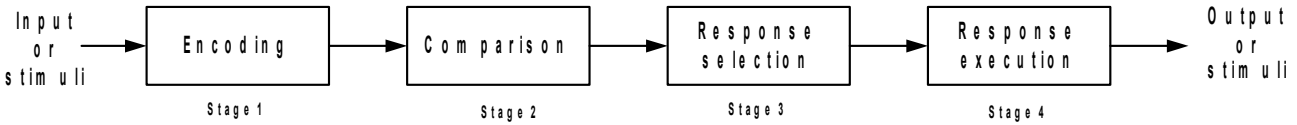
Attention in Interface Design

Lecture #8

Lesson Learned

- In the last few lectures we have discussed
  - Human information processing model
    - How information is perceived by the perceptual processor

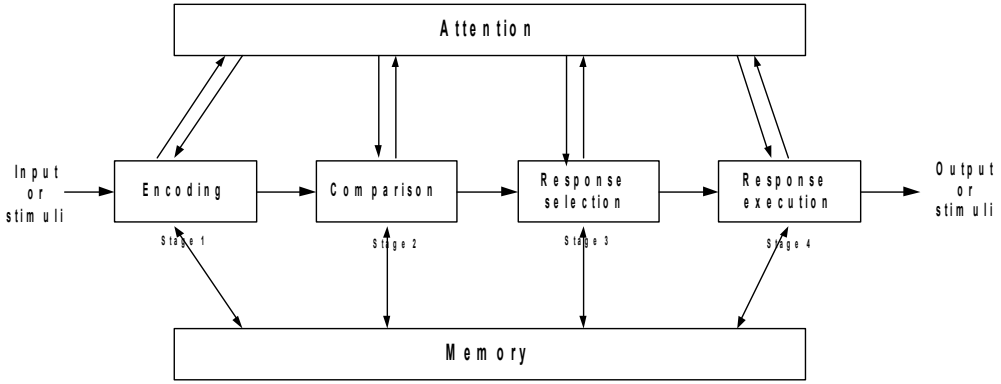


Human information processing stages

  - How information (visual) can be represented so that it can lead to better interface design
    - Graphical modeling techniques
    - Graphical coding

Lesson Learned

- Also we have learnt the extending human information processing model



- This model is an extension over the previous model and encompasses two important concepts in information processing
  - Attention
    - How human attend information
  - Memory
    - How information is stored in memory

Agenda

- Concepts of attention
- Importance of designing an interface assuming constraints in attention
- Some techniques to design interface while taking attention at the center stage

What is Attention?

- **Definition**

  Attention is the focusing of perception on a limited range of stimuli, leading to heightened awareness

- **Explanation**
  - Our senses are constantly bombarded with images, sounds, smells, tastes and touch
  - How to deal with all this information in such a way as to make sense out of it
  - Human tendency is to avoid getting overloaded with information
  - This is done by employing the selective process of attention
    - Withdraw from some things in order to deal efficiently with others

Illustration: Cocktail Party Phenomenon

Cocktail Party Phenomenon

- You arrive in a party
  - All around you a sea of faces
  - A babble of voices
  - Number of conversations in several groups
  - People are moving here and there

- After initial impression of chaos, you find yourself attracted to one group and one conversation; others ‘faded’

- Your attention can switched to a new direction while you heard your name and may lost the thread of existing conversation

Focused Attention vs. Divided Attention

- **An attention may be**
  - **Focused attention**
    - **Attending one event at a time out of several competing stimuli**

    Example
      - **When several students in a class asking to their teacher simultaneously**
  - **Divided attention**
    - **Ability to attend to more than one things at a time**

    Example
      - **When watching a video music**

Voluntary Attention vs. Involuntary Attention

- **A further properties of attention is**
  - **Voluntary attention**
    - **Making a conscious effort to change attention**

    Example
      - **While driving a car and you see a mass fighting themselves on the road side**

  - **Involuntary attention**
    - **When the salient characteristics of the competing stimuli grab the attention**

    Example
      - **While working with a computer and heard your favorite music in the next room**

Importance of Attention in HCI

- Understanding of attentional phenomenon can be usefully applied to interface design
  - Leads us to design an interface so that user can effectively interact with a system
  - An interface should be such that its design is enough to check even the involuntary attention
  - Guide user's attention to the relevant information on an interface

so on…..

