COGNITIVE SCIENCE (ATTENTION)

HCI & WEB DESIGN – ROSANNE BIRNEY

OVERVIEW

- Attention
  - Visual attention
  - Auditory attention
  - Divided attention: multi-tasking

ATTENTION

- Selecting things to concentrate on at a point in time from the mass of stimuli around us
- Allows us to focus on information that is relevant to what we are doing
- Involves audio and/or visual senses

- Focussed and divided attention enables us to be selective in terms of the mass of competing stimuli but limits our ability to keep track of all events

INFORMATION-PROCESSING 'BOTTLENECKS'

- Our perceptual systems can process many pieces of information in parallel
- However, there are 'bottlenecks' in our information-processing system, where serial processing (one thing at a time) rather than parallel processing occurs
- Our cognitive processes must decide which piece of information to attend to

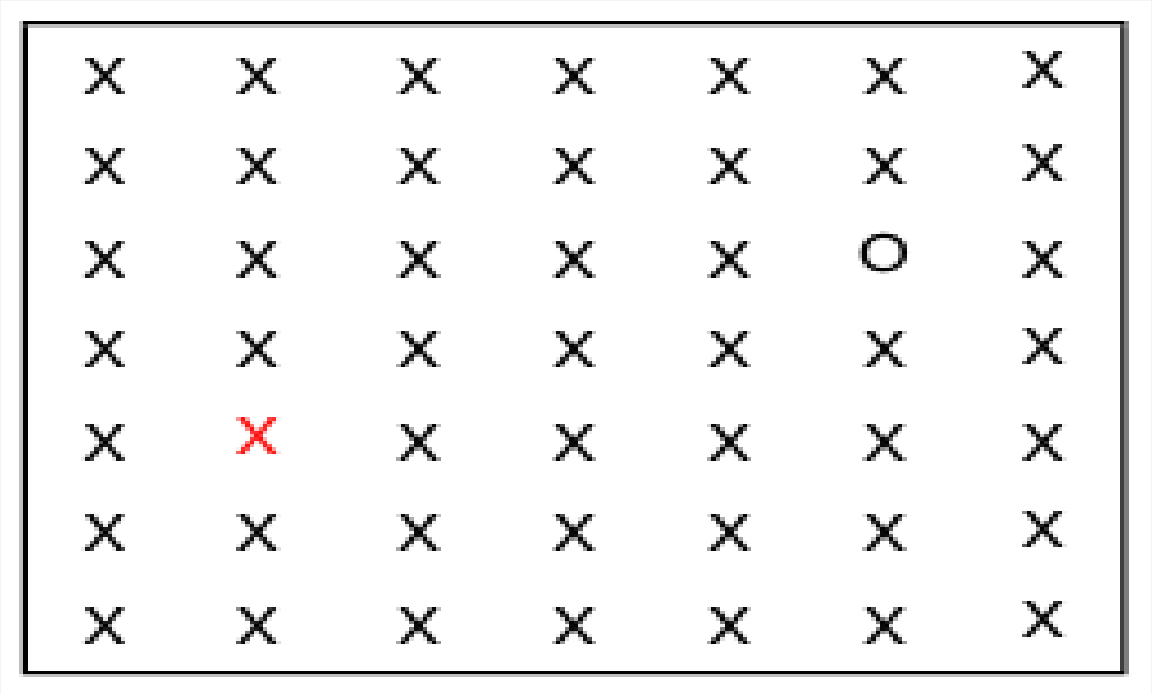
VISUAL ATTENTION

- Visual search:
  - Consists of two stages
    - Feature processing
    - Feature combination

