Human-Computer Interaction: HCI

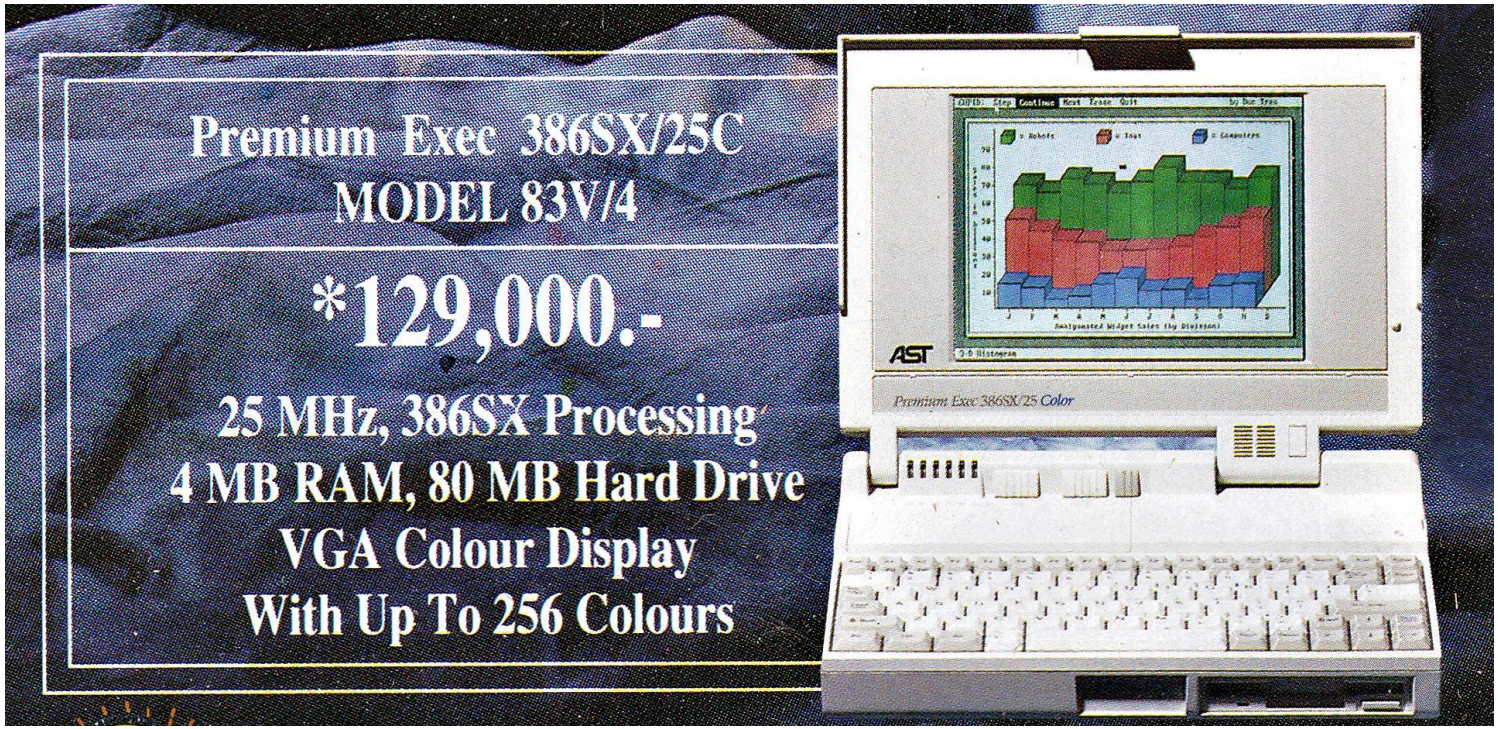
Montri Phothisonothai

International College, KMITL

Sep 11 & 18, 2017

Notebook in 1992

- 129,000 THB (3,900 USD)



Ultimate Goal of HCI?