Techniques to Guide Interface

- Alerting techniques
- Color
- Structured information
- Spatial and temporal cues

Attention with Alerting Techniques

- Alerting techniques
  - Flashing
  - Blinking
  - Reverse video
  - Auditory warning etc.

Attention with Colors

- Color is a useful coding mechanism for grouping
  - Use different colors to distinguishing layers
    - Different information at different layers
  - Color makes things stand out
    - Use color to make feature prominent

      Example: Several applications at the bottom line out of which active one is with different color
  - Proper foreground/background for comfortable display
    - Important information with more contrast display and less important information with less contrast display

Attention with Structured Information

- Structure the information so that it is easy to navigate through
  - Presenting not so much information and not too little on a screen
  - Instead of arbitrarily presenting data on the screen, it should be grouped and ordered into meaningful parts
    - Blank space
    - Color
    - Font variations etc.

Attention with Structured Information

Dept	Student	Hostel	Roll	CGPA	Rank
CS	S. Gavaskar	VS	7478961	9.56	11
CS	R. Shastry	MS	7631256	7.98	18
CS	M. Amarnath	JCB	7540343	8.12	19
CS	M. Azaharuddin	NH	7739434	8.55	16
CS	Kapil Dev	AH	7658522	9.01	15
CS	S. Kirmani	VS	7467615	7.21	23
IT	S. Tendulkar	HJB	9634232	9.45	12
IT	R. Dravid	VS	9944144	9.11	13
IT	S. Ganguly	VS	9854053	8.99	14
IT	Irphan Pathan	MS	9969565	7.23	17
IT	Zahir Khan	JCB	9978571	7.30	20

