MIE 240: Human-centred system design

Design guidelines for cognition

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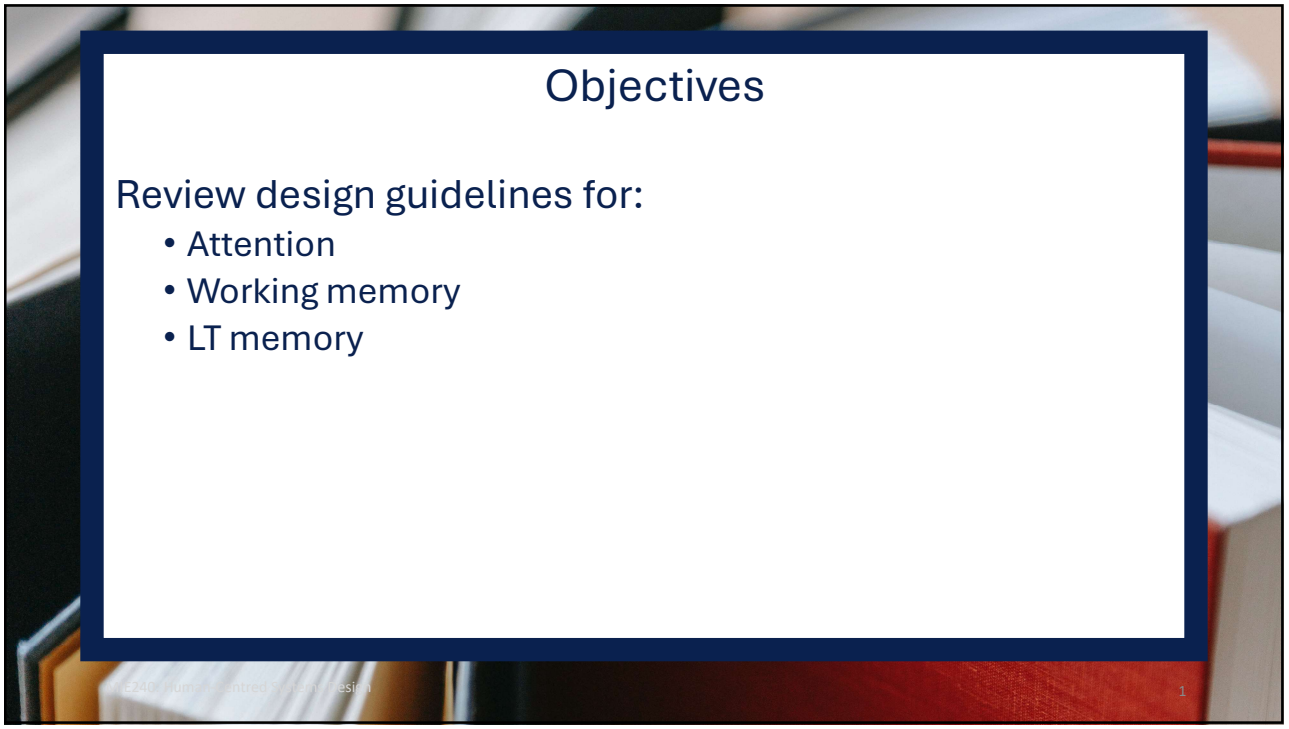

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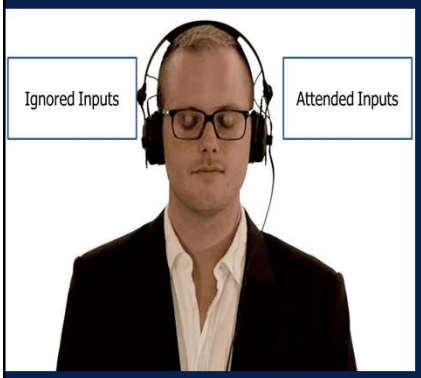