- Human and the machine completely connected
- Neural Linking
  - https://neuralink.com/
- OpenAI
  - www.openai.com

Elon Musk, the founder and CEO of Neuralink and OpenAI and more

https://en.wikipedia.org/wiki/Elon_Musk

Sensory Information of **Taste, Tongue, Mouth**

- Human I/O Units
- Processed by the Brair

Photo by http://dkcoin8.com

Sensing the Future of HCI

- Sensing the future of HCI: **Touch**, **Taste**, and **Smell** user interfaces

Marianna Obrist, University of Sussex
Carlos Velasco, University of Oxford and Imagineering Institute
Chi Vi, University of Sussex
Nimesha Ranasinghe, Keio-NUS CUTE Center
Ali Israr, Disney Research
Adrian Cheok, Imagineering Institute
Charles Spence, University of Oxford
Ponnampalam Gopalakrishnakone, National University of Singapore

Magazine interactions Interactions
Volume 23 Issue 5, September-October 2016
Pages 40-49

Multisensory HCI Design

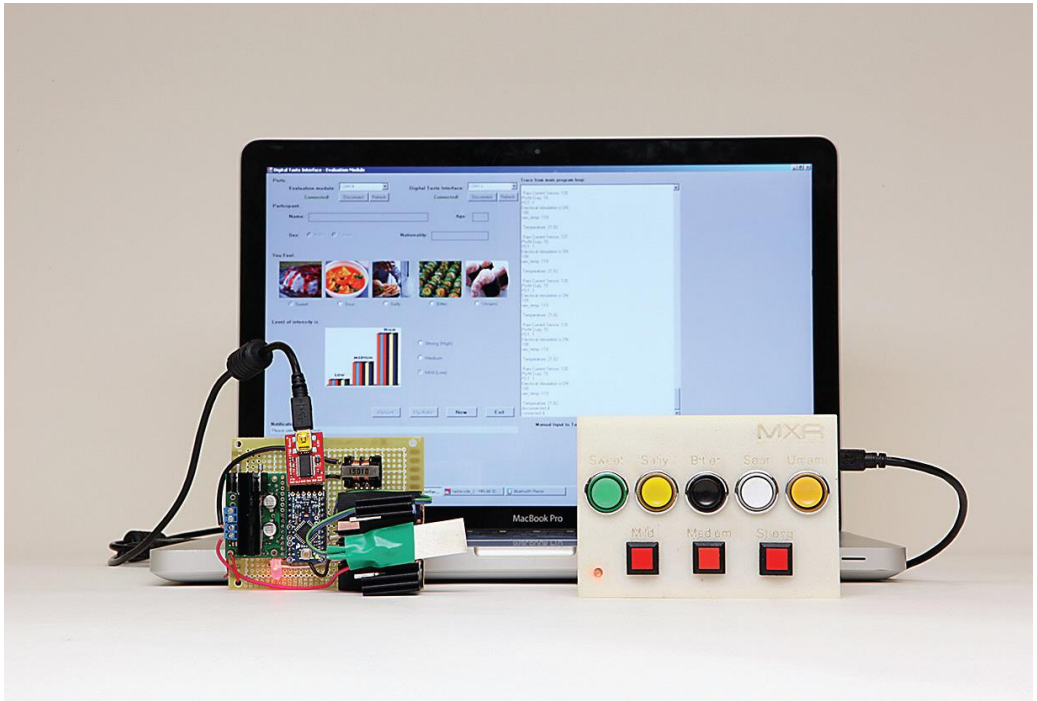
- Tactile, Gustatory, and Olfactory
- Relationships between the senses
  - (e.g., integration of taste and smell into flavor)
- Understand what limitations come when users need to monitor information from more than one sense simultaneously

Beyond Audio-Visual Interfaces

- It is key for HCI to leverage the full range of tactile sensations (vibrations, pressure, force, balance, heat, coolness/wetness, electric shocks, pain and itch, etc.), taking into account the active and passive modes of touch and its integration with the other senses.

