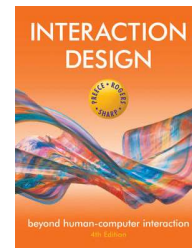


Chapter 3

Cognitive Aspects



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Why do we need to understand users?

- ❖ Interacting with technology is cognitive (الإدراكي).
- ❖ 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 (الإدراك) and recognition.
- ❖ Memory.
- ❖ Learning.
- ❖ Reading, speaking and listening.
- ❖ Problem-solving, planning, reasoning and decision-making.



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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), **color**, sound and flashing lights.



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Activity (1st screen): 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

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Activity (2nd screen): Find the price for a double room at the Quality Inn in Columbia



South Carolina		Area	Phone	Rates	
City	Motel/Hotel	code		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	<u>Quality Inn</u>	803	772-0270	\$34	\$41
Columbia	Ramada Inn	803	796-2700	\$36	\$44
Columbia	Vagabond Inn	803	796-6240	\$27	\$30

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Activity Discussion

- ❖ The two screens produced different results:
 - 1st screen: took an average of **5.5sec.** to search.
 - 2nd screen: took **3.2sec.** 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.



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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.



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Perception

- ❖ How information is acquired from the world and transformed into experiences.
- ❖ Obvious implication is to design representations that are easily perceivable, e.g.
 - **Text** should be **readily**.
 - **Icons** should be **easy** to distinguish and read.



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Is **color** contrast good? Find Italian


Black Hills Forest	Peters Landing	Jefferson Farms	Devlin Hall
Cheyenne River	Public Health	Psychophysics	Positions
Social Science	San Bernardino	Political Science	Hubard Hall
South San Jose	Moreno Valley	Game Schedule	Fernadino Beach
Badlands Park	Altamonte Springs	South Addision	Council Bluffs
Juvenile Justice	Peach Tree City	Cherry Hills Village	Classical Lit
Results and Stats	Highland Park	Creative Writing	Sociology
Thousand Oaks	Manchesney Park	Lake Havasu City	Greek
Promotions	Vallecito Mts.	Engineering Bldg	Wallace Hall
North Palermo	Rock Falls	Sports Studies	Concert Tickets
Credit Union	Freeport	Lakewood Village	Public Radio FM
Wilner Hall	Slaughter Beach	Rock Island	Children's Museum
Performing Arts	Rocky Mountains	Deerfield Beach	Writing Center
Italian	Latin	Arlington Hill	Theater Auditions
Coaches	Pleasant Hills	Preview Game	Delaware City
McKees Rocks	Observatory	Richland Hills	Scholarships
Glenwood Springs	Public Affairs	Experts Guide	Hendricksville
Urban Affairs	Heskett Center	Neff Hall	Knights Landing
McLeansboro	Brunswick	Grand Wash Cliffs	Modern Literature
Experimental Links	East Millinocket	Indian Well Valley	Studio Arts
Graduation	Women's Studies	Online Courses	Hughes Complex
Emory Lindquist	Vacant	Lindquist Hall	Cumberland Flats
Clinton Hall	News Theatre	Fisk Hall	Central Village
San Luis Obispo	Candlewood Isle	Los Padres Forest	Hoffman Estates



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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



