

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](http://www.theinvisiblegorilla.com/videos.html)
 - Movie perception test
 - Door study

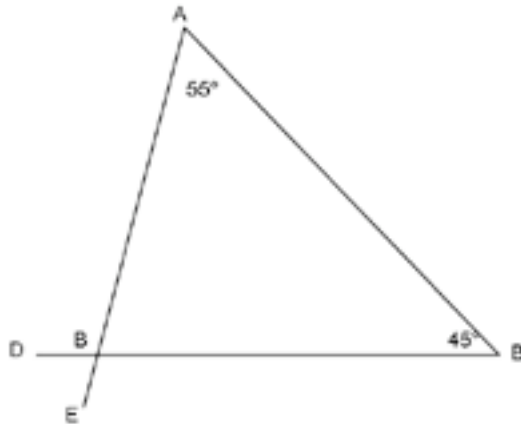
Change Blindness

- 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.psycho.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°)

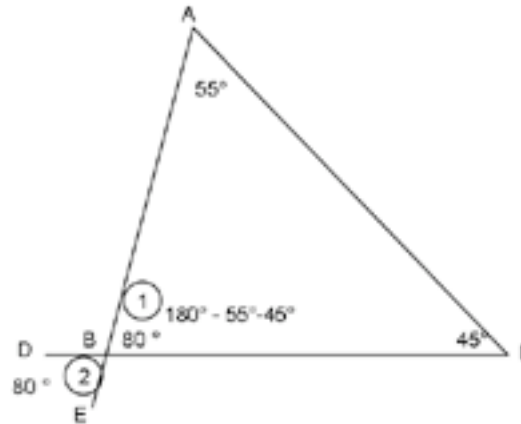
$$= 180^\circ - 55^\circ - 45^\circ$$

$$= 100^\circ$$

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

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

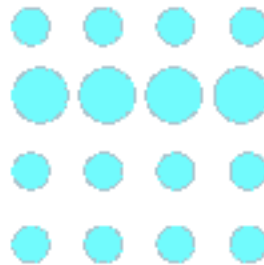
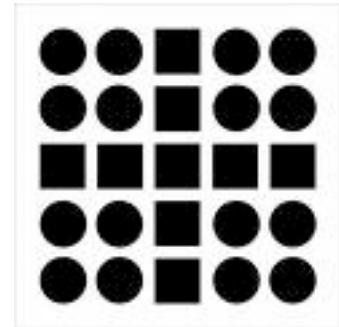
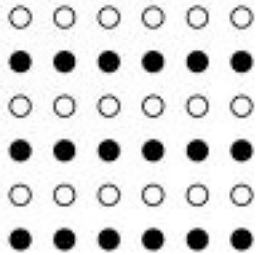
- Describe how people organise visual elements into a meaningful whole
 - Figure/Ground
 - Proximity
 - Similarity
 - Symmetry
 - Continuity
 - Closure
 - <http://graphicdesign.spokanefalls.edu/tutorials/process/gestaltprinciples/gestaltprinc.htm>



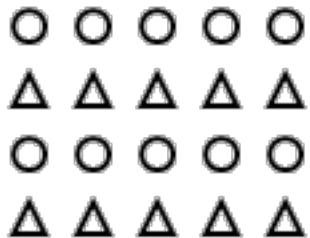
Figure-ground

- **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.



