

# Understanding Users

- cognitive processes

Unit 8



# Why review cognitive psychology?

- Interacting with technology involves a number of cognitive processes
  - We need to take into account characteristic & **limitations** of users
  - Predict what users can and cannot be expected to do
  - Identify and explain the nature and causes of problems users encounter
- Cognitive theories, modelling tools, and methods can lead to the design of better interactive products

# Core cognitive processes

- Attention
- Perception and recognition
- Memory
- Reading, speaking and listening
- Problem-solving, planning, reasoning, decision-making, learning

# Attention

- Selecting things to concentrate on, at a point in time
  - Visual and auditory
  - VIDEO
- <http://www.theinvisiblegorilla.com/videos.html>
- Limited resource

# Attention

- Set of mechanisms which regulate cognitive processes and feelings
- 3 different cognitive networks supporting 3 types of task
  - Alerting: achievement and maintenance of a state of arousal, or sensitivity to incoming stimuli
  - Orienting: selection of information from a source of incoming stimuli
  - Executive attention: maintain or suppress information focussing to relevant parts of the perceptual field, while ignoring tasks irrelevant stimuli.

RED

RED

# Change blindness

- <http://www.theinvisiblegorilla.com/videos.html>
  - Movie perception test
  - Door study

# Change Blindness

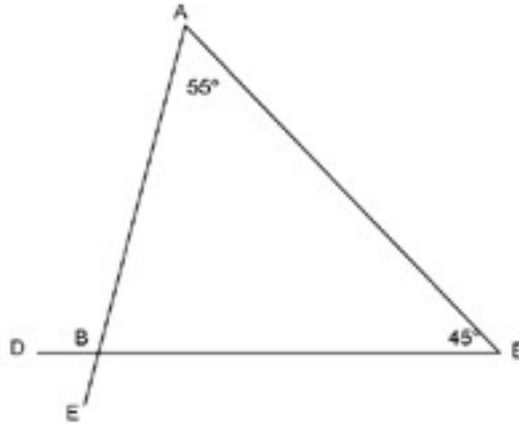
- Phenomenon that occurs when a person viewing a visual scene fails to detect large changes in the scene
- In a huge number of traffic accidents the "driver looked but failed to see"
  - Information from the world enters the driver's eyes: at some point this information is lost
  - **They are looking but they are not seeing**
  - **To see an object change, it is necessary to attend to it.**
- ***Flicker paradigm:*** an original and a modified image continually alternate, one after the other, with a brief blank field between the two

[http://nivea.psych.univ-paris5.fr/Mudsplash/Nature\\_Supp\\_Inf/Movies/Movie\\_List.html](http://nivea.psych.univ-paris5.fr/Mudsplash/Nature_Supp_Inf/Movies/Movie_List.html)



# Split attention

Example demonstrating split attention



In the above figure, find a value for Angle DBE

Solution:

Angle ABC =  $180^\circ - \text{Angle BAC} - \text{Angle BCA}$  (Internal angles of a triangle sum to  $180^\circ$ )

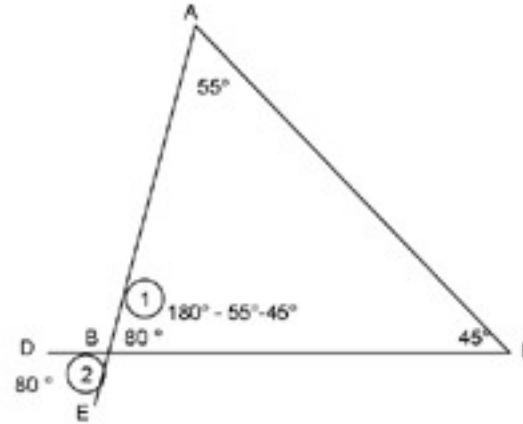
$$= 180^\circ - 55^\circ - 45^\circ$$

$$= 100^\circ$$

Angle DBE = Angle ABC (vertically opposite angles are equal)

$$= 80^\circ$$

Integrated example



# Split attention

- Multiple sources of information need to be integrated before they can be understood
- Multimedia design
- E-learning
  - Split-Attention Principle: When giving a multimedia explanation, present words as auditory narration rather than as visual on-screen text