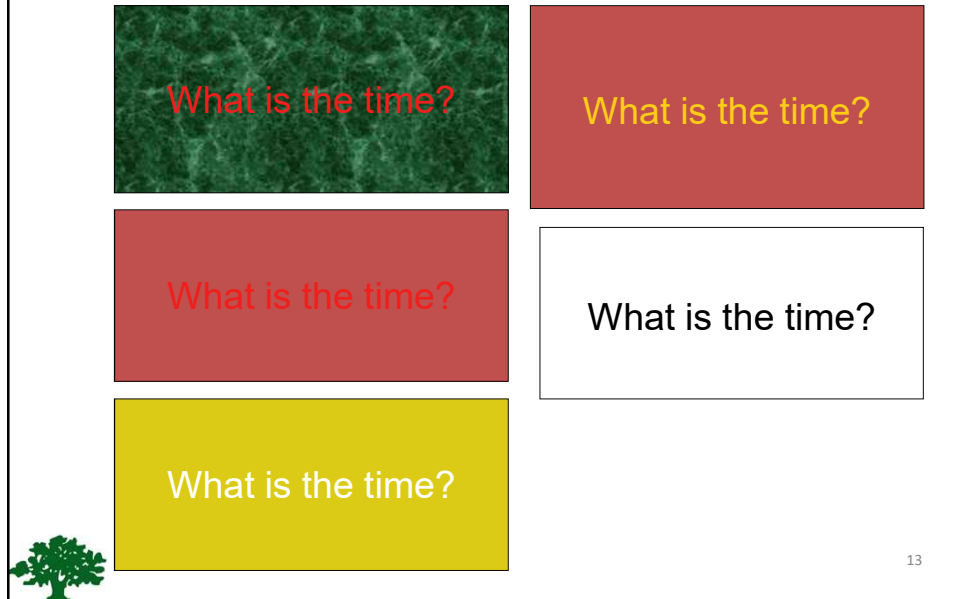
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Activity Discussion

- ❖ 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 (harmful) 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?

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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.



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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.



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Processing in Memory 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.



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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.



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Context is Important e.g.

- ❖ “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 neighbours.
- ❖ You are only used to seeing your neighbour in the hallway of your apartment block and seeing him out of context makes him difficult to recognize initially”



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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 (اعتباطي) material.
 - e.g. birthdays and phone numbers.



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Recognition vs. Recall

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



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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.

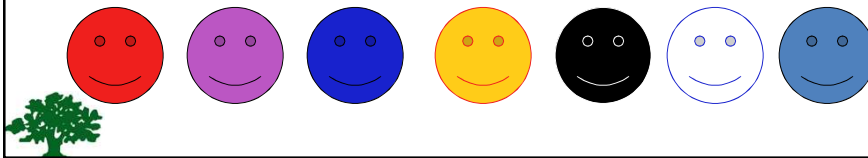


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What some designers get up to...

- ❖ 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?



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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 space.



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Digital content management

- ❖ Is a growing problem for many users
 - vast numbers of documents, images, music files, video clips, emails, attachments, bookmarks, etc.,
 - where and how to save them all, then remembering what they were called and where to find them again
 - naming most common means of encoding them
 - but can be difficult to remember, especially when have 1000s and 1000s
 - How might such a process be facilitated taking into account people's memory abilities?



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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.



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Is Apple's Spotlight search tool any good?



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Memory Aids

❖ SenseCam developed by Microsoft Research Labs.

- A wearable device that occasionally 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**.



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SenseCam



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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.



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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



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Design Implications

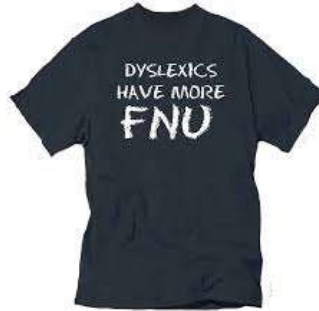
- ❖ Design interfaces that encourage **exploration**.
- ❖ Design interfaces that **constrain** and **guide** learners.
- ❖ Dynamically linking concepts and representations can facilitate the learning of complex material.



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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 (**3-4 options**).
- ❖ Emphasize the accent (tone) of artificially generated speech voices.
 - they are harder to understand than human voices.
- ❖ Provide opportunities for making text large on a screen.



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Problem-solving, planning, reasoning and decision-making

- ❖ All involves **reflective cognition**.
 - e.g. thinking about what to do, what the options are, and the consequences.
- ❖ Often involves aware processes, discussion with others (or oneself), and the use of artifacts.
 - e.g. maps, books, pen and paper.
- ❖ May involve working through different scenarios and deciding which is best option.



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Design Implications

- ❖ Provide additional information and functions for users who wish to understand more about how to carry out an activity more effectively. (e.g. web searching)
- ❖ Use simple computational aids to support rapid decision-making and planning for users on the move.



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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.



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