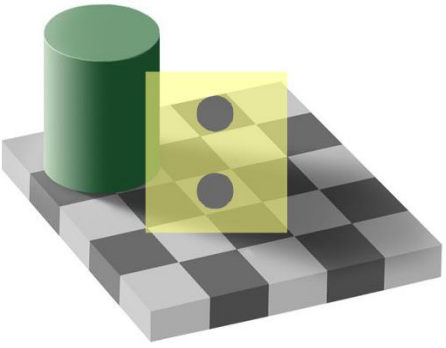
Ilusões visuais - Contraste

Adelson's "Checker-shadow illusion"



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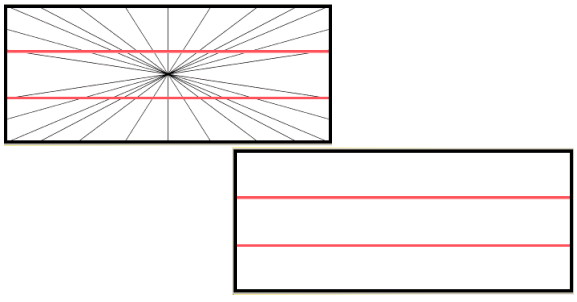
Visual Illusions – Geometry and angles

Hering Illusion



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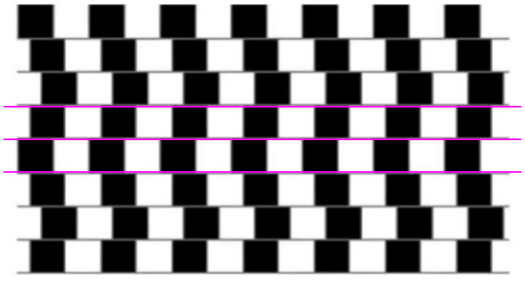
Visual Illusions



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Pattern Recognition

- Process that matches information from a stimulus with information retrieved from memory
  - very powerful process
  - subconscious
  - does not use only current data
  - solves ambiguities

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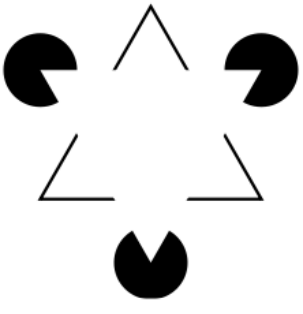
Pattern recognition



(Kaniza illusion, Wikipedia)

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Pattern recognition

Aoccdrnig to a rseearch sduty at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

http://www.positscience.com/games-teasers

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Other senses

- Audition
  - Information on direction, objects and distance
  - Only sense that is really 3D
  - Cannot be “turned off”
  - Human hearing - 20Hz to 15KHz
  - Filtering is possible (Background noise – cocktail party example).

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Other senses

- Touch
  - Important feedback
  - Key senses or people with sight problem
  - Several receptors in skin:
    - Termoreceptors: cold and hot
    - Nociceptor: pain
    - Mecanoreceptor: pression
  - Some areas more sensitive (fingers).

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Othet senses

- Smell and Taste
  - High latency
  - Difficult use in HCI

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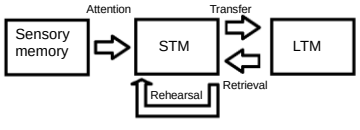
Memory

The Atkinson–Shiffrin model (1968) asserts that human memory has three components:

- Sensory memory
- Short-term memory / working memory
- Long-term memory



https://en.wikipedia.org/wiki/Atkinson%E2%80%93Shiffrin_memory_model

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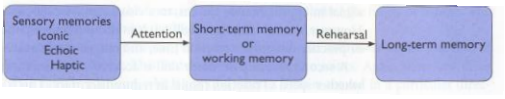
Human Information Processing System - Memory

- The Atkinson–Shiffrin model (1968) memory has three components
  - Sensory memory / iconic memory, very short
    - 1 a 2 seconds
  - Short-term memory / working memory
    - +/- 18 seconds, 7+/-2 items
  - Long-term memory



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Short Term Memory

- Working memory:
  - Mental calculus (6*35)
  - Reading (understand a sentence)
  - …
- Characteristics:
  - Quick acess +/- 70ms
  - Quick forget +/- 200ms
  - Limited capacity 7 +/- 2
  - Can be increased with chunking, to enter long-term memory

Short Term Memory: chunking

265397620853

351 234 370 545

HEC ATR ANU TH ETR EETP

THE CAT RAN UP THE TREE

Short Term Memory (STM)

649325401741 → 12 digits

111122223333 → 3 digits and a rule

234370200 351 234 370 545

Portugal Aveiro University area IEETA building

These numbers correspond to different "chunks"

