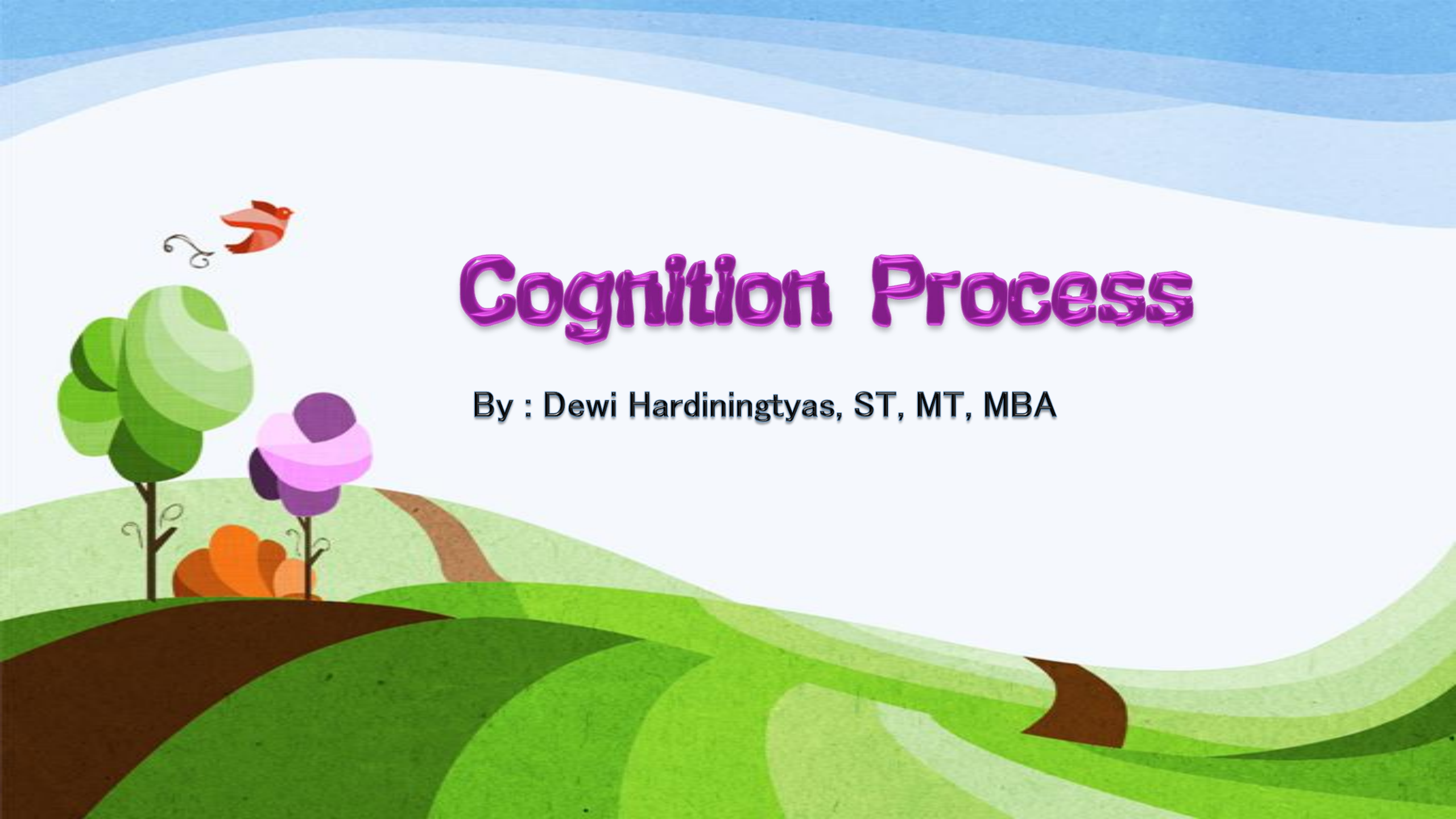
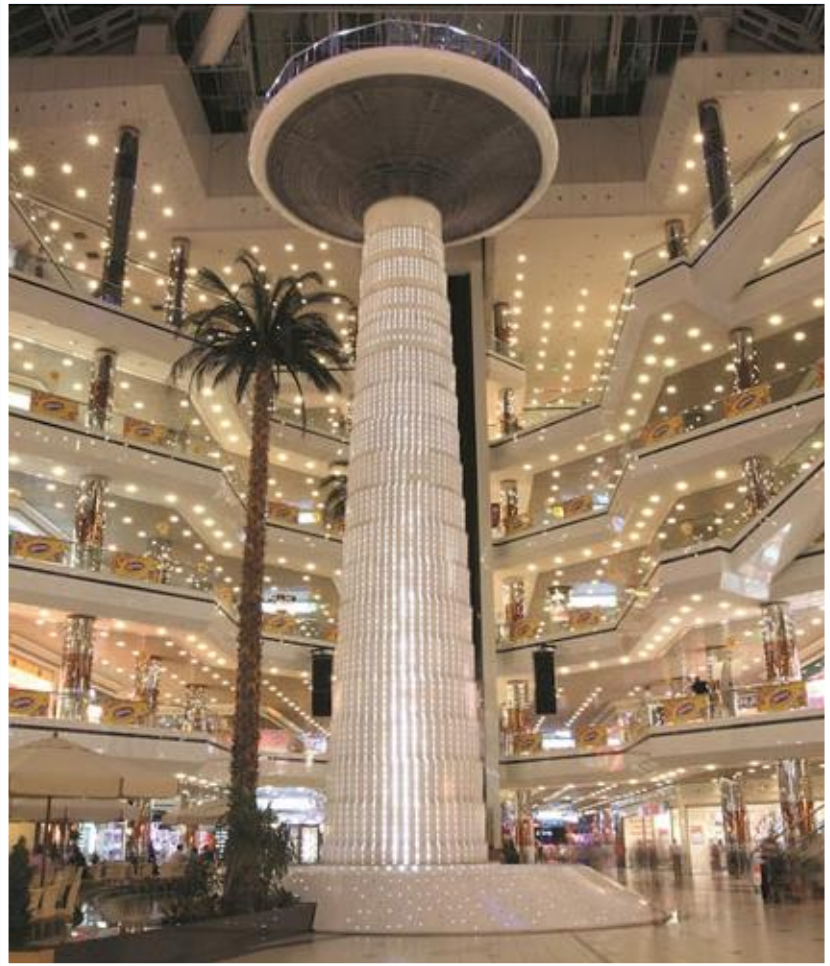