- New tools for interactive experience design and will help to uncover the sensory stimulation and emotional responses.

Taste+ (Digital Taste Interface)



The user can augment the flavors of food and beverages by applying weak and controlled electrical pulses on their tongue using electronically enhanced everyday . The initial experimental results show that users perceive virtual salty and sour sensations.

Digital Taste Interface: How does it work?

- Using chemicals in an interactive system is unrealistic since a set of chemicals is difficult to store and manipulate. Furthermore, the chemical stimulation of taste is analogous in nature, making it impractical to use this approach for digital interactions.
- New non-chemical approach is required to achieve digital control over the sensation of taste.
- Simulating the sensation of taste is introduced by actuating the human tongue through **electrical** and **thermal** stimulation methods.
- The Digital Taste Interface consists of two main modules;
  - Control module (to formulate different electrical and thermal stimuli)
  - Tongue interface (which has two silver electrodes to wear on the human tongue).
- The effects of factors such as magnitude of current, frequency, and the change of temperature have been accounted for stimulating the tongue noninvasively.
- The experimental results suggested that sourness and saltiness are the main sensations that could be evoked while there are evidences of sweet and bitter sensations too.

HCI Research: Digital Taste Interface

Digital Taste Interface

- https://www.youtube.com/watch?v=7HMDIIWgAhc&hl=en%5FUS&version=3

* Nimesha Ranasinghe, PhD Thesis, at NUS

Moving Toward the Chemical Senses

- There are still many challenges when studying **taste** and particularly **smell**, especially related to varying over time, and cross-sensory influences.
- Smell and taste are known as the chemical senses because they rely on chemical transduction
- how to digitize these senses in the HCI context compared with others like sound and light (We do not yet know entirely)
- In the case of **touch**, the process is well facilitated through the haptic technologies

AromaShooter: Smell-delivery Device

- Technological development due to the rich understanding achieved by *psychology* and *neuroscience*

Augmented Reality Flavors

- Augmented Reality Flavors: Gustatory Display Based on Edible Marker and Cross-Modal Interaction
- https://www.youtube.com/watch?v=qMyhtrejct8

HCI Haptics - Force Feedback

Robot-art-2017

- https://www.youtube.com/watch?v=3pgftBhorFY

Modality (human–computer interaction)

- Classification of a single independent channel of sensory **input**/**output** between a computer and a human
- System is designated unimodal if it has only one modality implemented, and multimodal if it has more than one
- Type of Modalities in HCI
  - Computer–human modalities
  - Human–computer modalities

Computer–Human Modalities

- Computers utilize a wide range of technologies to communicate and send information to humans:
- **Common modalities**
  - Vision – computer graphics typically through a screen
  - Audition – various audio outputs
  - Tactition – vibrations or other movement
- **Uncommon modalities**
  - Taste
  - Smell
  - Heat
  - Pain
  - Balance