Chunk: the largest meaningful unit that a person recognizes; depends on the person knowledge

Long-term Memory

- Long-term memory
  - Slower access (+/- 1/10 sec)
  - Practically infinite in size and duration
  - Elaborative rehearsal transfers chunks to long-term memory

Long-term Memory - LTM

- 3 process related to LTM:
  - Storage/remembering
  - Forgetting
  - Information retrieval

Long-term Memory - LTM

- Storage/remembering:
  - Repetition (from STM to LTM)
  - Remembered information related to repetition time (Total time hypothesis)
  - Time distribution improve learning
  - Structure, significance and familiarity easier to remember.
    - Ex: more difficult to remember abstract terms than objects

Long-term Memory - LTM

- Forgeting, two theories
  - Decay
    - Information is lost gradually but slowly
  - Interference
    - More recent information replace older information
    - Old information might interfere with more recent two
      - Ex: Phone number changing
  - It is not sure that we forget!

Long-term Memory - Recognition vs. Recall

- Information retrieval - Recognition vs. Recall
  - Recognition: remembering with the help of a visible cue
    - aka “Knowledge in the world”
  - Recall: remembering with no help
    - aka “Knowledge in the head”
- Recognition is much easier
  - so menus are more learnable than command languages

Emotion

- Various theory how it works
- Involves cognitive and physical response to stimuli
- Biological response to a physical stimuli is called affect
- Affect Infuence how we react to situations
  - “Negative affect can make it harder to do even easy tasks; positive affect can make it easier to do difficult tasks”

(Donald Norman)

Emotion

- Implications for interface design
  - stress will increase the difficulty of problem solving
  - relaxed users will be more forgiving of shortcomings in design
  - aesthetically pleasing and rewarding interfaces will increase positive affect

Selective attention

Occurs when we block out certain features of our environment and focus on one particular feature

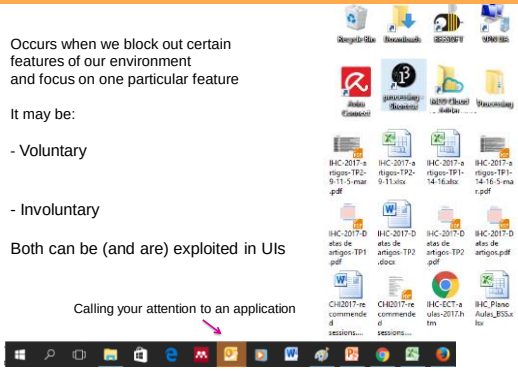
It may be:

- Voluntary

- Involuntary

Both can be (and are) exploited in UIs

Calling your attention to an application



http://study.com/academy/lesson/selective-attention-definition-examples-quiz.html

Selective attention - example

Book
Pencil
Slide
Window
Car
Hat

Selective attention - example

Green
Orange
Red
Black
Pink
Blue

Selective Attention

- Exemplo Youtube
  - http://www.youtube.com/watch?v=vJG698U2Mvo&feature=related

HIPS Strengths and weaknesses (*versus* computer)

Strengths	Weakesses
LTM infinite capacity	STM limited capacity
LTM duration and complexity	STM limited duration
Capacity to learn	Error prone processing
Powerful selective attention	Non reliable access to LTM
Powerful pattern recognition process	Slow processing

Recommendation:
Assign tasks between user and computer according to the capacities of each

Example: minimize the users STM load
do not ask the user to perform computations

User Profile- other characteristics

- Experience and knowledge - education and reading level
  experience with the system and task
  mother language
  computer literacy …
- Work and task - usage frequency
  training
  usage type (mandatory, optional)
  usage of other systems …
- Physical Characteristics – color vision deficiencies
  physical deficiencies
  handedness
  age …

User Profile- other characteristics

- Physical Characteristics
  - Long term
    - color vision deficiencies, physical deficiencies, handedness, age
  - Short term
    - Stress, fatigue

User Profile- other characteristics

- Experience and knowledge
  - education and reading level
  - experience with the system and task
  - mother language
  - computer literacy
- Work and task
  - usage frequency
  - Training
  - usage type (mandatory, optional)
  - usage of other systems …

How do these characteristics influence UI design?

- Much system experience, but low task experience -> more semantic help
- Much task experience but low system experience -> more syntactic help
- High usage frequency -> easy to use
- Low usage frequency -> easy to learn and remember
- Mandatory -> easy to use
- Optional -> easy to learn and remember
- Color (particularly red and green) should not be used as only cue to convey information
  - Etc., …

Conclusion

- Users are much different from UI designers
- Users vary a lot among thenselves
- Users change along time (evolve, forget...)

Final recommendation:
Consider the user as an unknown species and study it scientifically

Main Biography

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