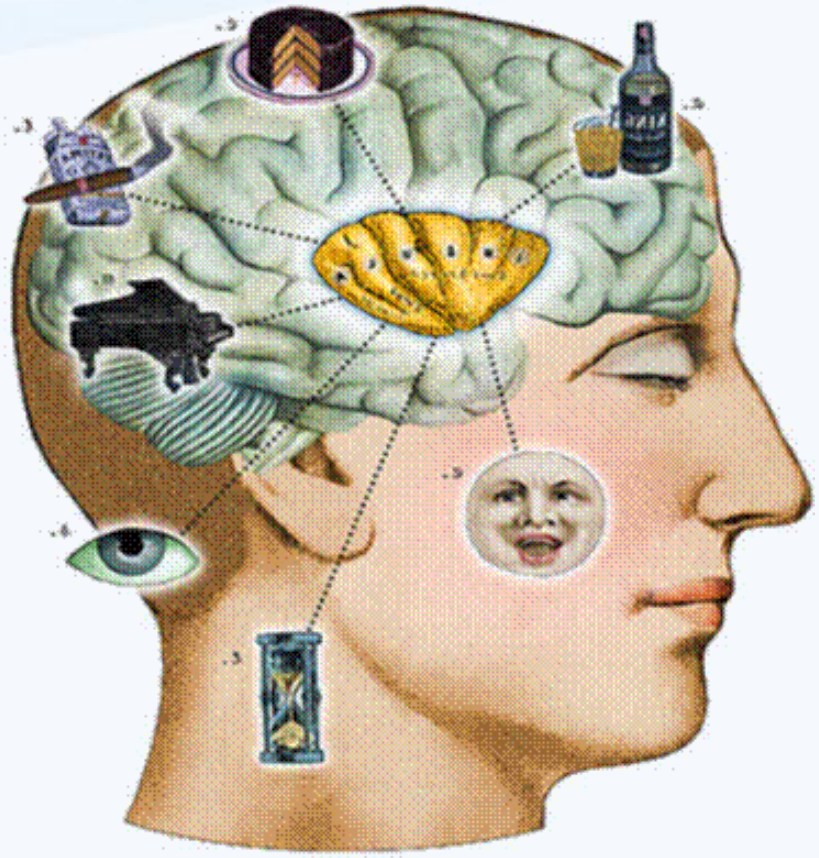
Cognition Process

By : Dewi Hardiningtyas, ST, MT, MBA



Forgetting?

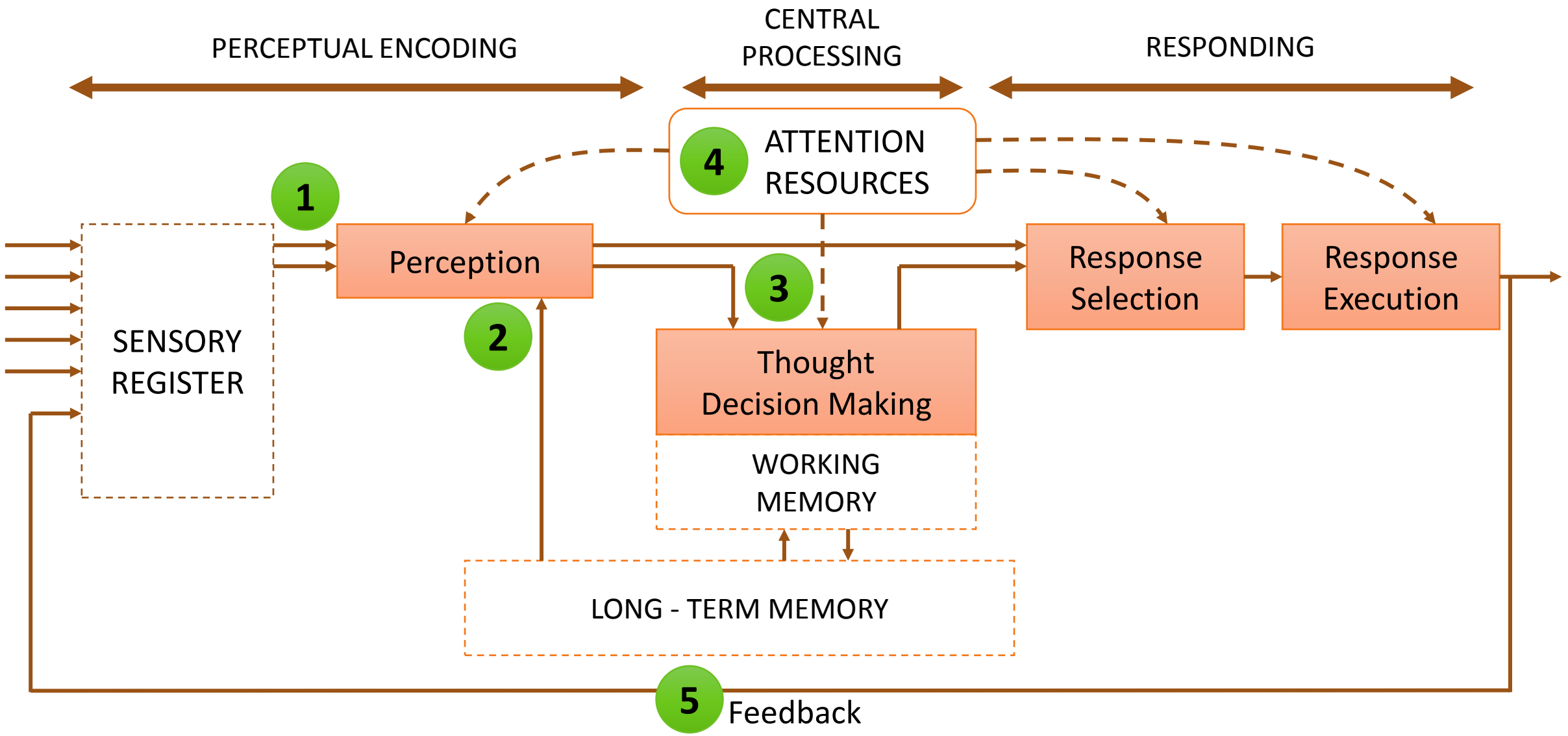
Remembering?



