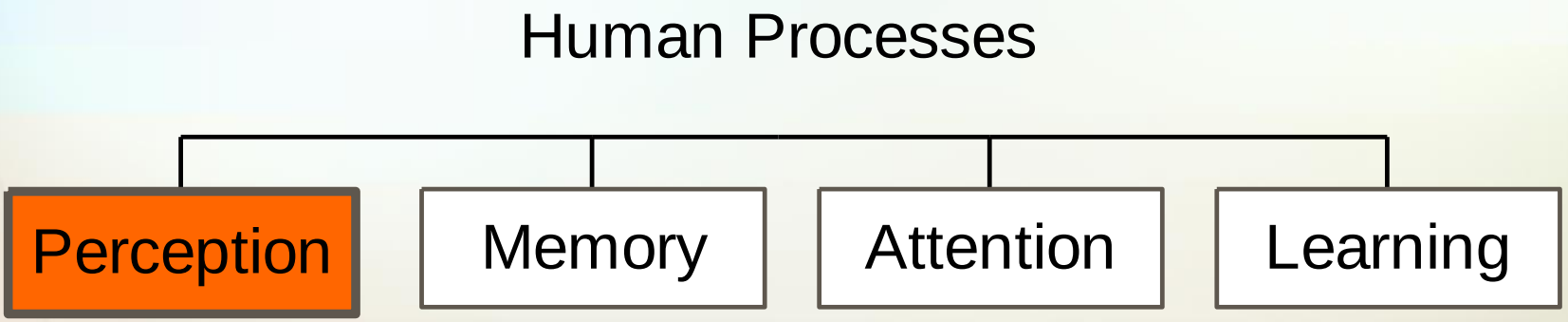
The User: Perception & Attention

Overview of Lecture

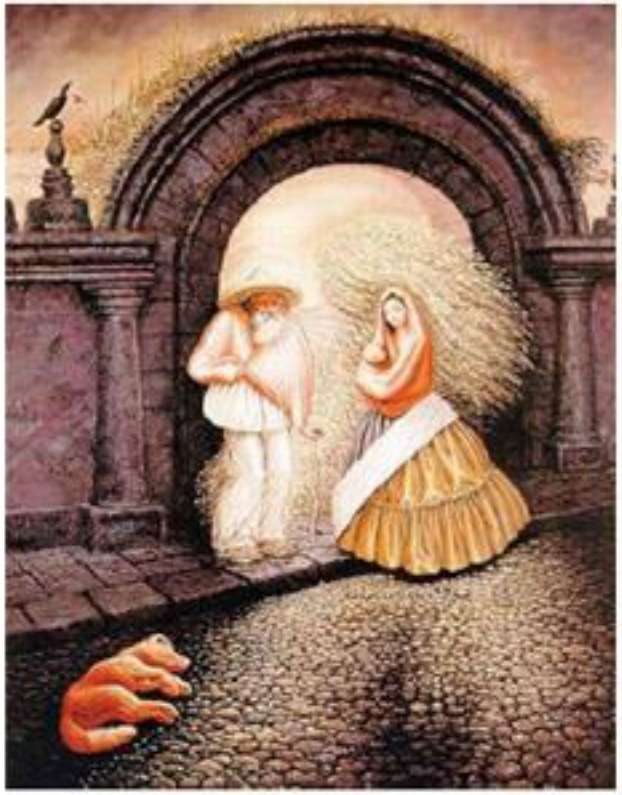
- Cognitive processes:
  - Perception
  - Attention