Attention with Structured Information

```
India
Bangalore : Hotel Cauvery
(055) 623-9511 S:$18  D:$28
Bangalore : Holiday Inn
(055) 623-9006 S:$21  D:$24
Bangalore : Hotel Highway
(055) 626-8346 S:$20  D:$30
Bangalore : Hotel Paradise
(055) 621-7513 S:$16  D:$25
Chennai : Quality Inn
(044) 522-6512 S:$18  D:$26
Chennai : Hotel Sagar
(044) 520-5544 S:$14  D:$22
Chennai : Hotel Blue Lagoon
(044) 513-5536 S:$16  D:$26
Mumbai : Hotel Grand Plaza
(044) 533-4585 S:$18  D:$26
Mumbai : Hotel Opera Star
(044) 530-4562 S:$15  D:$25
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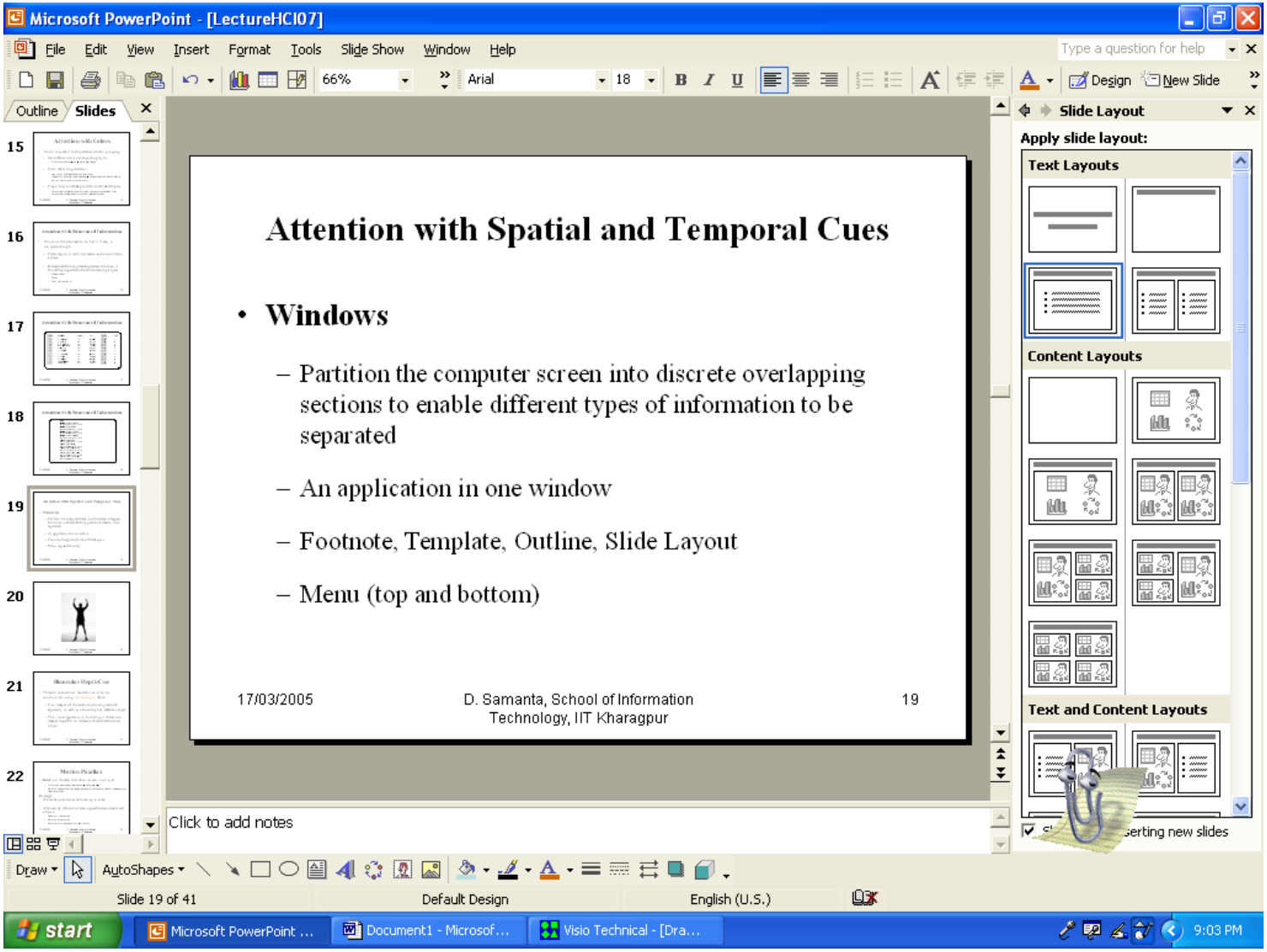
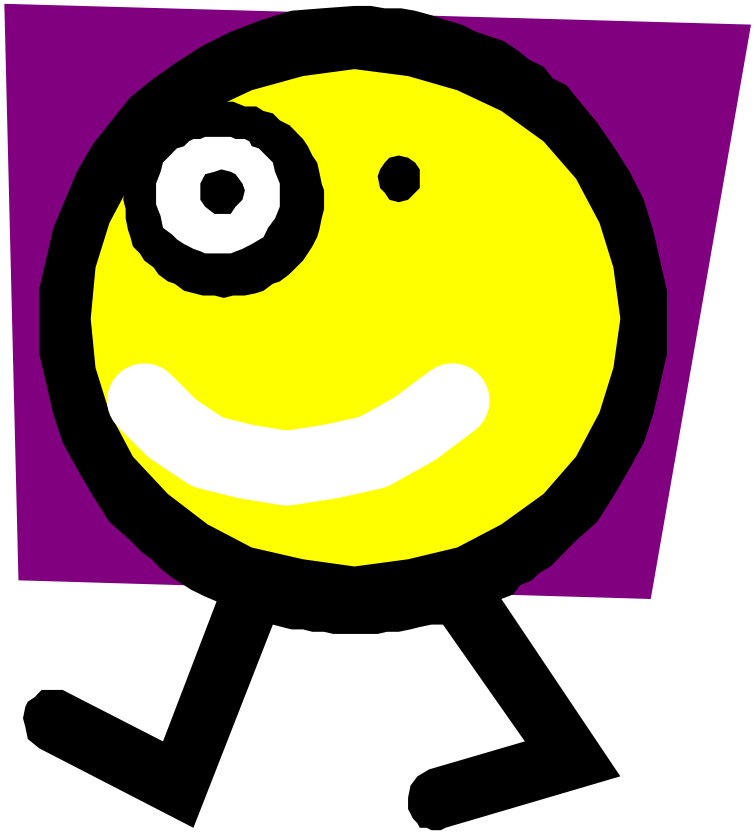
Attention with Spatial and Temporal Cues



Guidelines

- Important information which needs immediate attention should always be displayed in a prominent place to catch user's eye
  - e.g. warning message, current working space at the center
- Less urgent information should be allocated to less prominent region but in specific area of the screen so that the user will know where to look when this information is required
  - e.g. top menu/bottom menu, help line etc.
- Information that is not needed very often should not be displayed but should be made available on request
  - e.g. help facility, pop-up menu, system date etc.



Multitasking and Attention

- **Multitasking**
  - Carry out a number of tasks during the same period of time by altering between them
  - Continuously switching between different activities rather than performing and completing tasks in a serial manner
  - Tasks are overlapping
    - Primary tasks
    - Secondary tasks
    - Foregrounded tasks

Multitasking and Attention

- **Example:** Pilot in a Cockpit
  - Attending to air-traffic control communication
  - Monitoring various flight instruments
  - Dealing with system malfunction (such as fuel leak)

Multitasking and Attention

- **How to deal with multitasking?**
  - Attending to air-traffic control communication
  - Monitoring various flight instruments
  - Dealing with system malfunction (such as fuel leak)

Cognitive Aids

- **Attention plays important role**
  - Mummy served you your favorite disk with either no salt or double salt
    - Because while she was cooking (it is her routine work!) she had to attend a phone call
  - How mummy could avoid it?

Cognitive Aids

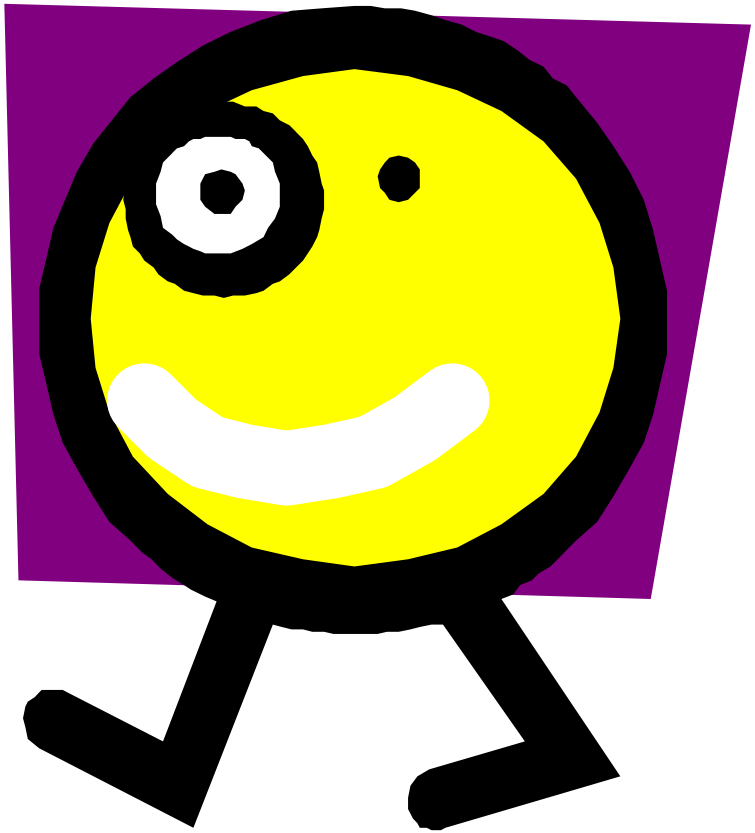
- **People follows cognitive aids**
  - Writing lists
  - Trying not in handkerchief