COGNITION

is a group of mental processes that includes attention, memory, producing and understanding language, learning, reasoning, problem solving, and decision making.

Human Information Processing Model



Explanation

1. The senses gather information from the environment, which is then perceived, providing meaningful interpretation of what is sensed.
2. Perception which is influenced by prior knowledge , comes through a mechanism called top–down processing. This prior knowledge is stored in long–term memory.
3. Sometimes, perception leads directly to the selection and execution of response. This condition requires temporary effort demanding–store, called working memory.
4. Mental or cognitive resources, a sort of pool of attention or mental effort that is limited availability and can be allocated to process as required.
5. Our actions often generate new information to be sensed and perceived, noted with the feedback loop.

Information Processing Stages

1. Perceptual Encoding

Includes human sensory system issues (see previous chapter). Bring knowledge to the sensory input; give it meaning

2. Central Processing

Includes concerns about 'attention resources' and issues related to perception, memory and thoughts about the need for decision making.

3. Responding

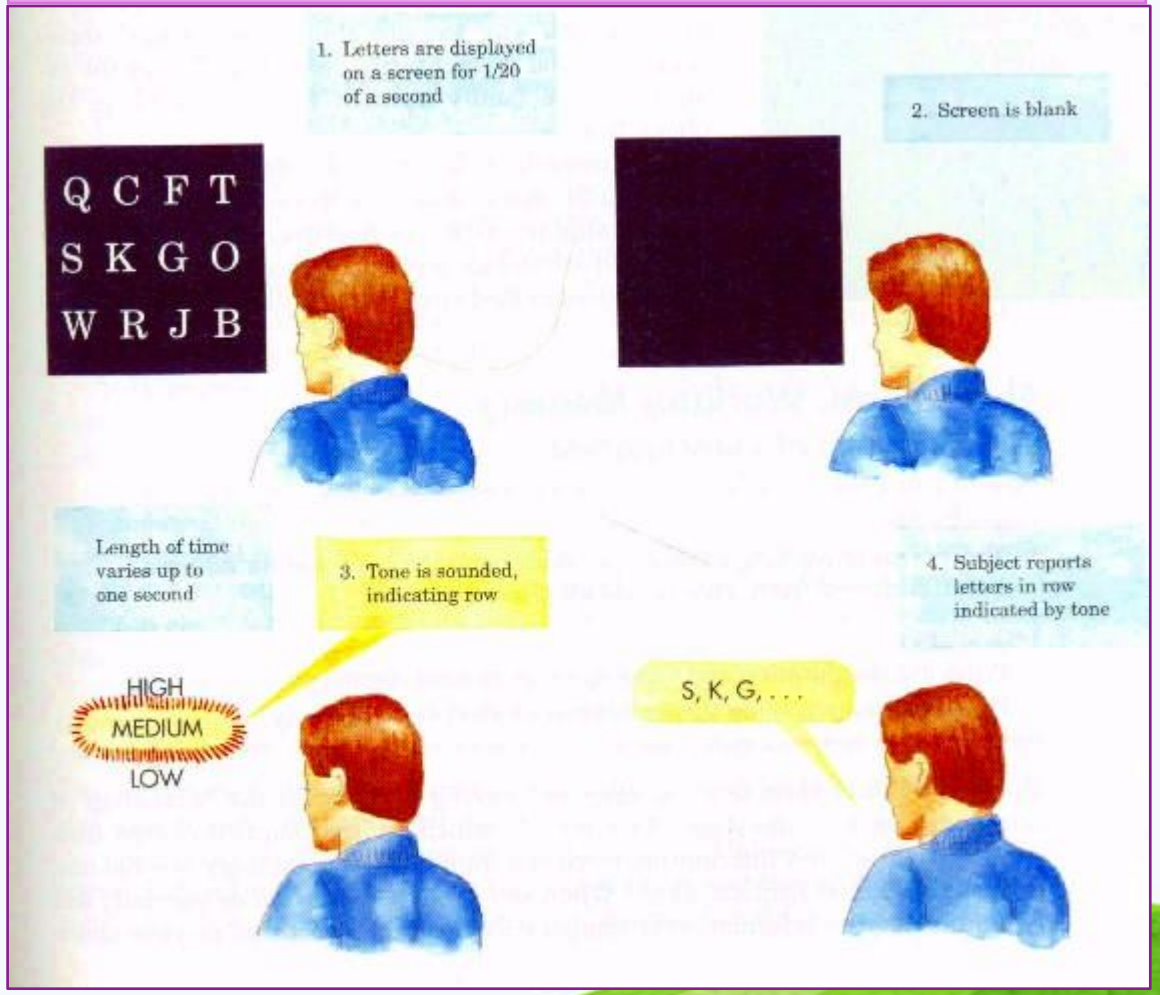
Includes selection and execution of the senses, feedback loop.