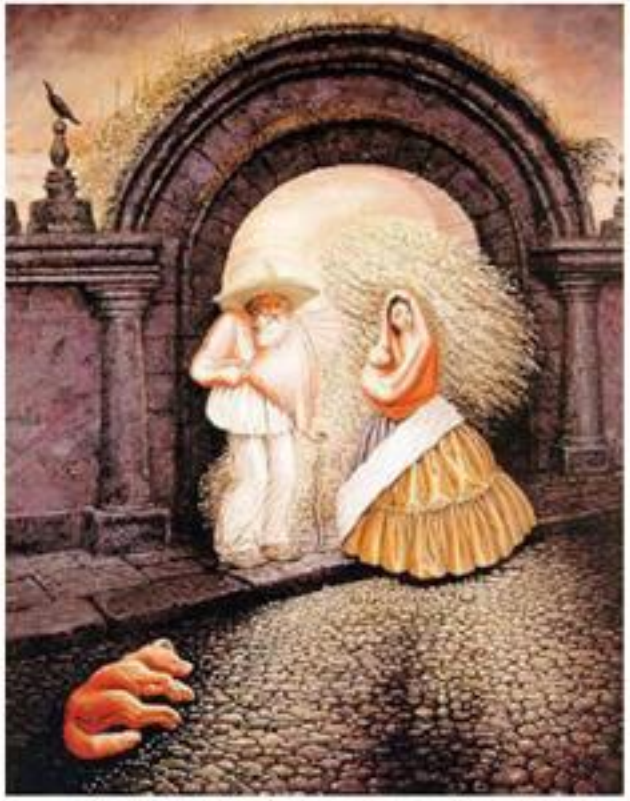
Cognitive Processes - Perception



Cognitive Processes - Perception

Are these 2 pictures the same?





Cognitive Processes - Perception

- *Perception* is fundamental to interacting with computers
- Perception can involve all the different senses (visual, hearing, touch, smell..)
- To date, mostly concerned with visual perception because screen is usually the interface

Cognitive Processes - Perception

- Two classes of Visual Perception Theory
  - Constructive
  - Ecological

Cognitive Processes – Perception
Constructive

Constructive perception: Anything perceived on a screen is also a result of our prior knowledge and expectations

Cognitive Processes – Perception

Constructive Example

Cognitive Processes – Perception

Constructive Example

- Prior knowledge of what a dalmation looks like helps us to construct the image
- Without prior knowledge, we would not able to make sense of the picture
- Once we know what the picture depicts it is impossible to perceive it as random dots again, we have a meaningful interpretation

