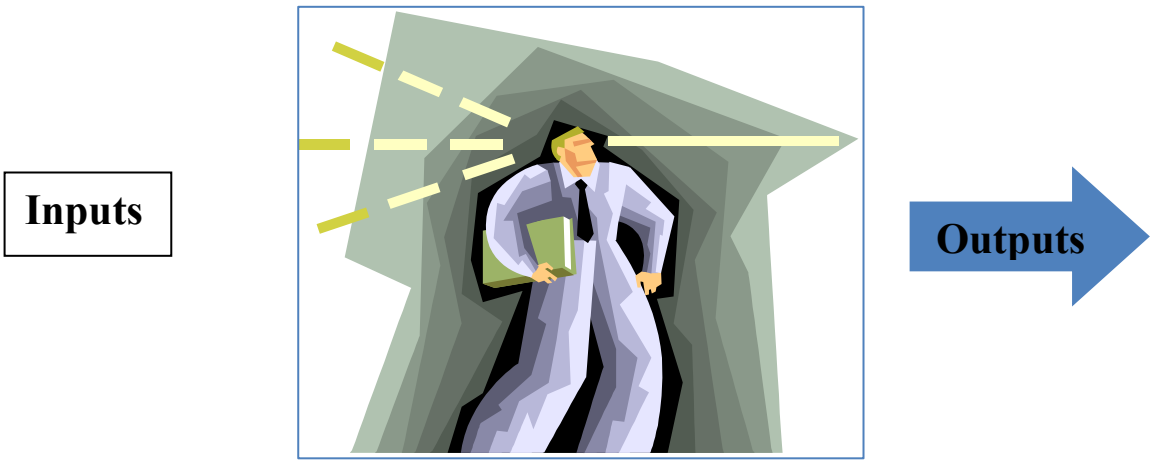
Human Information Processing

Information Processing

An information system that accepts inputs from the external world and produces responses directed out to the external world as shown in the following figure.



Human Information Processing (HIP)

What exactly is human information processing? Information Processing is the change in a state of information. It allows us to split information down into steps which can be easily read and understood by the human brain. It allows people to store, retrieve and use information with ease. There are **four steps** to how information is collected and used:

1. Absorb the information (استيعاب المعلومات)
2. Analyse the information(تحليل المعلومات)
3. Use the information (استخدم المعلومات)
4. Do something with the information (افعل شيئًا بالمعلومات)

The Model Human Information Processor

An important concept from cognitive psychology is the model human processor (MHIP). This describes the cognitive process that people go through between perception and action. It is important to the study of HCI because cognitive processing can have a significant effect on performance, including task

completion time, number of errors, and ease of use. This model was based on the human information processing model.

The model human processor consists of **three interacting systems**. Each has its own memory and processor.

Human Information Processing

1.Perceptual processor (Lecture#2)

_ Outputs into audio storage

_ Outputs into visual storage

2.Cognitive processor

_ Outputs into working memory.

_ Has access to:

o Working memory

o Long term memory

3.Motor processor

_ Carries out actions

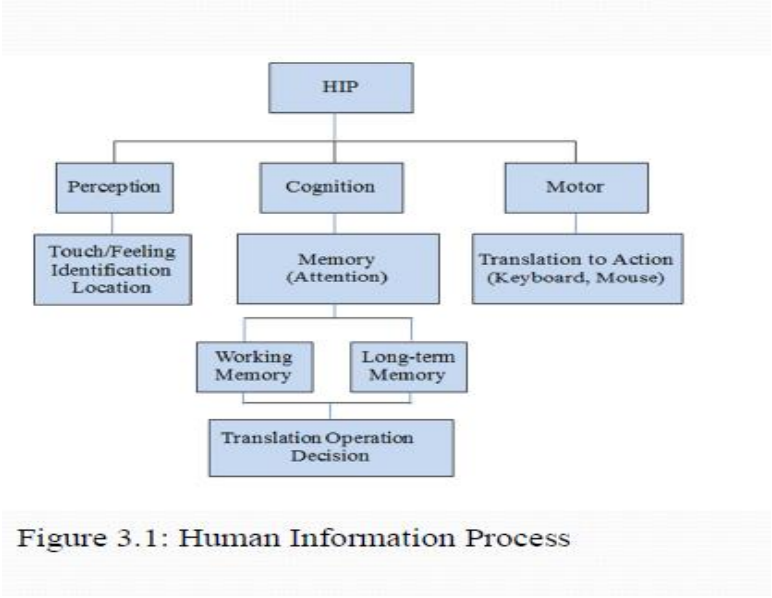


Figure 3.1: Human Information Process

2.Cognition

Cognition is the processing of information from the world around us. It ncludes **perception, attention, pattern matching, memory, language processing, decision making, and problem solving**. Cognitive load is the amount of mental resources needed to perform a given task.