Sensory Register & Perception

Sensory Register

- Information must first be picked up by the senses before it can be processed (e.g., visual, auditory, touch, taste, smell)
  - Sensory store holds large capacity of info
  - Information is maintained in sensory register for no more than 2 – 3 seconds (echoic)

Sperling experiment demonstrates that info processed in sensory register is large, but short-lived



Subliminal Perception

- **Subliminal perception – perception below the threshold of awareness.**
  - Is it possible? If so, how would it affect behavior?
  - Sometimes, it's written in a cigarette advertisement.

- **Priming Effect** – People can identify a stimulus faster the second time they see it, even if they weren't consciously aware they saw it the first time.

Feature Analysis – Text Perception

- **Feature Analysis** – recognizing and evaluating pattern features
  1. Break stimulus pattern into component features
  2. Match features to stored patterns in LTM
  3. Decide which stored pattern is best match.
- **Feature Analysis** – allows us to read familiar words rapidly and overlook typographical errors.
  - Eg. If we see the word ‘the’ enough times, we begin to process it automatically as a global shape rather than analyze the individual features (parts of letters and individual letters).
- **Unitization** – transformation from feature analysis to global or holistic processing as familiarity with pattern increases.

GOOD EXAMPLE OF A BRAIN STUDY. IF YOU CAN READ THIS YOU HAVE A STRONG MIND.

7H15 M3554G3
53RV35 7O PR0V3
H0W 0UR M1ND5 C4N
D0 4M4Z1NG 7H1NG5!
1MPR3551V3 7H1NG5!
1N 7H3 B3G1NN1NG
17 WA5 H4RD BU7
N0W, 0N 7H15 LIN3
Y0UR M1ND 1S
R34D1NG 17
4U70M471C4LLY
W17H 0U7 3V3N
7H1NK1NG 4B0U7 17,
B3 PROUD! 0NLY
C3R741N P30PL3 C4N
R3AD 7H15.
PL3453 5H4R3 1F
U C4N R34D 7H15.

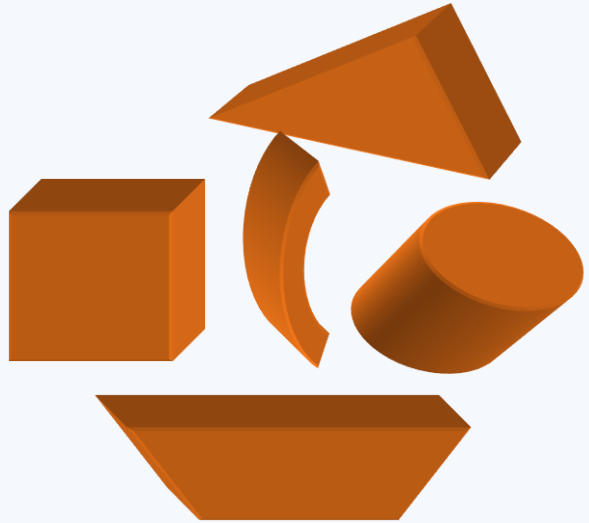
I cxn rxplxce xvexy txirx lextex of x sextexce xitx an x, anx yox stxll xan xanxge xo rxad xt – ix wixh sxme xifxicxltx.

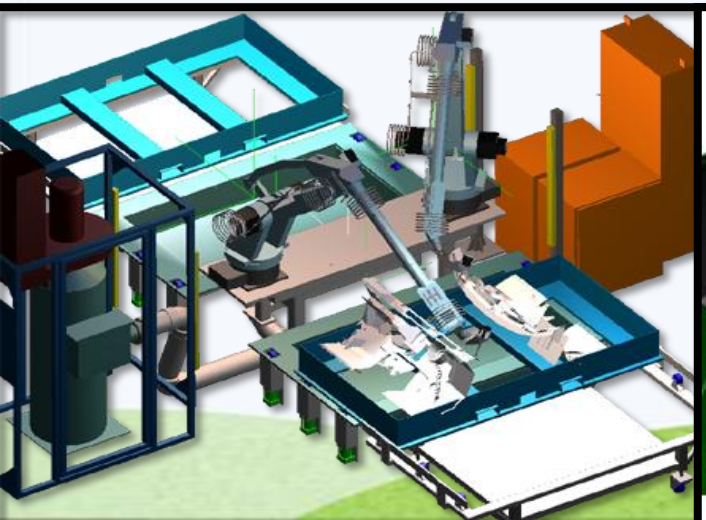
HF Implications For Text Perception

1. **Feature Compatibility** – Features of display can be read faster and more accurately if they are consistent with features in memory.
2. **Upper and Lowercase** – Printed CAPS are recognized more easily than lowercase in isolated words, but mixture of lower and upper cases is best for sentences
   - Example: WARNING! Keep a safe distance
3. **Use print for text display** – Print is easier to read than cursive
4. **Minimize abbreviations** – Avoid abbreviations, but when needed use a consistent rule such as 3 – 4 letter truncation.
   - Example: NAVAIRWARCENTRASYSDIV
5. **Space between words or strings** – separating strings into chunks makes it easier to read and remember
   - Example: (850) 555-1234