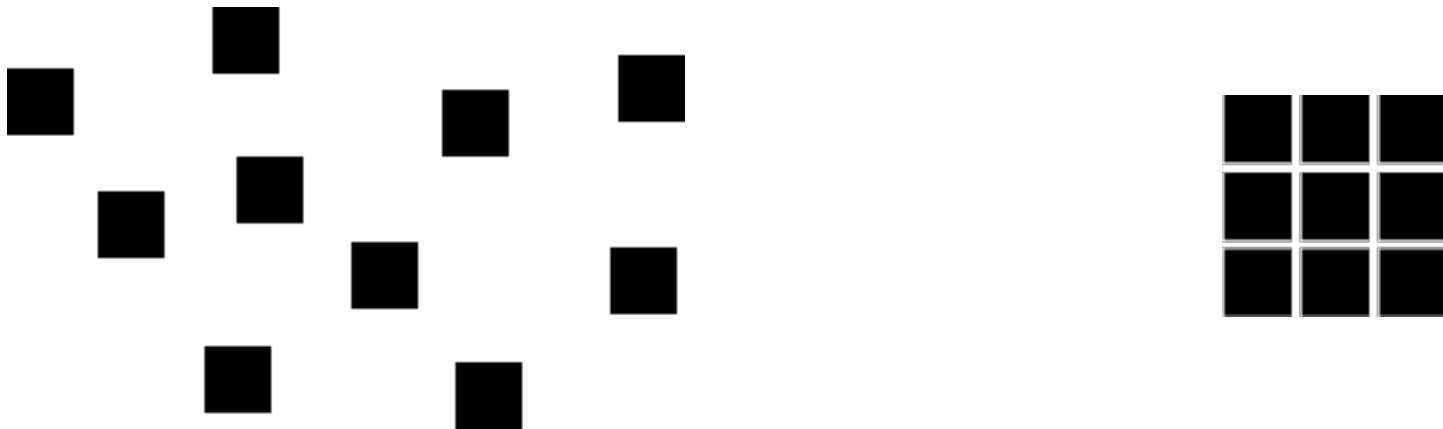
Similarity 2

- 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.



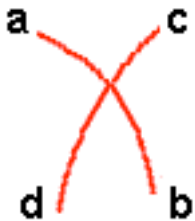


Common Fate

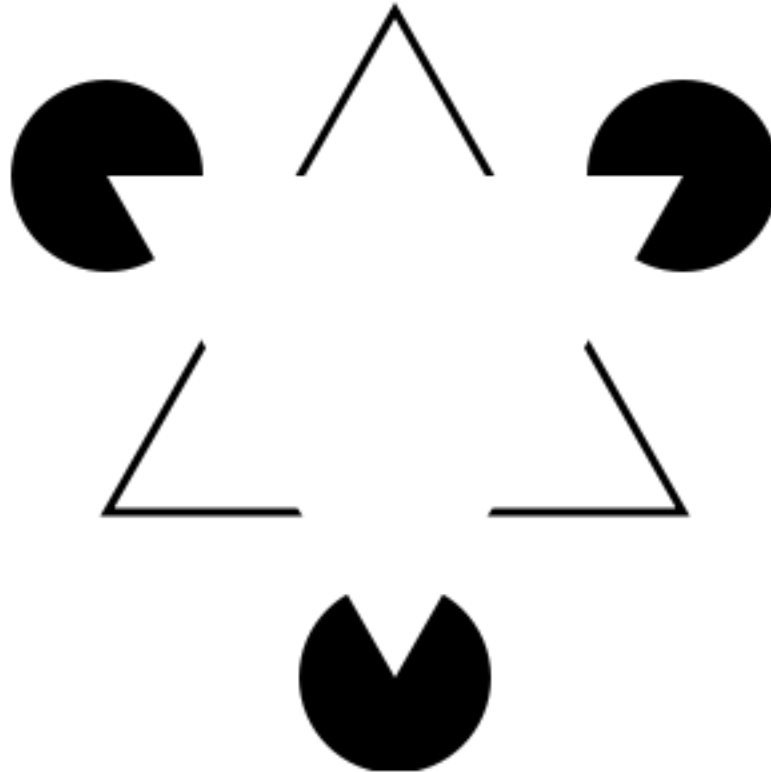
- When objects move in the same direction, we tend to see them as a unit.
- <http://www.andyrutledge.com/common-fate.php>

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



Kanisza's Triangle



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

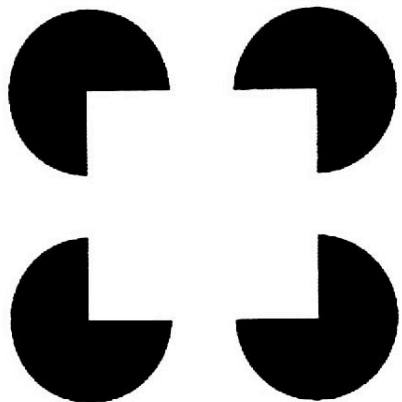


Figure 25. Illusory contours as seen in the Kanizsa figure.

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**