

# Why do we need to understand users?

- Interacting with technology is cognitive
- Need to take into account cognitive processes involved and cognitive limitations of users
- Provides knowledge about what users can and cannot be expected to do
- Identifies and explains the nature and causes of problems users encounter
- Supply theories, modelling tools, guidance and methods that can lead to the design of better interactive products

# Cognitive processes

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

# 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 at the interface should be structured to capture users' attention, e.g. use perceptual boundaries (windows), colour, reverse video, sound and flashing lights

## Activity: Find the price of a double room at the Holiday Inn in Columbia

South Carolina					
City	Motel/Hotel	Area code	Phone	Rates	
				Single	Double
Charleston	Best Western	803	747-0961	\$126	\$130
Charleston	Days Inn	803	881-1000	\$118	\$124
Charleston	Holiday Inn N	803	744-1621	\$136	\$146
Charleston	Holiday Inn SW	803	556-7100	\$133	\$147
Charleston	Howard Johnsons	803	524-4148	\$131	\$136
Charleston	Ramada Inn	803	774-8281	\$133	\$140
Charleston	Sheraton Inn	803	744-2401	\$134	\$142
Columbia	Best Western	803	796-9400	\$129	\$134
Columbia	Carolina Inn	803	799-8200	\$142	\$148
Columbia	Days Inn	803	736-0000	\$123	\$127
Columbia	Holiday Inn NW	803	794-9440	\$132	\$139
Columbia	Howard Johnsons	803	772-7200	\$125	\$127
Columbia	Quality Inn	803	772-0270	\$134	\$141
Columbia	Ramada Inn	803	796-2700	\$136	\$144
Columbia	Vagabond Inn	803	796-6240	\$127	\$130

# Activity: Find the price for a double room at the Quality Inn in Pennsylvania a

Pennsylvania  
Bedford Motel/Hotel: Crinaline Courts  
(814) 623-9511 S: \$118 D: \$120  
Bedford Motel/Hotel: Holiday Inn  
(814) 623-9006 S: \$129 D: \$136  
Bedford Motel/Hotel: Midway  
(814) 623-8107 S: \$121 D: \$126  
Bedford Motel/Hotel: Penn Manor  
(814) 623-8177 S: \$119 D: \$125  
Bedford Motel/Hotel: Quality Inn  
(814) 623-5189 S: \$123 D: \$128  
Bedford Motel/Hotel: Terrace  
(814) 623-5111 S: \$122 D: \$124  
Bradley Motel/Hotel: De Soto  
(814) 362-3567 S: \$120 D: \$124  
Bradley Motel/Hotel: Holiday House  
(814) 362-4511 S: \$122 D: \$125  
Bradley Motel/Hotel: Holiday Inn  
(814) 362-4501 S: \$132 D: \$140  
Breezewood Motel/Hotel: Best Western Plaza  
(814) 735-4352 S: \$120 D: \$127  
Breezewood Motel/Hotel: Motel 70  
(814) 735-4385 S: \$116 D: \$118

# 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

# Design implications for attention

- Make information salient when it needs attending to
- Use techniques that make things stand out like color, ordering, spacing, underlining, sequencing and animation
- Avoid cluttering the interface with too much information
- Search engines and form fill-ins that have simple and clean interfaces are easier to use

# Perception

- 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
  - Icons should be easy to distinguish and read



# Is color contrast good? Find Italian

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

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

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

Devlin Hall  
Positions  
Hubard Hall  
Fernadino Beach  
Council Bluffs  
Classical Lit

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

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

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

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

Performing Arts  
Italian  
Coaches  
McKees Rocks  
Glenwood Springs  
Urban Affairs

Rocky Mountains  
Latin  
Pleasant Hills  
Observatory  
Public Affairs  
Heskett Center

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

Writing Center  
Theater Auditions  
Delaware City  
Scholarships  
Hendricksville  
Knights Landing

McLeansboro  
Experimental Links  
Graduation  
Emory Lindquist  
Clinton Hall  
San Luis Obispo

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

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

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

# Are borders and white space better? 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

# Activity

- 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)
- Some argue that too much white space on web pages is detrimental to search
  - Makes it hard to find information
- Do you agree?

# Which is easiest to read and why?

What is the time?

What is the time?

What is the time?

What is the time?

What is the time?

# Design implications

- Icons should enable users to readily *distinguish* their meaning
- Bordering and spacing are effective visual ways of grouping information
- Sounds should be audible and distinguishable
- Speech output should enable users to distinguish between the set of spoken words
- Text should be legible and distinguishable from the background
- Tactile feedback should allow users to recognize and distinguish different meanings

# Memory

- Involves first encoding and then retrieving knowledge.
- We don't remember everything - involves filtering and processing what is attended to
- Context is important in affecting our memory (i.e. where, when)
- We recognize things much better than being able to recall things
- we remember less about objects we have photographed than when we observe them with the naked eye (Henkel, 2014)

# Processing in memory

- Encoding is first stage of memory
  - determines which information is attended to in the environment and how it is interpreted
- The more attention paid to something...
- The more it is processed in terms of thinking about it and comparing it with other knowledge...
- The more likely it is to be remembered
  - e.g. when learning about HCI, it is much better to reflect upon it, carry out exercises, have discussions with others about it, and write notes than just passively read a book, listen to a lecture or watch a video about it

# Context is important

- Context affects the extent to which information can be subsequently retrieved
- Sometimes it can be difficult for people to recall information that was encoded in a different context:
  - “You are on a train and someone comes up to you and says hello. You don’t recognize him for a few moments but then realize it is one of your neighbors. You are only used to seeing your neighbor in the hallway of your apartment block and seeing him out of context makes him difficult to recognize initially”