Feature Analysis – Object Perception

- **Geons** (Biederman) – fundamental geometric shapes that are combined to produce all other complex objects
- We recognize an object by:
  1. Breaking object into geons
  2. Categorizing each geon on basis of feature match
  3. Identifying the object on basis of geon configuration

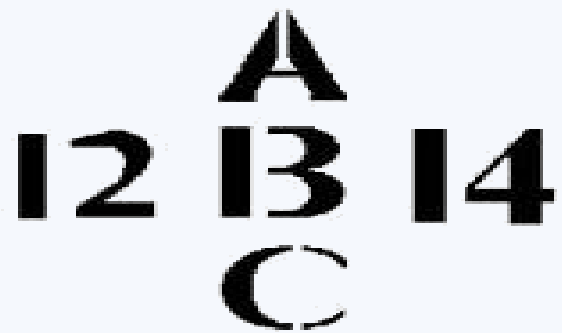




From a human factors perspective, what are the implications for simulator accuracy? – computer graphics vs. photo-realism

Top-down & Bottom-up Processing

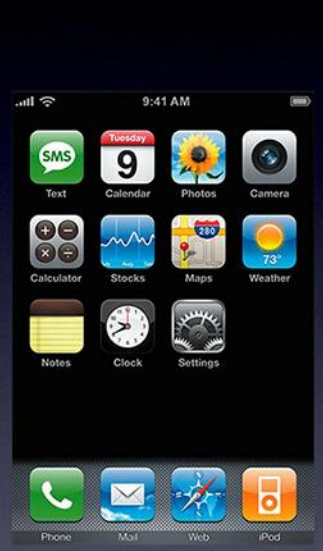
- **Bottom-up processing** (data-driven) – object recognition guided by sensory features
- **Top-down processing** (conceptually-driven) – object recognition affected by surrounding context
- ***Typically both processes work simultaneously, but when stimulus quality is low, top-down processing is predominant.***



Top-down & Bottom-up Processing Guidelines For Text And Icon Design

1. **Optimize bottom-up processing**
   - Ease of viewing and discrimination – size, contrast.
2. **Optimize top-down processing**
   - Use actual words, not random text strings
   - Minimize number of words that need to be recognized
   - Provide context information
3. **Evaluate tradeoffs**
   - Consider the optimal viewing conditions vs. availability of context, because of limited space
4. **Usability testing**
   - When testing for usability, do include context in which stimulus will actually be seen

Evolution of the iOS Home Screens

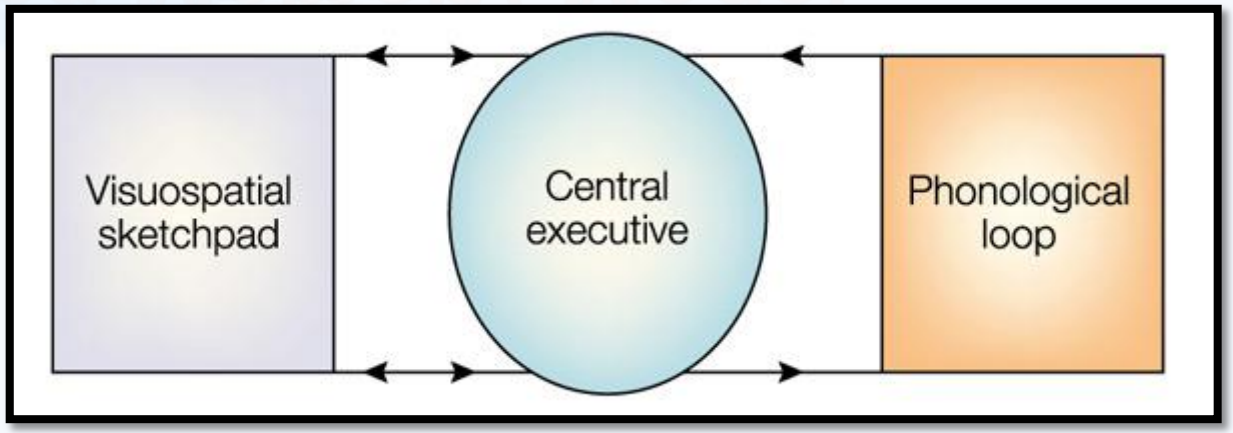



Working Memory

Working Memory

- Limitations in information processing. Only a limited amount of information can be brought from sensory to working memory. **Working memory is the temporary holding of information that is active.**
- Working memory is limited in two ways: **“Capacity” and “Time”**
- Working memory is limited in
  - ‘how much’ information can be kept active
  - ‘how long’ it can be kept active