Last lecture

- Information processing model
- Attention
- Working memory
- Long-term memory

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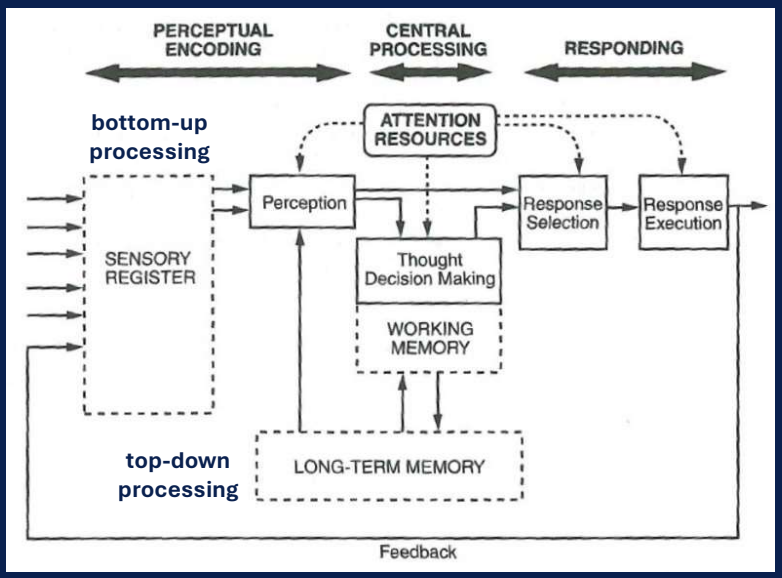
Information processing model



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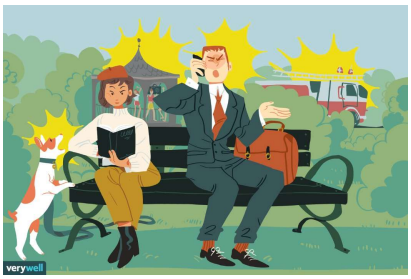
Attention

Attention: cognitive process of selectively concentrating on one aspect of the external or internal environment while ignoring other aspects. Driven by *salience, effort, expectancy*, and *value*.

Four types of attention multi, divided, sustained, alternating



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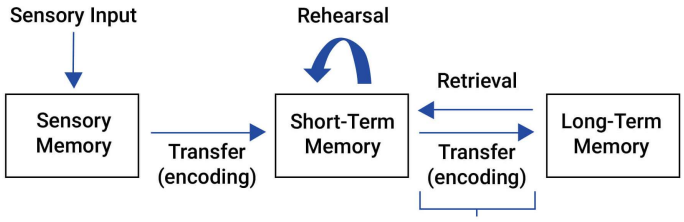
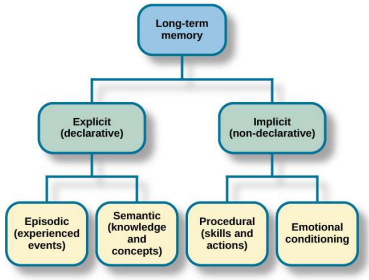
Working and LT memory

- **Working Memory**: temporary (~30 – 90 sec) and limited capacity (7 +/- 2 chunks) of verbal and spatial information that is currently being used.
- **Long-term memory**: Nearly permanent storage of information with unlimited capacity. Three phases encoding, storage, and retrieval.





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Attention

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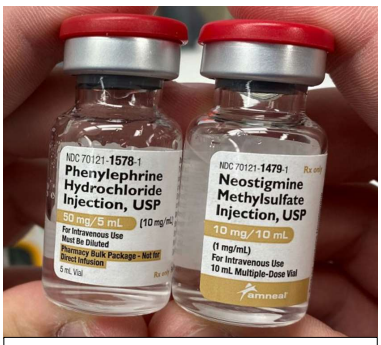
Design implications for selective attention

1. **Optimize** *letter size* **processing (sensory register)**
   - Ease of viewing, hearing, and discrimination - size, contrast



Look alike medications

tall man	*lettering*
ce**FAZ**olin	dexame**THASONE**
cefo**TE**tan	desmede**TOM**idine
cef**OX**itin	diphenhydr**AMINE**
cef**TAZ**idime	diaze**PAM**
cef**TRIAX**one	dil**TIAZ**em
chlorpro**MAZINE**	**LOR**azepam
clo**NID**ine	ni**CAR**dipine
quiN**ID**ine	ni**FED**ipine

*Brand names, which always start with a capital letter.