Human–Computer Modalities

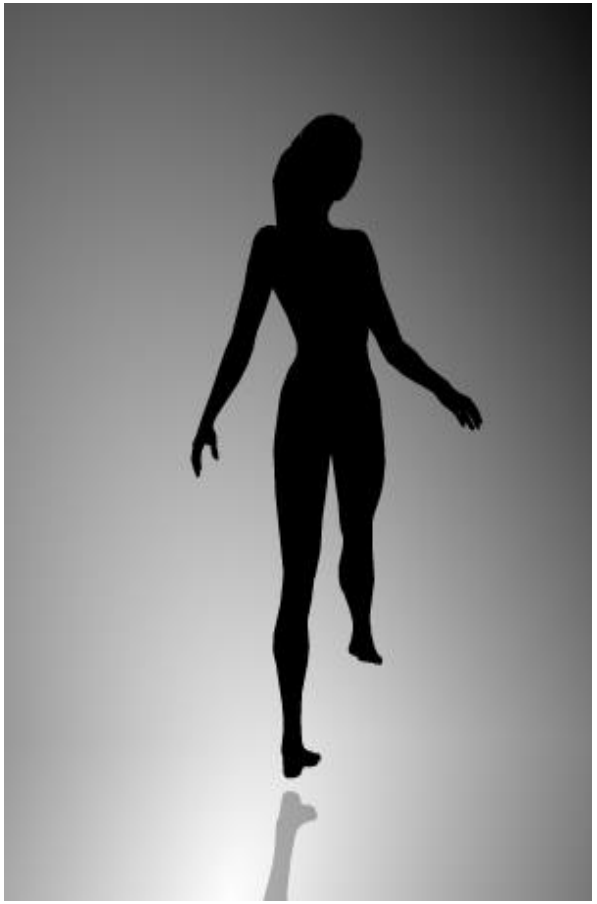
- Computers can be equipped with various types of input devices and sensors to allow them to receive information from humans.
- **Simple modalities**
  - Keyboard
  - Pointing device
  - Touchscreen
- **Complex modalities**
  - Computer vision
  - Speech recognition
  - Motion
  - Orientation

Example of Complex modalities

- Speech recognition was a major selling point of the iPhone 4S and following Apple products, with the introduction of **Siri**

- Other complex modalities such as computer vision in the form of **Microsoft's Kinect** or other similar technologies can make sophisticated tasks easier to communicate to a computer especially in the form of three dimensional movement

Clockwise or anti-clockwise?



If **clockwise**, then you **use more of the right side of the brain** and vice versa.
Most of us would see the dancer turning anti-clockwise though you can try to focus and change the direction