Working Memory Model



Baddeley's Working Memory Model

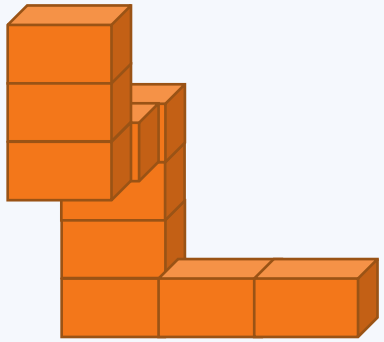
- **Working Memory** (short-term memory) – temporary (approx 30 – 90 sec) and limited capacity (7 +/– 2 chunks) of verbal and spatial information that is currently being used. (Info will be replaced by new info if not rehearsed)
- **Central Executive** – attention control system that coordinates info from other two subsystems.
- **Visuospatial Sketchpad** – holds info in an analog spatial form while it is being used. (eg. Mental imagery)
- **Phonological Loop** – represents verbal information in an acoustical form while it is being rehearsed. (eg. Sub-vocal articulation)

CHUNKING

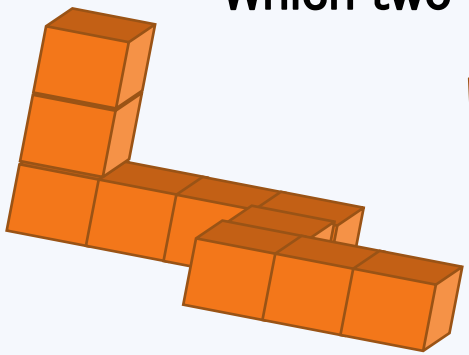
- The capacity of human working memory to be around 7±2 chunks
- Physical and cognitive properties that bind items together
  - Eg. 8 4 7 9 has 4 chunks
  - 28 36 45 89 also has 4 chunks
- Chunking reduces the number of items in working memory and makes use of meaningful associations. Also, material can be more easily rehearsed.
- Remember this 081235003070 or 0812-35-003-070. Which one is easier?

Spatial Ability

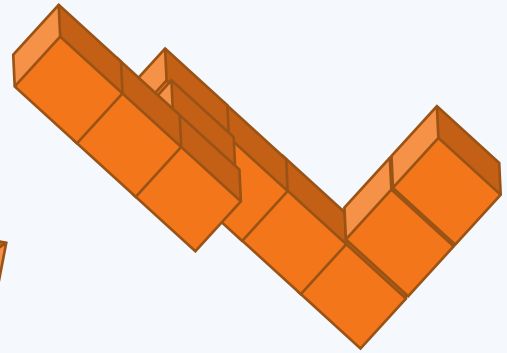
*Vandenberg & Kuse



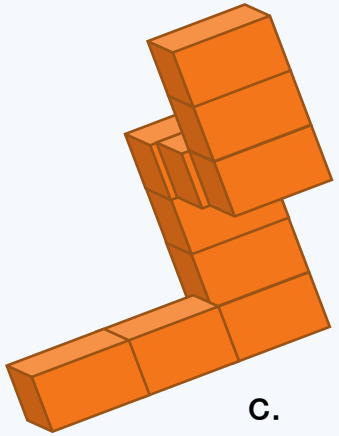
Which two of the four shapes below are the same as this one?



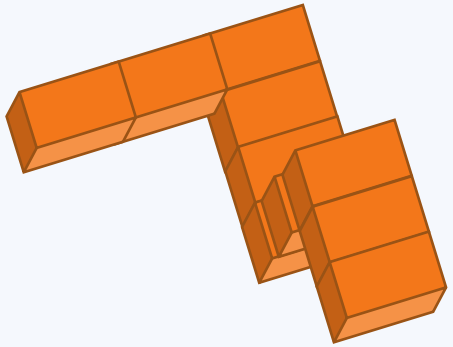
a.



b.



c.



d.

As you try to answer this question, how is the central executive allocating your attention resources?

HF Implications of Working Memory Limits

1. **Minimize working memory load**
   - Keep the memory requirement short and small enough for working memory. (eg : view side by side in Ms. Office).
2. **Provide visual echoes**
   - Whenever synthetic voice is used to convey verbal message, be coupled with a visual readout.
3. **Exploit chunking**
   - Physical chunk size
     - keep to 3–4 characters/chunk.
   - Meaningful sequences
     - 1776/230/1492/755
   - Superiority of letters over numbers
     - 1–800–ASK HELP
   - Keeping numbers separate from letters
     - N 4393 QJ is better than N4393QJ
5. **Provide placeholders for sequential tasks.**
6. **Minimize confusability**
   - Create visual, audio, or spatial distinctions
     - Confusion between A5433 and A5432
7. **Avoid unnecessary zeros in codes to be remembered.**
   - The zeros code like 0002385
8. **Consider working memory limits in instructions.**
   - The sentences presented in instructions must be accurately comprehended.
     - “Do A. Then do X and Y”
     - is better than
     - “Before doing X and Y, do A.”

LONG-TERM MEMORY (LTM)

Long-term Memory

- **Long-Term Memory** – mechanism for storing information and retrieving it at later times.
  - **Learning :** the processing of storing information in LTM.
  - **Retrieval** : accessing information from LTM back into WM
- LTM can **be distinguished** by :
  - **semantic memory :** general knowledge (memory for facts or procedures)
  - **event memory :** memory for specific events
- Important features that determine retrieval of LTM :
  - **Strength** – is determined by the frequency and recency of its use (eg. using notebook's password everyday, practicing emergency procedure before airplane take off)
  - **Associations** – each time retrieved in LTM may be linked or associated with other items (eg. the sound of a foreign word is associated with its sound in the native language of the speaker).