Medication group	Color of labels of infusion and perfusion pumps
Vasoactive drugs/high risk	Red
Sedation and neuro-blocking	Green
Hydrations	Blue
Antibiotics	Yellow
Analgesia	Light blue
Parenteral nutrition	Orange
Chemotherapy	Gray
Others	White

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Design implications for selective attention

2. **Support automaticity and unitization**
3. **Optimize top-down processing**
   - Minimize number of words that need to be recognized
   - Provide context

Meaningful icons

Limiting words, consistency

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Design implications for selective attention

4. **Maximize discriminating features**
   - Apply smaller vocabulary
   - Create context
   - Exploit redundancy gain
   - Test symbols and icons

Instructions from Air Traffic Control
"Delta 123, descend to 5,000 feet,"

Instructions from pilot to cabin crew
"Cabin crew, please take your seats for take-off."

Instructions from cabin crew to passengers
"Please ensure that your seatbelt is securely fastened, your seat back is in the upright position, and your tray table is stowed. All electronic devices should now be switched to airplane mode."

Phonetic alphabet

A ALPHA	N NOVEMBER
B BRAVO	O OSCAR
C CHARLIE	P PAPA
D DELTA	Q QUEBEC
E ECHO	R ROMEO
F FOXTROT	S SIERRA
G GOLF	T TANGO
H HOTEL	U UNIFORM
I INDIA	V VICTOR
J JULIET	W WHISKY
K KILO	X X-RAY
L LIMA	Y YANKEE
M MIKE	Z ZULU

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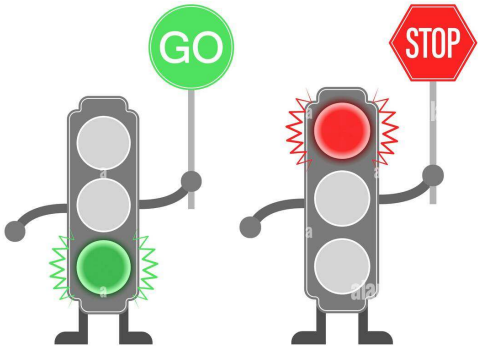
Design implications for selective attention

4. **Maximize discriminating features**
   - Apply smaller vocabulary
   - Create context
   - Exploit redundancy gain
   - Test symbols and icons

Test signs



Exploit redundancy

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Working memory

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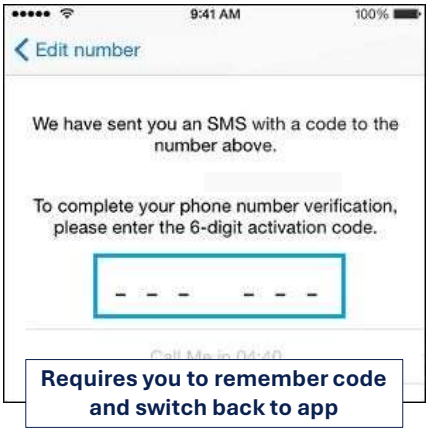
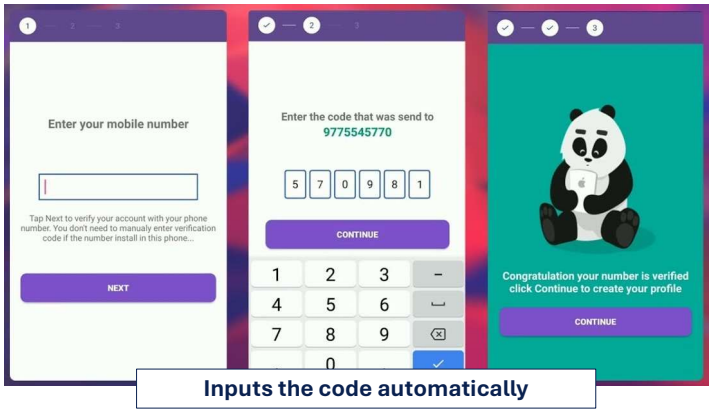
Design Implications of Working Memory