- **Attention span** is the amount of time a person can **concentrate** on a **task** without becoming **distracted**
- Adult learners can keep tuned in to a lecture for no more than 15 to 20 minutes at a time at the beginning of the class
  - as the lecture proceeded the attention span became shorter and often fell to three or four minutes towards the end of a standard lecture.”

# Design implications for attention

- Information at the interface be structured to capture users' attention,
  - e.g. use perceptual boundaries (windows), colour, video, sound and flashing lights
- 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 - follow the google.com example of crisp, simple design
- Avoid using too much because the software allows it

# Perception and recognition

- How information is acquired from the world and transformed into experiences
  - Obvious implication is to design representations that are readily perceivable, e.g.
    - Text should be legible
    - Text should be legible
    - TEXT SHOULD BE LEGIBLE
    - Icons should be easy to distinguish and understand
    - I CAN READ QUICKLY
    - I can read quickly
-

# Example -

- Text to speech
  - AT&T
    - <http://www.research.att.com/~ttsweb/tts/demo.php>
  - Loquendo
    - [http://www.loquendo.com/en/demos/demo\\_tts.htm](http://www.loquendo.com/en/demos/demo_tts.htm)

# Design implications for Perception

- Icons and other graphical representation should enable users to easily distinguish their meaning
- Sounds should be audible and distinguishable
- Speech output should enable users to distinguish the set of spoken words and understand their meaning
- Text should be legible and distinguishable from the background
- Tactile feedback in VR should allow users to recognise the meaning of the sensation being elicited (difference between squeezing and pushing)

# 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



# Find the price for a double room at the Quality Inn in Columbia

## South Carolina

City	Motel/Hotel	Area code	Phone	Rates	
				Single	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

# Results

- 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

# Find Italian

Black Hills Forest  
Cheyenne River  
Social Science  
South San Jose  
Badlands Park  
Juvenile Justice

Results and Stats  
Thousand Oaks  
Promotions  
North Palermo  
Credit Union  
Wilner Hall

Performing Arts  
Italian  
Coaches  
McKees Rocks  
Glenwood Springs  
Urban Affairs

McLeansboro  
Experimental Links  
Graduation  
Emory Lindquist  
Clinton Hall  
San Luis Obispo

Peters Landing  
Public Health  
San Bernardino  
Moreno Valley  
Altamonte Springs  
Peach Tree City

Highland Park  
Manchesney Park  
Vallecito Mts.  
Rock Falls  
Freeport  
Slaughter Beach

Rocky Mountains  
Latin  
Pleasant Hills  
Observatory  
Public Affairs  
Heskett Center

Brunswick  
East Millinocket  
Women's Studies  
Vacant  
News Theatre  
Candlewood Isle

Jefferson Farms  
Psychophysics  
Political Science  
Game Schedule  
South Addition  
Cherry Hills Village

Creative Writing  
Lake Havasu City  
Engineering Bldg  
Sports Studies  
Lakewood Village  
Rock Island

Deerfield Beach  
Arlington Hill  
Preview Game  
Richland Hills  
Experts Guide  
Neff Hall

Grand Wash Cliffs  
Indian Well Valley  
Online Courses  
Lindquist Hall  
Fisk Hall  
Los Padres Forest

Devlin Hall  
Positions  
Hubard Hall  
Fernadino Beach  
Council Bluffs  
Classical Lit

Sociology  
Greek  
Wallace Hall  
Concert Tickets  
Public Radio FM  
Children's Museum

Writing Center  
Theater Auditions  
Delaware City  
Scholarships  
Hendricksville  
Knights Landing