Semantic Memory

- **Semantic Networks** – information is stored in a network of associations
  - Think about how you try to recall a name from your past. Does it start by thinking of something associated with that person?
- **Schema** – One's entire knowledge structure about a given topic
  - Experts knowledge may be structured very differently from novices. Try to make a schema using mind mapping.
- **Mental Models** – They way in which one expects a system to work.
  - **Population Stereotype** – similar mental models held by many people. Ex : light switch is on in up position, hot water knob is on the left.
- **Cognitive Maps** – mental representations of spatial information, like the layout of a city, room, or a workplace.

Mention the knob related with its stove!

Branding

Results
- Profitability
- Sales

Strategy


- Objectives
  - Customers
  - Competition
- Research
- Positioning
  - Differentiation

Values


- List
- = brand

Brand =


- Idea!
- Promise
- Feeling

Products


- Services
- Fit?

Customer


- Journey
  - Awareness
  - Desire
  - Purchase

Visual


- Brand
  - identity
  - logo
    - colours
    - typeface

Staff


- Beliefs?
- Engaged?
- Actions?

Promotional


- Mix
  - Spend
    - reach
  - Integrated?

Brain


- Stories
- Repetition
- Experiences

www.nigeltemple.com

Event Memory

- **Episodic Memory** – personal knowledge or memory of a specific event (flashbulb)
  - Biased by plausible scenarios
  - Confidence in memory accuracy unrelated to actual accuracy
  - Implications for eyewitness testimony
    - Ex : If you saw the events of Aceh Tsunami on TV, what did you see live and what did you see replayed?
- **Prospective Memory** – memory of what one is supposed to do
  - Inability to retrieve info is referred to as cognitive failures or absent-mindedness
  - Failures prevented with reminders or checklists
    - Ex : Sticky-note “to do” lists

Forgetting

- **Forgetting** – caused by decay of item strength and association or inability to access (retrieve) information.
- **Memory retrieval fails** due to:

1. Weak item strength due to low frequency or recency of reactivation
   - Ex: Password that is accessed once a semester
2. Weak or few associations of item with other info
   - Ex: (apple – red – fire – water)
3. Interfering associations
   - Ex: giving your current spouse an anniversary card on the anniversary of your previous marriage.

HF Implications of LTM Limits

When you buy a new smartphone which use the same operating system, do you read its entire manual book?

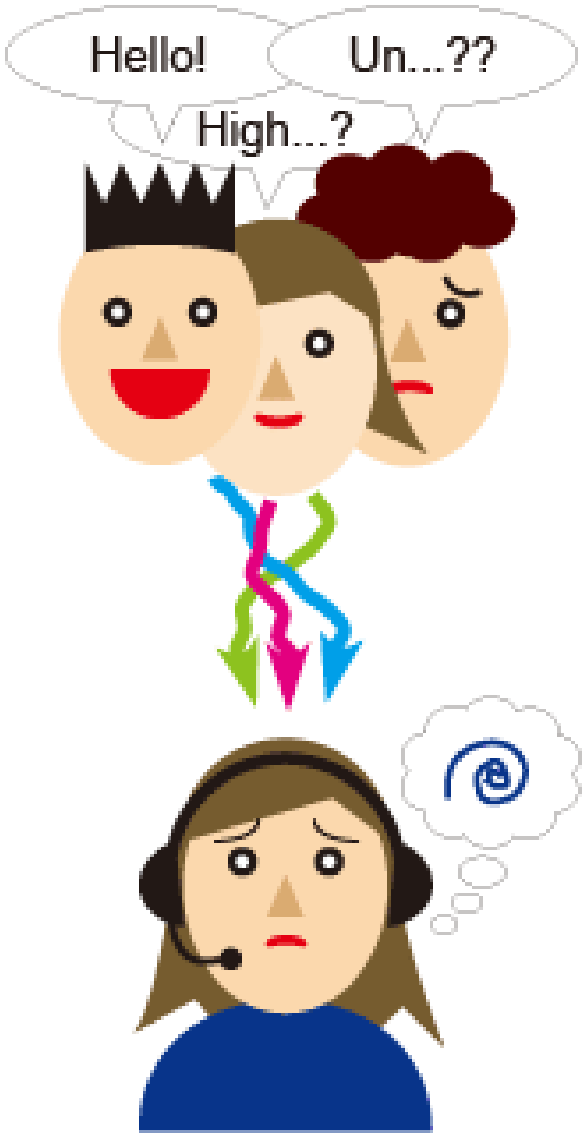
1. **Encourage regular use of information to improve frequency and recency.**
2. **Encourage active verbalization or reproduction of information that is to be recalled.**
3. **Standardize**
   - Environments and equipment, including control, displays, symbols, and operating procedures.
4. **Use memory aids**
   - When a task perform infrequently or critical, provide computer-based or hardcopy memory aids.
5. **Carefully design information to be remembered**
   - Info should be meaningful, concrete, distinctive, well-organized, able to be guessed based on other information, free of jargon
6. **Design to support development of correct mental models**
   - Input options and system state should be clearly visible
7. **Design info to be consistent with user stereotypes**

Attention

Due to limited attention resources, humans must allocate attention appropriately

- **Selective Attention** – allows us to process important information
  - Ex : "cocktail party effect"
- **Focused Attention** – allows us to filter out unwanted information
  - Ex : studying with the radio on
- **Divided Attention** – allows us to perform multiple tasks at once
  - Ex : driving while tuning the stereo
- **Time-Sharing** – switching between cognitive tasks
  - Results in "time-sharing decrement" are the drop in performance of one or both tasks
- ***HF implication : how is driving affected by cell phone use?***