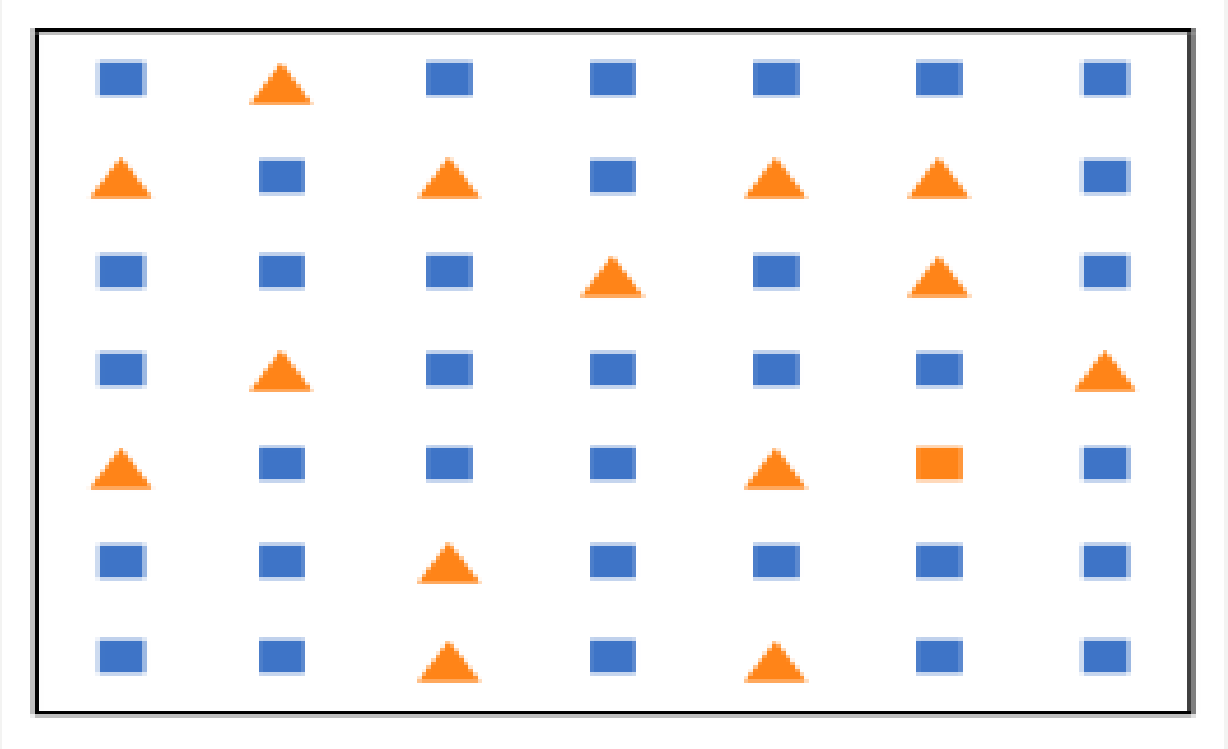
VISUAL ATTENTION

- Primitive features:
  - Identification of features occurs early in the process of visual form perception
  - These features include:
    - Colour
    - Orientation
    - Curvature
    - Line intersection

FIND THE RED ‘X’ AND THE BLACK ‘O’



FIND THE ORANGE SQUARE



VISUAL ATTENTION

- Attentional engagement theory (Duncan & Humphreys, 1992)
  - Objects compete for attention and entry into short-term memory
  - If search target is too similar to other objects, competition is increased
  - This slows response times in a visual search

ACTIVITY: FIND THE PRICE OF A DOUBLE ROOM AT THE HOLIDAY INN IN BRADLEY

Pennsylvania
Bedford Motel/Hotel: Crinaline Courts
(814) 623-9511 S: $18 D: $20
Bedford Motel/Hotel: Holiday Inn
(814) 623-9006 S: $29 D: $36
Bedford Motel/Hotel: Midway
(814) 623-8107 S: $21 D: $26
Bedford Motel/Hotel: Penn Manor
(814) 623-8177 S: $19 D: $25
Bedford Motel/Hotel: Quality Inn
(814) 623-5189 S: $23 D: $28
Bedford Motel/Hotel: Terrace
(814) 623-5111 S: $22 D: $24
Bradley Motel/Hotel: De Soto
(814) 362-3567 S: $20 D: $24
Bradley Motel/Hotel: Holiday House
(814) 362-4511 S: $22 D: $25
Bradley Motel/Hotel: Holiday Inn
(814) 362-4501 S: $32 D: $40
Breezewood Motel/Hotel: Best Western Plaza
(814) 735-4352 S: $20 D: $27
Breezewood Motel/Hotel: Motel 70
(814) 735-4385 S: $16 D: $18