# Activity

- Try to remember the dates of your grandparents' birthday
- Try to remember the cover of the last two DVDs you bought or rented
- Which was easiest? Why?
- People are very good at remembering visual cues about things
  - e.g. the color of items, the location of objects and marks on an object
- They find it more difficult to learn and remember arbitrary material
  - e.g. birthdays and phone numbers

# Recognition versus recall

- Command-based interfaces require users to recall from memory a name from a possible set of 100s
- GUIs provide MP3 players visually-based options that users need only browse through until they recognize one
- Web browsers, etc., provide lists of visited URLs, song titles etc., that support recognition memory

# The problem with the classic '7±2'

- George Miller's (1956) theory of how much information people can remember
- People's immediate memory capacity is very limited
- Many designers think this is useful finding for interaction design
- But...

# What some designers get up to...

- Present only 7 options on a menu
- Display only 7 icons on a tool bar
- Have no more than 7 bullets in a list
- Place only 7 items on a pull down menu
- Place only 7 tabs on the top of a website page

– But this is wrong? Why?



# Why?

- Inappropriate application of the theory
- People can scan lists of bullets, tabs, menu items for the one they want
- They don't have to recall them from memory having only briefly heard or seen them
- Sometimes a small number of items is good
- But depends on task and available screen estate

# Digital content management

- Memory involves 2 processes
  - recall-directed and recognition-based scanning
- File management systems should be designed to optimize both kinds of memory processes
  - e.g. Search box and history list
- Help users encode files in richer ways
  - Provide them with ways of saving files using colour, flagging, image, flexible text, time stamping, etc.

# Is Apple's Spotlight search tool any good?

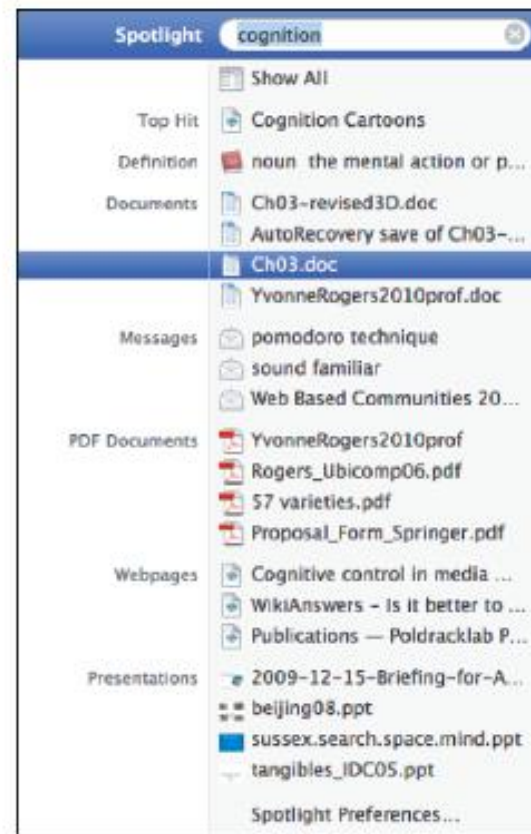


Figure 3.3 Apple's Spotlight search tool

# Digital Forgetting

- When might you wish to forget something that is online?
  - When you break up with a partner
  - Emotionally painful to be reminded of them through shared photos, social media, etc.,
- Sas and Whittaker (2013) suggest new ways of harvesting and deleting digital content
  - e.g. making photos of ex into an abstract collage
  - helps with closure



# Memory aids

- SenseCam developed by Microsoft Research Labs (now Autographer)
- a wearable device that intermittently takes photos without any user intervention while worn
- digital images taken are stored and revisited using special software
- Has been found to improve people's memory, suffering from Alzheimers

# SenseCam



**Figure 3.5** The SenseCam device and a digital image taken with it  
*Source:* ©Microsoft Research Cambridge.

# Design implications

- Don't overload users' memories with complicated procedures for carrying out tasks
- Design interfaces that promote recognition rather than recall
- Provide users with various ways of encoding information to help them remember
  - e.g. categories, color, flagging, time stamping

# Learning

- How to learn to use a computer-based application
- Using a computer-based application or YouTube video to understand a given topic
- People find it hard to learn by following instructions in a manual
  - prefer to learn by doing

# Design implications

- Design interfaces that encourage exploration
- Design interfaces that constrain and guide learners
- Dynamically linking concepts and representations can facilitate the learning of complex material

# Reading, speaking, and listening

- The ease with which people can read, listen, or speak differs
  - Many prefer listening to reading
  - Reading can be quicker than speaking or listening
  - Listening requires less cognitive effort than reading or speaking
  - Dyslexics have difficulties understanding and recognizing written words

# Applications

- Speech-recognition systems allow users to interact with them by asking questions
  - e.g. Google Voice, Siri
- Speech-output systems use artificially generated speech
  - e.g. written-text-to-speech systems for the blind
- Natural-language systems enable users to type in questions and give text-based responses
  - e.g. Ask search engine

# Design implications

- Speech-based menus and instructions should be short
- Accentuate the intonation of artificially generated speech voices
  - they are harder to understand than human voices
- Provide opportunities for making text large on a screen



# Summary

- Cognition involves several processes including attention, memory, perception and learning
- The way an interface is designed can greatly affect how well users can perceive, attend, learn and remember how to do their tasks
- Theoretical frameworks, such as mental models and external cognition, provide ways of understanding how and why people interact with products
- This can lead to thinking about how to design better products