  - Marker on the book

  and so on

- Cognitive aids according to Donald Norman (1992)
  - External representation that are intended to gain our attention at a time relevant to the task that needs to be performed
  - Use some makeshift reminder

Cognitive Aids and Interface Design

- System should be designed to provide information systematically about the status of an activity in terms of what has been done and what currently needs to be carried out
- If users are distracted from the activity at hand, the system should then be able to inform them of where they were in that activity when they return to it
- In addition, routine background, such as saving files, should be brought to the user's attention by displaying reminder prompts at the interface
- **Case study:** Reply to emails



Another Issue

- Many activities that we carry out in our everyday lives have become automated
- We simply do them without thinking about them

  Example
  - Tooth brushing
  - Riding a bike
  - Reciting multiplication table

- It is well known that more we practice, the more our performance improves to the point that we become skilled and our performance is automatic
- In other words, with prolonged practice, cognitive processes can also become fully automatic (called automatic cognitive processes)

Automatic Cognitive Processes

- Identifiable properties are
  - Fast
  - Demanding minimal attention and hence not interfering with other activities
  - Unavailable to consciousness

Example: **Stroop effect**

- A classic example to demonstrate the nature of an automatic cognitive process

Stroop Effect

A	B
ZYP	RED
QLEKF	BLACK
SUWRG	YELLOW
XCIDB	BLUE
WOPR	RED
ZYP	GREEN
QLEKF	YELLOW
XCDIB	BLACK
SUWRG	BLUE
WOPR	BLACK
SUWRG	RED
ZYP	YELLOW
XCDIB	GREEN
QLEKF	BLUE
WOPR	GREEN
ZYP	BLUE
XCDIB	RED
SWRG	YELLOW
ZYP	BLACK
QLEKF	GREEN

Stroop Effect

- **Take a watch to estimate**
  - How long it takes you to name the colors of the items in the two list
- **You should have found that**
  - It took you longer time to say the color names in the second list than in the first
  - When asked to name the colors of a list of nonsense syllables that are written in colored ink we have little problem
  - However, when asked to do the same for a list of color names that are printed in conflicting colors, our performance slow down
  - This is because the automatic cognitive process of reading the word conflicts with the automatic process of perceiving the color