ACTIVITY: FIND THE PRICE FOR A DOUBLE ROOM AT THE QUALITY INN IN COLUMBIA

South Carolina

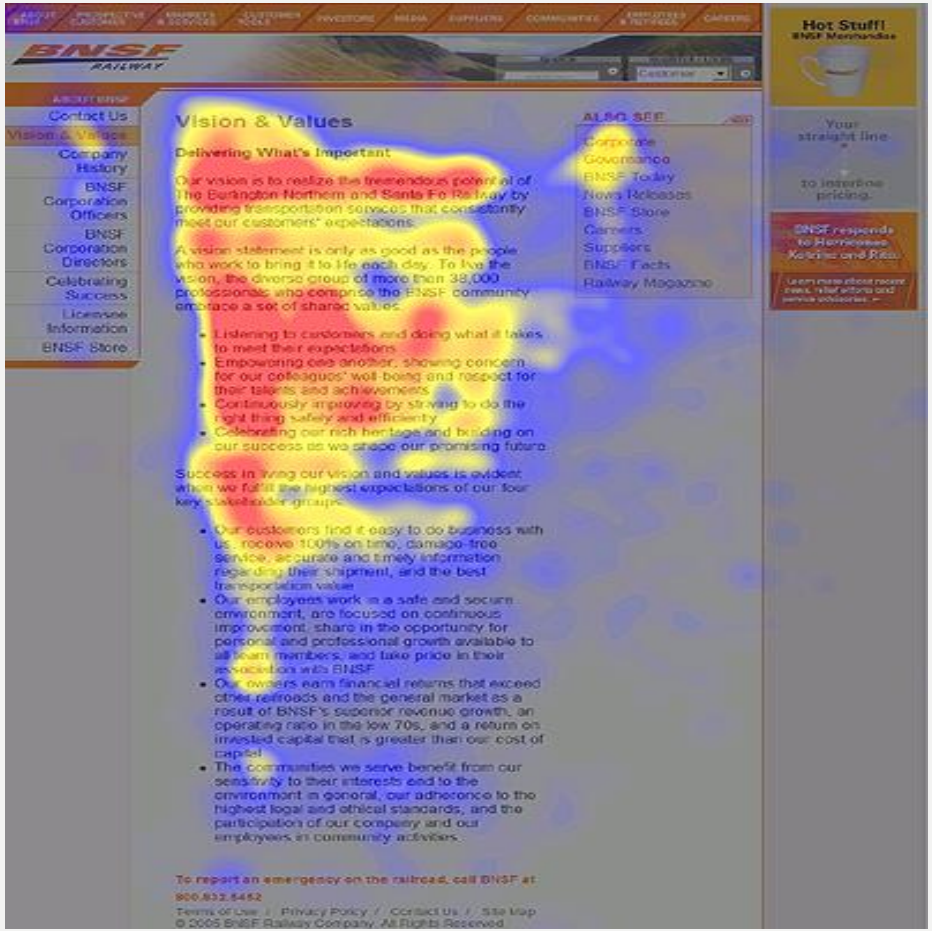
City	Motel/Hotel	Area code	Phone	Rates Single	Rates Double
Charleston	Best Western	803	747-0961	$26	$30
Charleston	Days Inn	803	881-1000	$18	$24
Charleston	Holiday Inn N	803	744-1621	$36	$46
Charleston	Holiday Inn SW	803	556-7100	$33	$47
Charleston	Howard Johnsons	803	524-4148	$31	$36
Charleston	Ramada Inn	803	774-8281	$33	$40
Charleston	Sheraton Inn	803	744-2401	$34	$42
Columbia	Best Western	803	796-9400	$29	$34
Columbia	Carolina Inn	803	799-8200	$42	$48
Columbia	Days Inn	803	736-0000	$23	$27
Columbia	Holiday Inn NW	803	794-9440	$32	$39
Columbia	Howard Johnsons	803	772-7200	$25	$27
Columbia	Quality Inn	803	772-0270	$34	$41
Columbia	Ramada Inn	803	796-2700	$36	$44
Columbia	Vagabond Inn	803	796-6240	$27	$30