Left and Right

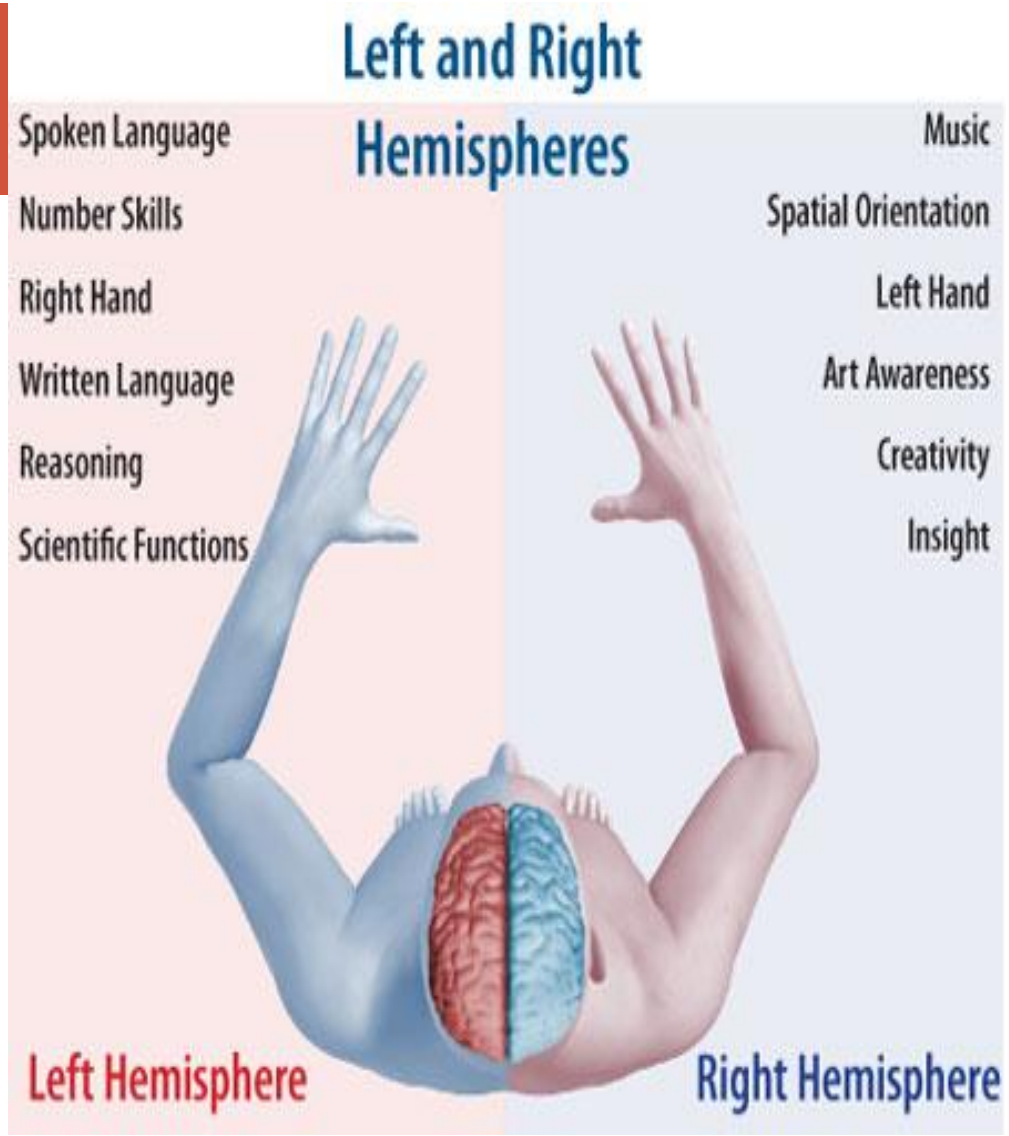
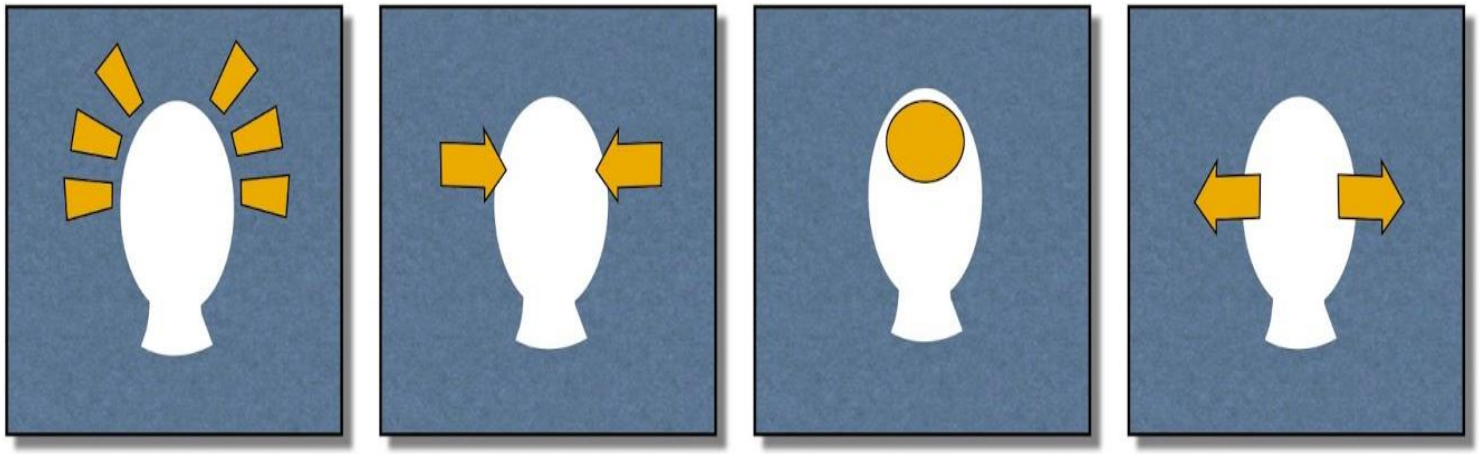