Modern Literature  
Studio Arts  
Hughes Complex  
Cumberland Flats  
Central Village  
Hoffman Estates

# Find French

Webmaster  
Russian  
Athletics  
Go Shockers  
Degree Options  
Newsletter

Curriculum  
Emergency (EMS)  
Statistics  
Award Documents  
Language Center  
Future Shockers

Student Life  
Accountancy  
McKnight Center  
Council of Women  
Commute  
Small Business

Dance  
Gerontology  
Marketing  
College Bylaws  
Why Wichita?  
Tickets

Geology  
Manufacturing  
Management  
UCATS  
Alumni News  
Saso

Intercollegiate  
Bowling  
Wichita Gateway  
Transfer Day  
Job Openings  
Live Radio

Thinker & Movers  
Alumni  
Foundations  
Corbin Center  
Jardine Hall  
Hugo Wall School

Career Services  
Doers & Shockers  
Core Values  
Grace Wilkie Hall  
Strategic Plan  
Medical Tech

Educational Map  
Physical Plant  
Graphic Design  
Non Credit Class  
Media Relations  
Advertising

Beta Alpha Psi  
Liberal Arts  
Counseling  
Biological Science  
Duerksen Fine Art  
EMT Program

Staff  
Aerospace  
Choral Dept.  
Alberg Hall  
French  
Spanish

Softball, Men's  
McKinley Hall  
Email  
Dental Hygiene  
Tenure  
Personnel Policies

English  
Graduate Complex  
Music Education  
Advising Center  
Medical School  
Levitt Arena

Religion  
Art Composition  
Physics  
Entrepreneurship  
Koch Arena  
Roster

Parents  
Wrestling  
Philosophy  
Wichita Lyceum  
Fairmount Center  
Women's Museum

Instrumental  
Nursing  
Opera  
Sports History  
Athletic Dept.  
Health Plan

# Results

- Weller (2004) found people took less time to locate items for information that was grouped
  - using a border (2nd screen) compared with using color contrast (1st screen)

# Gestalt psychology

- Perception = recognition of objects from basic visual elements
- The whole “gestalt” is greater than the sum of its parts
- When elements are placed in groups that define an object we tend to see the group and not the elements
- Discover the principles used by the *visual* system to group elements

# Gestalt principles

- Describe how people organise visual elements into a meaningful whole
  - Figure/Ground
  - Proximity
  - Similarity
  - Symmetry
  - Continuity
  - Closure
  - <http://graphicdesign.spokanefalls.edu/tutorials/process/gestaltprinciples/gestaltprinc.htm>

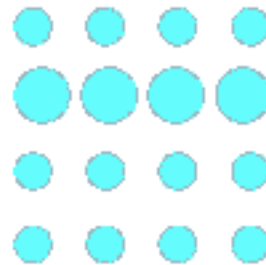
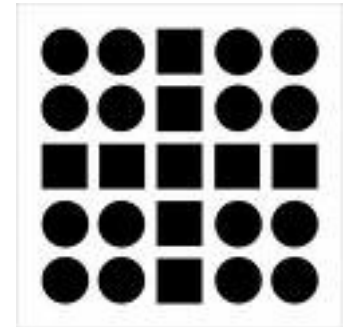
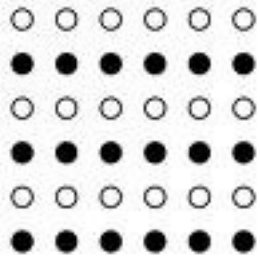




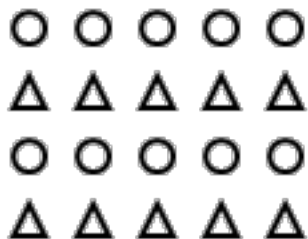
# Figure-ground

- **We perceive the environment by differentiating between objects and their backgrounds**
- **We have a natural tendency to perceive gestalt, whole entities**
- **We strive to find the simplest solutions to incomplete visual information –**

# What do you see here?



Similarity: Size



# Similarity

Things which share visual characteristics such as shape, size, color, texture, or orientation are seen as belonging together

- Unity occurs because the triangular shapes at the bottom of the eagle symbol look similar to the shapes that form the sunburst.