All user interfaces make cognitive demands on users. Users must master special rules of system use, learn new concepts, and retain information in short-term memory. They must create and refine a mental model of how the system works and how they should use it. Systems that use purely auditory interfaces further challenge human memory and attention because they present information serially and non-persistently.

Successful user interface designs must respect the limitations of human cognitive processing. If a design requires the user to hold too many items in short-term memory or to learn a complex set of commands too quickly, it will fail.

Cognitive Frameworks

Cognition is the process by which we gain knowledge. The processes, which contribute to cognition, include:

- o Understanding (الفهم)
- o Remembering (التذكر)
- o Reasoning (المنطق او الاستنتاج)
- o Attending (الحضور)
- o Being aware(ان تكون على على علم او ادراك المعلومه)
- o Acquiring skills (اكتساب المهارات)
- o Creating new ideas (خلق أفكار جديدة)

A key aim of HCI is to understand how humans interact with computers, and to represent how knowledge is passed between the two.

The basis for this aspect of HCI is the science of cognitive psychology. The results of work of cognitive psychologists provide many lessons, which can be applied in the design of computer interfaces. These results are expressed in the form of cognitive frameworks.

HCI is fundamentally an information-processing task. The human information processing approach is based on the idea that human performance, from displayed information to a response, is a function of several processing stages. The nature of these stages, how they are arranged, and the factors that influence how quickly and accurately a particular stage operates, can be discovered through appropriate research methods.

HUMAN MEMORY

It is generally agreed that there are three types of memory or memory function: *sensory buffers*, *short-term memory* or *working memory*, and *long-term memory*. There is some disagreement as to whether these are three separate systems or different functions of the same system.

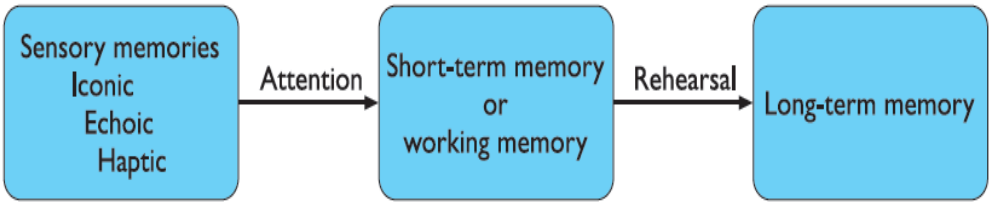


Figure 1.9 A model of the structure of memory

A. Sensory memory

The sensory memories act as buffers for stimuli received through each of the senses**: iconic memory for vision**, **echoic memory for sounds** and **haptic memory for touch.** These memories are **constantly overwritten** by new information coming in on these channels. Information is passed from the sensory memory into short-term memory by attention, filtering the stimuli to those that are at that moment of interest (arousal, or shift of attention).

B. Short-term memory

STM is used to **store information which is only required fleetingly**. **STM can be accessed rapidly**, however, **also decays rapidly**. **It has a limited capacity.** Miller stated the 7+/-2 rule, which means that humans can store 5-9 chunks of information. **Chunks** can be single items or groups of items, like 2 digits of a telephone number grouped together. Patterns can be useful as aids to memory.

C. Long-term memory

LTM differs from STM in various ways. It has an **unlimited capacity**, **a slow access time** and **forgetting occurs more slowly or not at all**. Information is stored here from the STM through **rehearsal**. There are 2 types of LTM: **episodic memory and semantic memory**. Episodic memory represents our memory of event and experiences in a serial form. Semantic memory is a structured record of facts, concepts and skills that we have acquired, derived from the episodic memory.

There **are 3 main activities** related to LTM: **storage of information**, **forgetting** and **information retrieval**.

Thinking: reasoning and problem solving

Thinking can **require different amounts of knowledge**. **Some thinking activities are very directed and the knowledge required is constrained**. **Others require vast amounts of knowledge from different domains**. Thinking can be divided in reasoning and problem solving.

Reasoning

Reasoning is the process by which we use the knowledge we have to draw conclusions or infer something new about the domain of interest.

Problem solving

Problem solving is the process of finding a solution to an unfamiliar taste, using (adapting) the knowledge we have.

3. Motor processor (Movement)

Before leaving this section on the human's input–output channels, we need toconsider motor control and how the way we move affects our interaction with computers**. A simple action** such as hitting a button in response to a question involves a number of processing stages. The stimulus (of the question) is received through the sensory receptors and transmitted to the brain. The question is processed and a valid response generated. The brain then tells the appropriate muscles to respond. Each of these stages takes time, which can be roughly divided into **reaction time** and **movement time**.

- Time taken to respond to stimulus:

  Reaction time + movement time