Photo by http://www.msha.com/

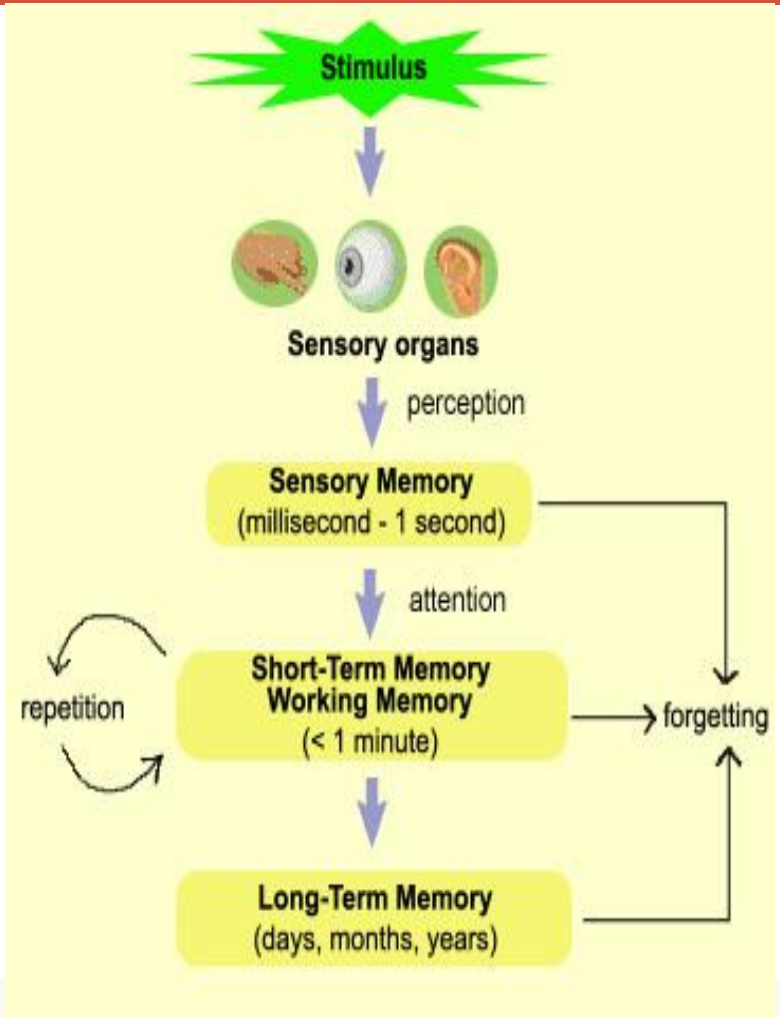
How People Learn:

Four cognitive processes every teacher should know



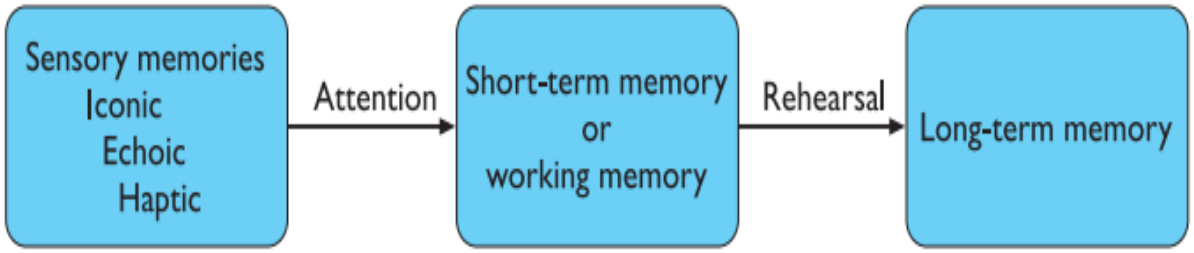
Attention Encoding Storage Retrieval

Memory and Learning



Sensory memory

- Buffers for stimuli received through senses
  - iconic memory: visual stimuli
  - echoic memory: aural stimuli
  - haptic memory: tactile stimuli



A model of the structure of memory

Short-term memory (STM)