1. Minimize working memory load (keep the memory requirement short)



Requires you to remember code and switch back to app



Inputs the code automatically

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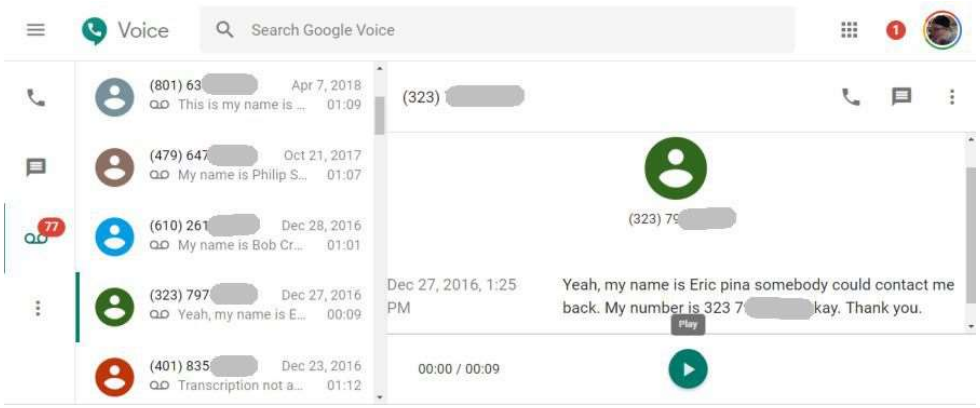
Design Implications of Working Memory

2. Provide visual cues - Couple auditory information with a redundant visual display to reduce working memory load.



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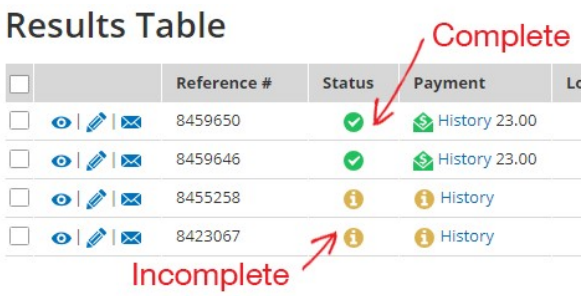
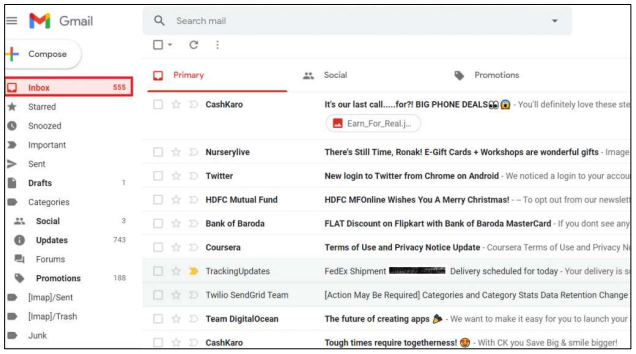
Design Implications of Working Memory

3. Provide placeholders for sequential tasks





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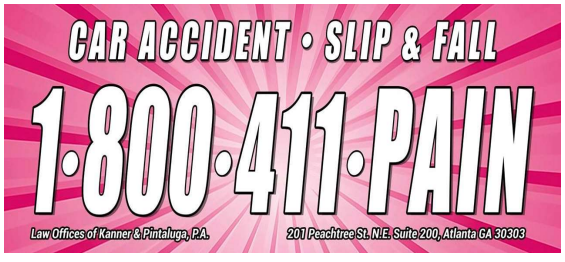
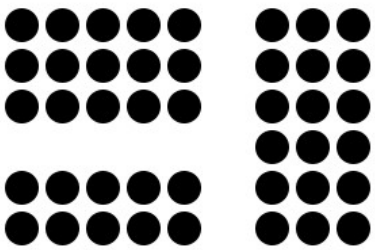
Design Implications of Working Memory

4. Exploit chunking
   - Chunk size – keep to 3 to 4 characters
   - Create meaningful sequences
   - Letters superior to numbers
   - Keep numbers separate from letters – HZY 701



5. **Minimize confusability**
   - Create visual, audio, or spatial distinctions
   - Use upper and Lowercase
     - WARNING! Keep a safe distance
   - Avoid abbreviations
   - Add spaces between words or strings
     - Example: (850) 555-1234



Law of Proximity

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Design Implications of Working Memory