Cognitive Processes – Perception

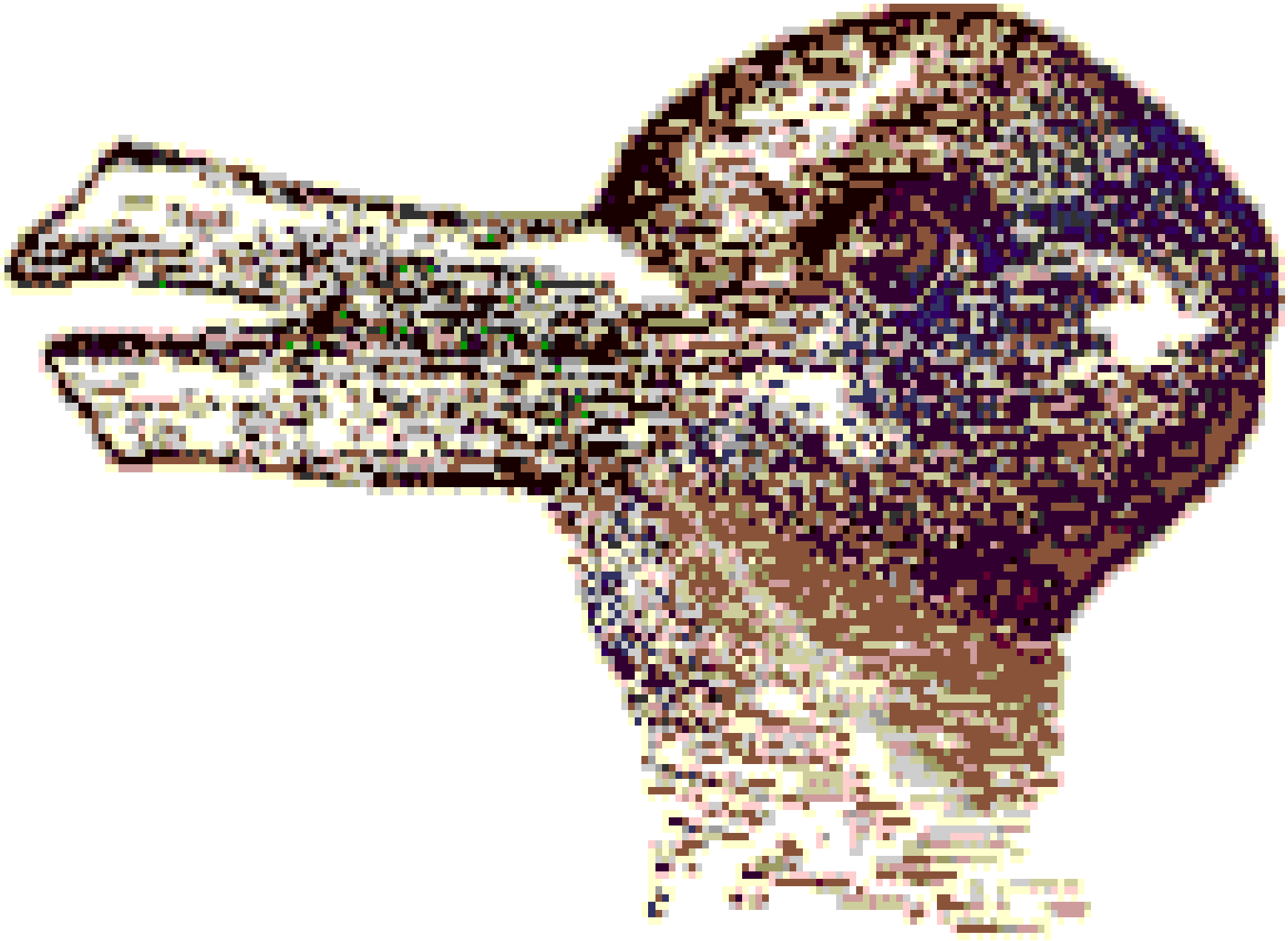
Constructive Example

- Constructivism uses context to interpret and understand what we perceive
- Not initially concerned with specific detail, more interested in the overall meaning of the scene

Cognitive Processes – Perception

Constructive Example

- **Which did you see – a seal or a donkey?**



Cognitive Processes – Perception
Constructive Example

- **Which did you see – a duck or a hare?**

Visual Perception
Constructive

Gestalt laws of perceptual organisation

'Laws' of perception that are regarded as being innate

- **Proximity**
- **Similarity**
- **Closure**
- **Continuity**
- **Figure-Ground**
- **Symmetry**

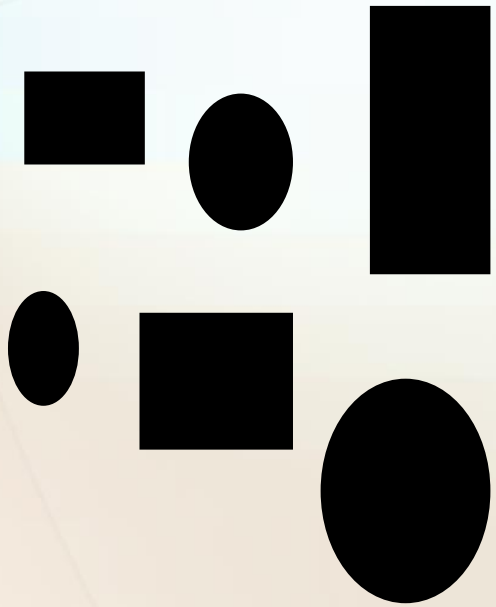
Visual Perception
Constructive

Proximity

- **The elements appear as groups rather than a random cluster of elements**

http://edition.cnn.com/ uses proximity

Visual Perception
Constructive



Similarity

- there is a tendency for elements of the same shape or colour to be seen as belonging together

Visual Perception
Constructive

Comment on the use of similarity in this photo ..

Visual Perception
Constructive

Use of Similarity (& Proximity)

Visual Perception
Constructive

Closure

- **missing parts of the figure are filled in to complete it**

http://www.youtube.com/watch?v=ne6tB2KiZuk - closure demonstrated in a different way

Visual Perception
Constructive

Use of Closure

Visual Perception
Constructive

Use of Closure

This example likely requires too much effort to allow closure to occur and the message may be lost.

This example makes it easy for closure to occur. Therefore the message is clear.