ACTIVITY

- Tullis (1987) found that the two screens produced quite different results
  - 1st screen - took an average of 5.5 seconds to search
  - 2nd screen - took 3.2 seconds to search
- Why, since both displays have the same density of information (31%)?
- Spacing
  - In the 1st screen the information is bunched up together, making it hard to search
  - In the 2nd screen the characters are grouped into vertical categories of information making it easier

EYE-TRACKING EQUIPMENT

- Eye-tracking technology can show where our visual attention is focused
  - Here are some examples – old vs. new!



EYETRACKING 'HEATMAP'

The red areas are those that were given the most visual attention – this is known as the 'F' pattern

AUDITORY ATTENTION

- Our auditory system uses selective attention to focus on one auditory message at a time
- How do we deal with listening to two things at one time?
  - In a "dichotic" listening task different sounds/messages are played into the left and right ears
  - Listeners are asked to focus on the sound being played into a particular ear and can usually repeat back that message easily
  - However, even the ignored message undergoes some processing

AUDITORY ATTENTION

- Cocktail-party phenomenon
  - We can instantly tune into a 'background' conversation if we hear our name mentioned
- In the dichotic listening task, listeners sometimes follow the meaningful message when it switches ears
  - Left: dogs six fleas
  - Right: eight scratch two
  - Response: dogs scratch fleas

AUDITORY ATTENTION

- In a dichotic listening task, listeners were able to identify some characteristics of the 'ignored' message (e.g. whether the speaker was male or female)

- An example of a dichotic listening task:
  - http://www.linguistics.ucla.edu/people/schuh/lx001/Dichotic/dichotic.html

DIVIDED ATTENTION

- Dual task performance:
  - Our ability to divide attention between concurrent tasks
  - Some tasks are combined easily (e.g. eating and watching TV)
  - Others are difficult to combine as they involve similar stimuli (e.g. reading and watching TV)

DUAL TASK PERFORMANCE

- Low-level tasks that require short-term storage of stimuli can interfere with each other
  - For example, processing two different sets of letters or numbers simultaneously
- High-level tasks are also difficult to combine
  - For example planning or retrieval from long-term memory
- There is a small detrimental effect when combining any two tasks, even if they are processed differently from each other

AUTOMATICITY

- Automatic processes:
  - Are fast and require little attention
  - Are unavailable to conscious inspection
  - Are hard to modify
  - Occur inevitably when triggered by an appropriate stimulus
- Controlled processes:
  - Are slower, and make greater demands on cognitive resources
  - Are flexible, and associated with conscious experiences (deciding, choosing, etc.)

AUTOMATICITY AND PRACTICE

- Schneider & Shiffrin (1977) showed that automaticity develops with practice
- Everyday actions become 'second-nature' when performed often enough
  - For example:
    - Driving
    - Walking
    - Speaking
    - Reading

MULTITASKING AND ATTENTION

- Is it possible to perform multiple tasks without one or more of them being detrimentally affected?
- Ophir et al (2009) compared heavy vs light multi-taskers
  - heavy were more prone to being distracted than those who infrequently multitask
  - heavy multi-taskers are easily distracted and find it difficult to filter irrelevant information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WHAT
"This project calls for real concentration.
Are you still able to monotask?"

DESIGN IMPLICATIONS FOR ATTENTION

- Make information salient when it needs attending to
- Use techniques that make things stand out like colour, ordering, spacing, underlining, sequencing and animation
- Avoid cluttering the interface with too much information
- Avoid using too much because the software allows it

COGNITIVE SCIENCE AND DESIGN

- A talk by Alex Faaborg (Designer @ Android) given at the Google I/O 2013 conference discusses how cognitive science theories are applied in the design of Google products
  - https://www.youtube.com/watch?v=z2exxj4COhU
  - First 20 minutes relates to perception and attention