A	B
ZYP	RED
QLEKF	BLACK
SUWRG	YELLOW
XCIDB	BLUE
WOPR	RED
ZYP	GREEN
QLEKF	YELLOW
XCDIB	BLACK
SUWRG	BLUE
WOPR	BLACK
SUWRG	RED
ZYP	YELLOW
XCDIB	GREEN
QLEKF	BLUE
WOPR	GREEN
ZYP	BLUE
XCDIB	RED
SWRG	YELLOW
ZYP	BLACK
QLEKF	GREEN

Automatic vs. Non-automatic Cognitive Processes

- Psychology make a distinction between two types of cognitive processes
  - Automatic cognitive process
  - Non-automatic cognitive process

- Non-automatic cognitive process
  - A controlled cognitive process

Example:

- Performing mental arithmetic where the person has to consciously work through the different parts of the sum

Automatic vs. Non-automatic Cognitive Processes

- The main distinction between the two kind of process is
  - Automatic processes are not affected by the limited capacity of the brain and do not require attention
  - Controlled process have limited capacity and require attention and conscious control
  - Automatic processes are very difficult to change after they have been learned whereas controlled processes can be changed relatively easily

Implication of Automatic Processing for ID

- Design that provides automatic processing is more efficient and are performed rapidly
- Example
  - Having learned a set of command it is very easy to use subsequently and difficult to unlearn them
  - <CTRL> + <P> is the usual command to perform print operation automatically come in mind
  - In a new design if the same commands have been changed to mean something else (say <CTRL> + <P> means display the page layout on the screen) it becomes a confrontation (Stroopy effect)

Implication of Automatic Processing for ID

- Automatic processes are more inflexible, in that they are difficult to modify, which can disrupt performance
  - After considerable learning it is possible to change the automatic cognition
  - However, even after relearning it is common for people in times of stress to revert to the automatic processes that were previously learned
  - It is always frustrating and even sometimes lead to more catastrophic effects (such as driving a car with ultra-new design)
- For safe interface design, designed must honor the automatic cognitive processes and hence attention

Recommended Materials

- My Home page

  http://facweb.iitkgp.ernet.in/~dsamanta

  (For the presentation slides of the current lecture

- Book

  Human-Computer Interaction by Jenny Preece and et al. Addison-Wesley, New York

  Chapter 5