Visual Perception
Constructive

Continuity

- The eye will naturally follow a line or curve

Visual Perception
Constructive

Use of Continuity

Visual Perception
Constructive

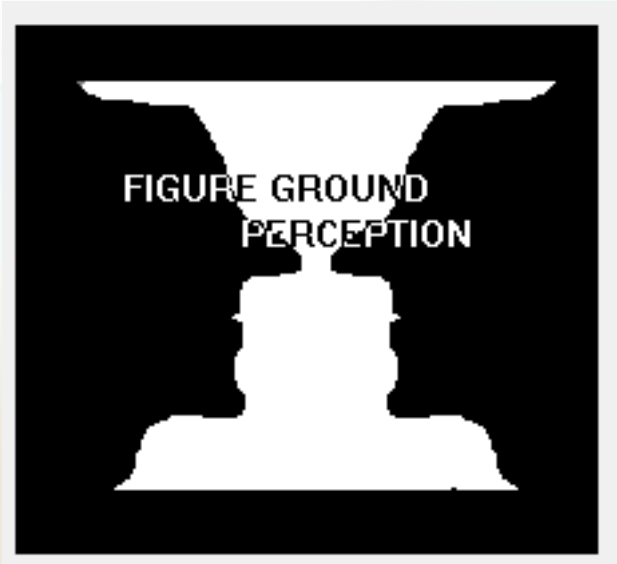
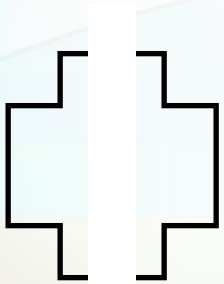
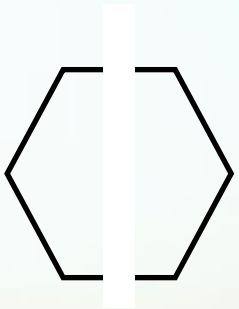


Figure-Ground

- Simplifies the visual scene into the figure that we look at and everything else is the background.

Visual Perception
Constructive





Symmetry

- **regions bounded by symmetrical borders tend to be perceived as coherent figures**

http://www.bbc.co.uk/news uses symmetry

Visual Perception
Constructive

Use of Symmetry

Cognitive Processes – Perception
Ecological

- **Ecological theory argues that visual perception is a direct process**

Cognitive Processes – Perception
Ecological - Affordance

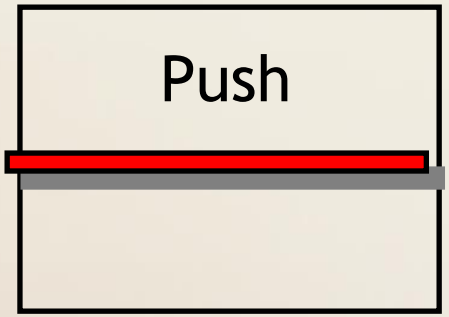
- A central concept of the ecological approach is the notion of affordance

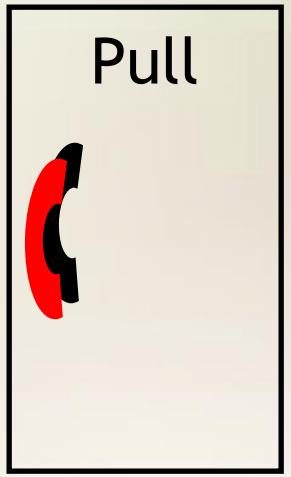
- When the affordance of an object is perceptually obvious (perceptual affordance), it is easy for us to know how to interact with it

- When the opposite is true, we tend to make mistakes when trying to interact with the object

Cognitive Processes – Perception
Ecological - Affordance

- **Scroll bars - intuitive to dragging upwards/downwards**
- **Door handle – good affordance for pushing/ pulling**





Cognitive Processes – Perception
Ecological - Affordance

- **Affordance is very important with regards to interface objects such as buttons, scrollbars etc. (direct manipulation systems)**

- **How are affordances affected with flat design?**

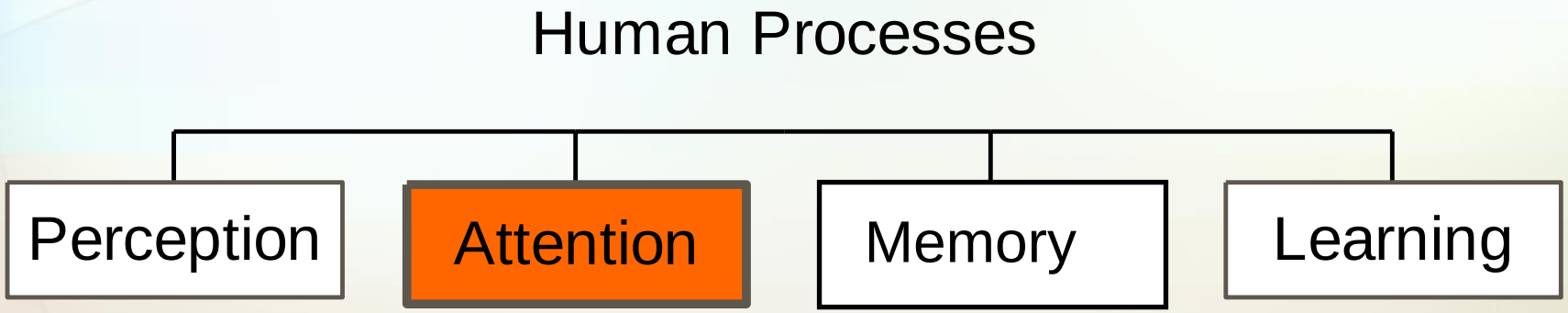
Exercise 1:

Let's look at the following 2 websites. How do they use the *Gestalt laws*?

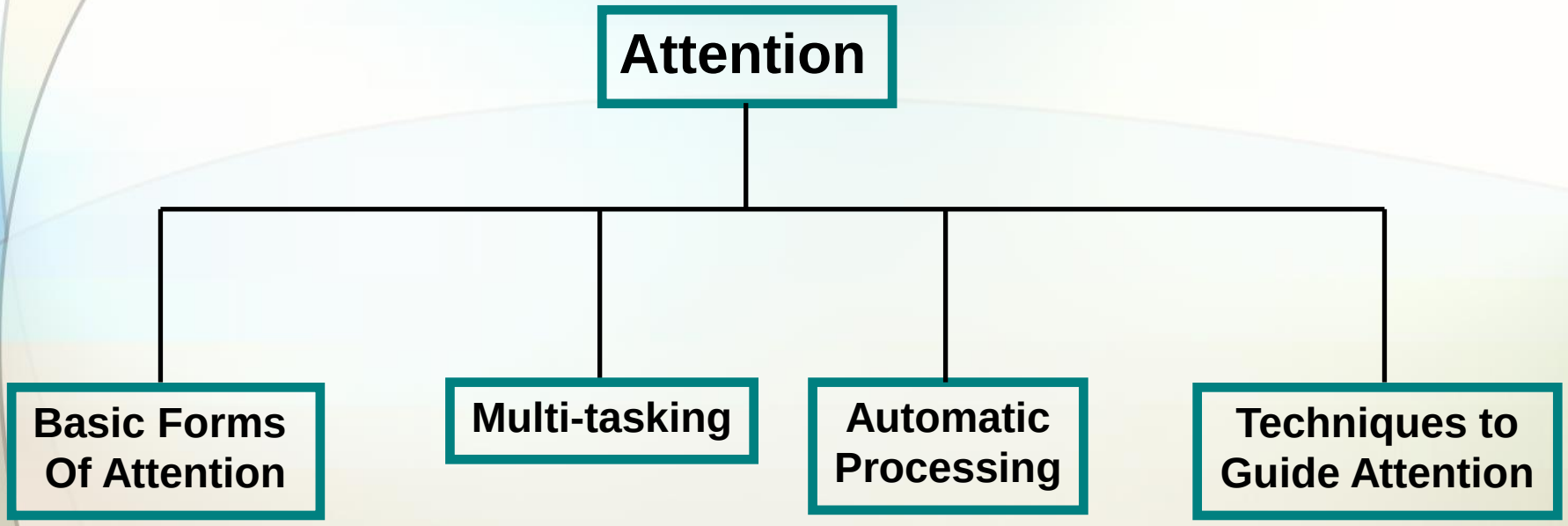
BBC

RTÉ

Cognitive Processes - Attention



Cognitive Processes - Attention



Cognitive Processes - Attention

Basic Forms of Attention

- Our ability to attend to one event out of a mass of stimuli is known as *focused attention*

- We are also capable of *divided attention*, e.g. driving while holding a conversation

- Attention may also be *voluntary* (we make a conscious effort to change our attention) or *involuntary* (a stimuli suddenly grabs our attention)

Cognitive Processes - Attention

Cognitive Processes - Attention

- How do you think that a user can be more focused?
  - One of the most important ways to help focus users attention to the information they need is to structure the interface so that it is easy to navigate through
  - Also, the perceptual laws of grouping should be used so that information can easily be perceived

Cognitive Processes - Attention

- The following slide contains an example screen from a hotel information system

- Answer the following questions from the example screen

  - What is the phone number of the Days Inn in Charleston?
  - Name the hotel that offers a double room for $33?