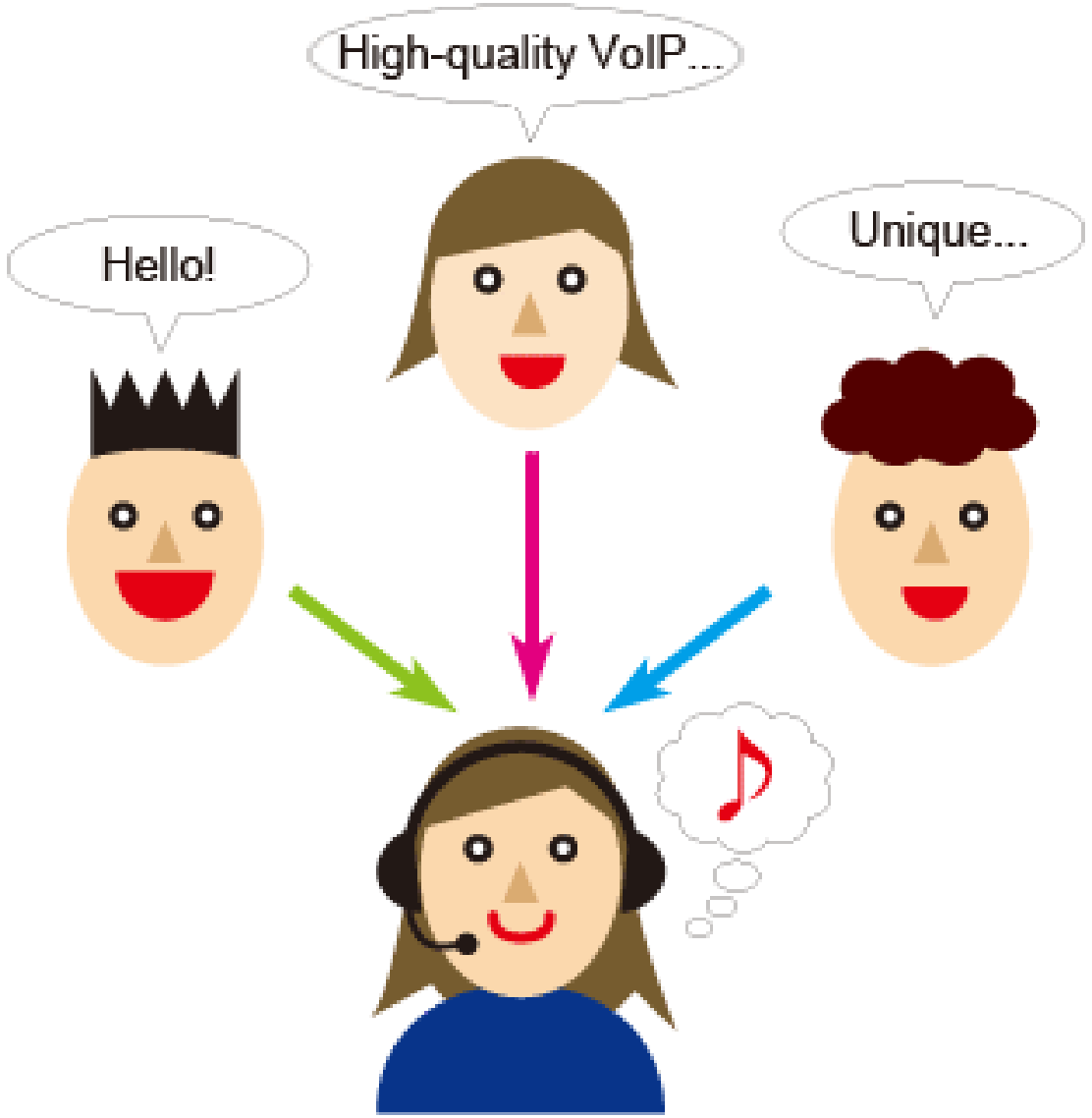
Before Conventional Teleconference



"Cocktail Party Effect"

Locating each speaker's virtual position in the audio space

After Teleconference with "eSound™ Positioning"



Automatic vs. Controlled Processing

- **Controlled Processing** – effortful cognitive processes requiring attention to initiate and sustain (processing unfamiliar info)
- **Automatic Processing** – processing performed with little demand on attention (well practiced tasks)

BLUE	RED	GREEN	YELLOW
GREEN	RED	YELLOW	BLUE
RED	YELLOW	GREEN	BLUE
YELLOW	GREEN	BLUE	RED
GREEN	BLUE	RED	YELLOW

Situation Awareness

- Designers, researches, and users of complex dynamic system often employ the cognitive concept of situation awareness, or SA, to characterize user's awareness of the meaning of dynamic changes in their environment.
- **Situation Awareness defines as the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.**
- Example : in controlled-flight-into-terrain-accidents it almost always assumed that the pilot lost awareness of the aircrafts' altitude over or trajectory toward the terrain.
- SA measurement : SA Global Assessment technique (SAGAT)
  - Further information see http://www.hf.faa.gov/workbenchtools/)

Addressing Time-sharing Overload

- Task redesign
- Interface redesign
- Training
- Automation

There can be no knowledge without emotion. We may be aware of a truth, yet until we have felt its force, it is not ours. To the cognition of the brain must be added the experience of the soul.

(Arnold Bennett)


KEEP
CALM
AND
STUDY
HARD