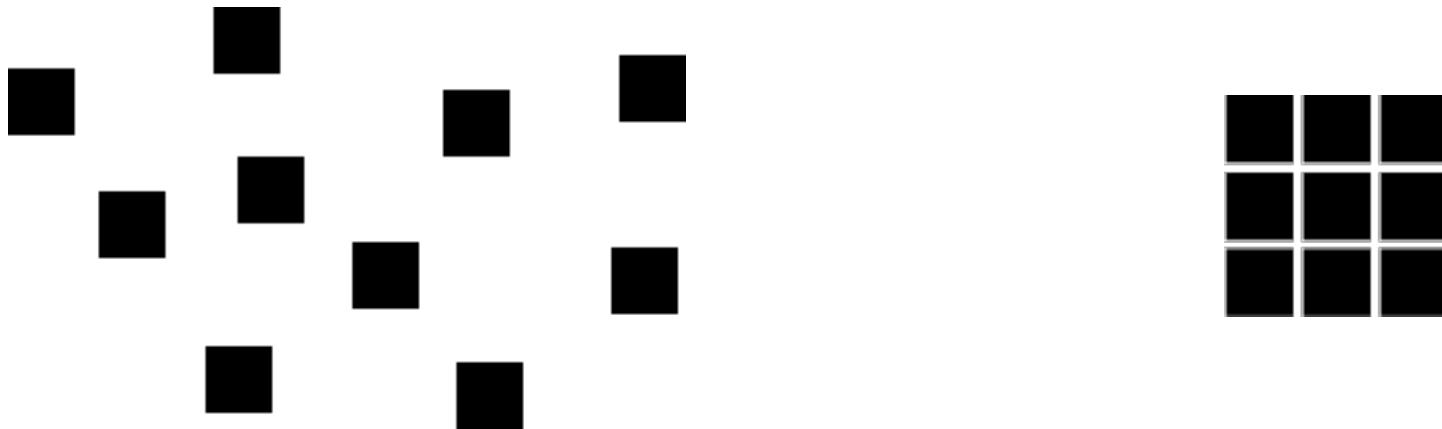
# Similarity 2

- When similarity occurs, an object can be emphasised if it is dissimilar to the others.
- This is called anomaly.
- Focal point of attention



# Proximity

- When elements are placed close together. They tend to be perceived as a group.



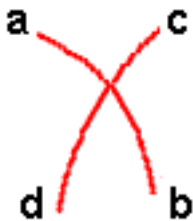


# Common Fate

- When objects move in the same direction, we tend to see them as a unit.
- <http://www.andyrutledge.com/common-fate.php>

# Law of good continuation

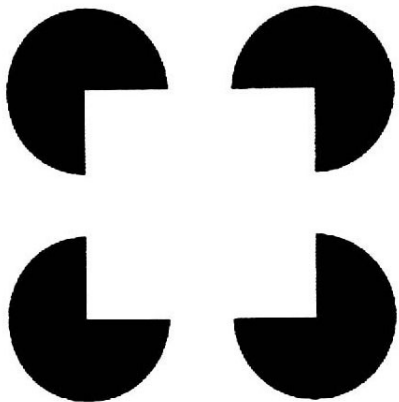
- Contours based on smooth continuity are preferred to abrupt changes of direction
- The tendency to perceive unseen parts of an object as continuing in a predictable way





# Closure

- Closure occurs when an object is incomplete or a space is not completely enclosed
- If enough of the shape is indicated, people perceive the whole by filling in the missing information



# Conclusion

- **Gestalt Principles can be used to –  
impose a logical structure on UI's**
- **help people create logical groupings  
and increase visibility and  
comprehensibility of UI**