- Temporary recall
  - rapid access ~ 70ms
  - rapid decay ~ 200ms
  - limited capacity - 7± 2 (digit span)

Examples

457

Examples

68798

Examples

26539762085 3

Examples

44 113 245 8920

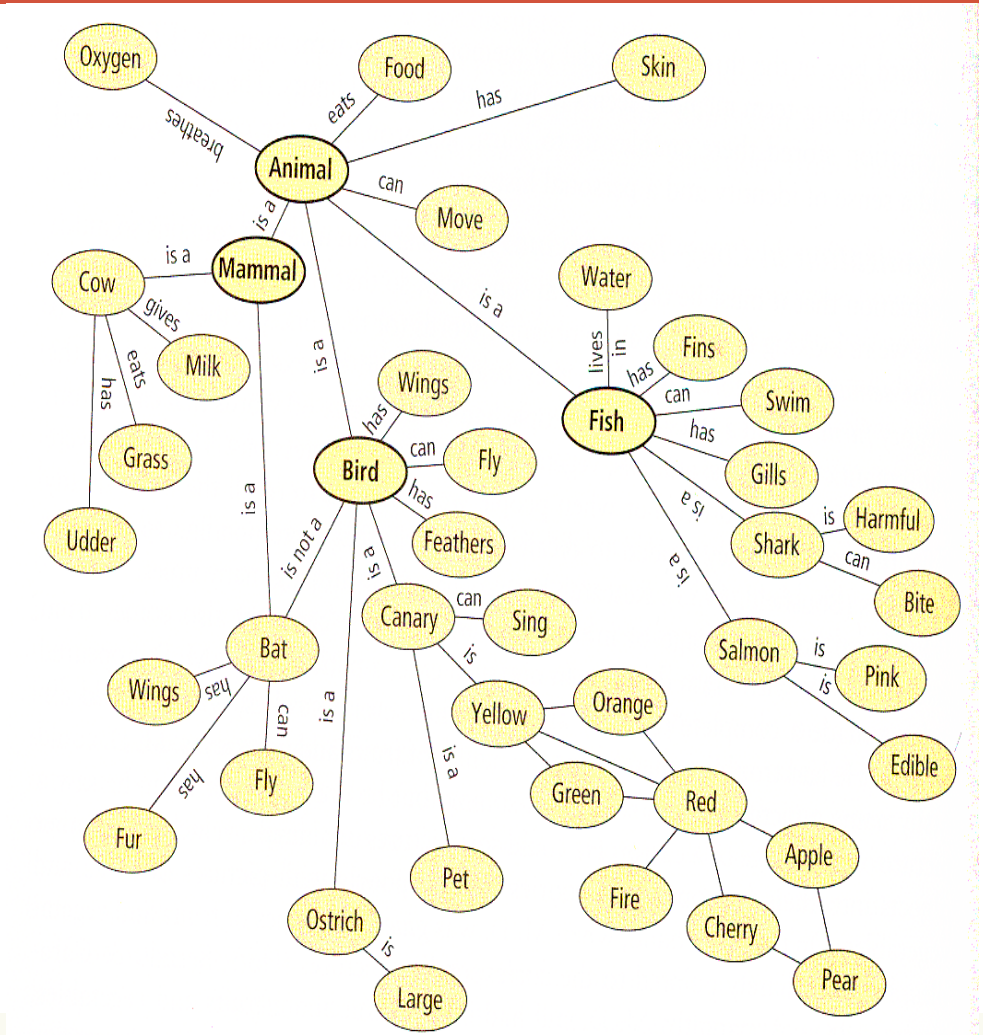
Long-term memory (LTM)

- Repository for all our knowledge
  - slow access ~ 1/10 second
  - slow decay, if any
  - huge or unlimited capacity

- Two types
  - episodic – serial memory of events
  - semantic – structured memory of facts, concepts, skills

  semantic LTM derived from episodic LTM

LTM - semantic network



Your LTM – semantic network?

- Computer
- C Language