City	Hotel	Phone	Room Single	Room Double
Charleston	Best Western	575-3454	$23	$39
Charleston	Days Inn	878-3423	$20	$34
Charleston	Holiday Inn	234-4623	$36	$46
Charleston	Howard Johns	342-5728	$33	$47
Charleston	Ramada Inn	387-4523	$18	$28
Charleston	Sheraton Inn	764-5879	$40	$80
Charleston	Marda Hotel	476-5876	$26	$38
Columbia	Best Western	422-7567	$32	$50
Columbia	Carolina Inn	336-8711	$20	$25
Columbia	Holiday Inn	761-4765	$22	$33
Columbia	Howard Johns	487-8232	$34	$40
Columbia	Quality Inn	471-4762	$20	$35
Columbia	Ramada Inn	479-9897	$33	$47

Cognitive Processes - Attention

- The following slide contains an example screen from a different hotel information system

- Again, answer the following questions from the example screen

  - What is the phone number of the Holiday House?
  - Name the hotel that offers a double room for $27?

Pennsylvania
Bedford Motel/Hotel: Crinoline Courts
342-4657 S:$18 D:$28
Bedford Motel/Hotel: Holiday Inn
465-3865 S:$29 D:$36
Bedford Motel/Hotel: Midway
763-8623 S:$21 D:$26
Bedford Motel/Hotel:Penn Manor
654-9987 S:$18 D:$25
Bedford Motel/Hotel: Quality Inn
764-8766 S:$22 D:$29
Bradley Motel/Hotel: Holiday House
777-9898 S:$28 D:$24
Bradley Motel/Hotel: De Soto
7798-9836 S:$22 D:$25
Bradley Motel/Hotel: Holiday Inn
733-9851 S:$32 D:$27
Breezewood Motel/Hotel : Western Plaza
837-9373 S:$28 D:$29

Cognitive Processes - Attention

- In this example, the way information is structured at the interface has a major impact on our ability to find and attend to information

- In the original study, (Tullis 1984) average search times for a single item were 3.2 seconds for the first screen and 5.5 seconds for the second

- In the first screen, information is easier to find:
  - similar information has been grouped into categories
  - spacing is employed to facilitate the perceptual process

Cognitive Processes - Attention

What is Multitasking?

Cognitive Processes - Attention

The 1987 Northwest FL 255 crash was attributed to failure to extend flaps and slats for takeoff and non-performance of critical checklists.

Cognitive Processes - Attention

Automatic Processing

- Many activities that we carry out regularly become automated, we do them without really thinking about them

- Cognitive processes can also become automatic with practice

- Automatic cognitive processes are identified as
  - fast
  - demanding minimal attention and hence don't interfere with other activities
  - unavailable to consciousness

Cognitive Processes - Attention

The classic example used to demonstrate the phenomenon of automatic cognitive processing is the Stroop Effect

XHFG
EJHFU
EEF
KJBVN
DJEBSI
DJVBY
DKSNVL
SKHJSHE
FJJVN
EIJHFH
KSNNC
DSKA
KD
VNNVJR
EFJJIE
VKJNDS
EOEUJ
DJNVK
SSXZ
DJSD
DFJJNV
EIUGHBV

RED
YELLOW
BLUE
BLACK
GREEN
YELLOW
BLACK
RED
BLUE
GREEN
RED
GREEN
YELLOW
BLACK
GREEN
YELLOW
BLUE
RED
YELLOW
BLUE
GREEN
BLACK

Cognitive Processes - Attention

- It should have taken longer to say the colour names in the second list

- This is because in the second list there is a conflict between the automatic process of reading the words and the automatic process of perceiving the colours

- Difference between automatic and non-automatic cognitive processes
  - Automatic processes are not affected by the limited capacity of the brain
  - They require little attention and are extremely difficult to unlearn

Cognitive Processes - Attention

Implications for HCI design

- Consider a user who has learned a set of keyboard combinations for a particular word processor to the extent that they have become automatic processes

- If key combos have been changed -> major effort for the user to unlearn their automatic processes

- Leads to much frustration on the part of the user

- Potentially dangerous in critical applications such as process control plants

Terms of Reference

- Norman, D. (1990) *The Design of Everyday Things*
- Preece, J. et al. (2002) *Interaction Design*
- Shneiderman, B. & Plaisant, C. (2005) *Designing the User Interface*
- Benyon, D. et al (2005) *Designing Interactive Systems*
- Craik, K. (1943) *The Nature of Explanation*