6. Avoid unnecessary zeros (e.g., 000478 or 0.700)
7. Ensure congruence of instructions
   - **Incongruent**: Before adding the chicken broth, sauté the onion and garlic
   - **Congruent**: First sauté the onion and garlic. Then add the chicken broth.
8. Avoid negation
   - "Do not take without food"
   - "Take with food" or "take with a meal"

MEAT AND VEGETABLE SOUP

1 large can tomatoes
2 medium white onions, chopped
2-3 lb. chuck roast, cut up
2 fresh ears of corn
1 large can corn (kernel)
Water
1 large soup bunch of chopped shallots, cabbage, celery, turnips, carrots, potatoes and parsley
1 large can peas
Salt and pepper to taste

Boil meat in water with salt and pepper. Simmer 1 hour. Add tomatoes, onions, shallots, cabbage, celery and turnips. Simmer 1 hour. Add carrots, potatoes, corn on cob, corn, peas and parsley. May need more salt and pepper. Simmer 3 hours.

Willis Boudreaux, West Bank Council, New Orleans, La.

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Long-term memory

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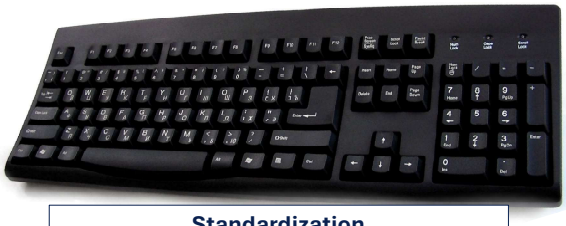
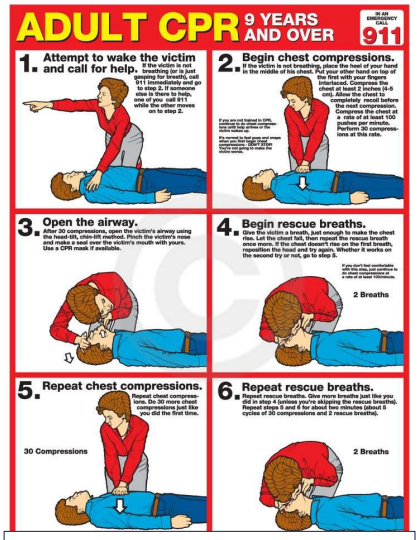
LTM implications for design

1. Encourage regular use of information
2. Encourage active reproduction
3. Standardization - Lessens amount of learning required when using new system
4. use memory aids – "place knowledge in the world"



Standardization



"Knowledge in the world"

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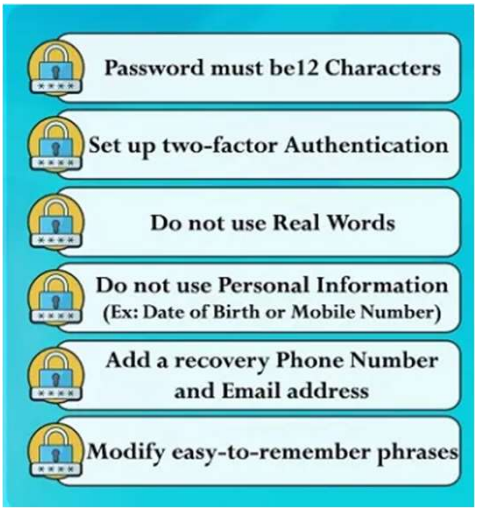
LTM implications for design

5. Carefully design information to be remembered. Information should be:
   - meaningful,
   - concrete,
   - distinctive,
   - organized,
   - free of jargon,
   - presented in multiple modes,
   - not require obscure context info
6. Design helpful habits
   (*incentives and disincentives*)



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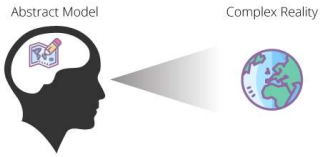
LTM implications for design

7. Design to support development of mental models
   - Input options and system state should be clearly visible and transparent



Option 1	**Option 2**
A = 1	A = 2
B = 2	B = 1
C = 3	C = 4
D = 4	D =3

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Next lecture (Wed., Jan. 22)

Topic: Design guidelines for decision-making
Read/Review: Ch. 7 (7.1 – 7.3, 7.4 – 7.9)

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