Learning Process: Cognitive and HCI Factors

There is a big problem in assuming users will read the manual and refer to it when they get stuck. This is because very they rarely do! New users to a system often just start to use the system, exploring its features, or they observe other users using the system. "Experts" on systems can be even less inclined to pick up the manual partly due to psychological factors. They often prefer to use familiar methods rather than learning new, more efficient methods.

The learning process / transition from a novice to an expert can be broken down into three stages as shown below:

Cognitive Stage --> Associative Stage --> Autonomous Stage

Cognitive

The **cognitive** stage involves learning declarative knowledge and memorising information in order start developing general rules. See the next section for more about declarative knowledge.

Associative

The **associative** stage involves applying the declarative knowledge in order to develop procedural knowledge.

Autonomous

The **autonomous** stage is where the skills that have been acquired become automatic to the person. The original declarative knowledge becomes less involved in the carrying out of the task.

Procedural and Declarative Knowledge

Being able to learn a new skill involves gaining declarative knowledge and procedural knowledge.

Declarative

Declarative knowledge is not applied knowledge. Rather it involves learning **facts** about the world or system.

Procedural

Procedural knowledge involves knowing **how** to do something rather than just knowing about it.

Example

An example that demonstrates the difference between procedural and declarative knowledge is the skill of driving a car. Knowing about the technical aspects of how a car's steering wheel, gear stick and pedals work is a long way away from knowing how to use them in an applied context i.e. on the road.

Good HCI Design Helps Users to Learn a System

To help users **learn** a system, the system should provide **feedback** and prompt the user to action. They may often not know what they should be doing if they encounter an unfamiliar situation. The interaction process should be kept simple. Short input requirements for each interaction step is a way to maintain simplicity. Allowing the users to use **Knowledge In The World (KITW)** and **metaphors** where possible will improve ease of use.

Feedback

Feedback can be provided in both textual or visual format depending on whether a GUI is being employed. Some good guidelines on what error messages and system feedback messages should contain are outlined below:

- What just happened

- Why it happened

- What can be done

- Plain English!

The last point is an important one. Giving complex explanations involving jargon, which is meaningless to the typical user, will only cause problems. Including error codes and other similar technical information is often unnecessary as the user cannot understand, let alone use, this information.

Collaborative and Situated Learning

Users do not always learn alone. Learning can be a social or collaborative process. Knowledge can be learnt from other people. The study of collaborative learning looks closely at people's motivations and how they can express and analyse problems in a collaborative fashion in order to reach a solution.

Situated learning

Situated learning involves learning as an "apprentice" within an organisation or community.

Cognitive Approach to HCI Design

The cognitive approach to human-computer interaction considers the abilities of the human brain and sensory-perception in order to develop a user interface that will support the end user.

Metaphoric Design

Using metaphors can be an effective way to communicate an abstract concept or procedure to users, as long as the metaphor is used accurately. Computers use a "desktop" metaphor to represent data as document files, folders, and applications. Metaphors rely on a user's familiarity with another concept, as well as human affordances, to help users understand the actions they can perform with their data based on the form it takes. For instance, a user can move a file or folder into the "trashcan" to delete it.

A benefit of using metaphors in design is that users who can relate to the metaphor are able to learn to use a new system very quickly.

A potential problem can ensue, however, when users expect a metaphor to be fully represented in a design, and in reality, only part of the metaphor has been implemented. For example, Macintosh computers use the icon of a trashcan on the desktop, while PCs have a recycle bin. The recycle bin does not actually "recycle" the data; instead it behaves like the Macintosh trash can and is used to permanently delete files. On the other hand, in order to eject a mounted disc on a Macintosh, the user must drag the icon of a CD-ROM to the trashcan. When this was first introduced, it was confusing to users because they feared losing all the data on their CD-ROM. In more recent versions of the Mac OS, the trashcan icon turns into an eject symbol when the user drags a mounted disc to the trashcan. This does not make the metaphor flawless, but it does prevent some user confusion when they are ejecting the mounted disc.

Attention and Workload Models

When designing an interface to provide good usability, it is important to consider the user's attention span, which may be based on the environment of use, and the perceived mental workload involved in completing a task. Typically, users can focus well on one-task-at-a-time. For example, when designing a web-based form to collect information from a user, it is best to contextually collect information separately from other information. The form may be divided into "Contact Information" and "Billing Information", rather than mixing the two and confusing users.

By "chunking" this data into individual sections or even separate pages when there is a lot of information being collected, the perceived workload is also reduced. If all the data were collected on a single form that makes the user scroll the page to complete, the user may become overwhelmed by the amount of work that needs to be done to complete the form, and he may abandon the website. Workload can be measured by the amount of information being communicated to each sensory system (visual, auditory, etc.) at a given moment. Some websites incorporate Adobe Flash in an attempt to impress the user. If a Flash presentation does not directly support a user's task, the user's attention may become distracted by too much auditory and visual information.

Overloading the user's memory is another common problem on websites. For example, when there are too many options to choose from, a user may feel overwhelmed by the decision they have to make, become frustrated, and leave the website without completing their goal.

Human Information Processing Model

Human Information Processing (HIP) Theory describes the flow of information from the world, into the human mind, and back into the world.

When a human pays attention to something, the information first gets encoded based on the sensory system that channeled the information (visual, auditory, haptic, etc.).

Next, the information moves into Working Memory, formerly known as Short-Term memory. Working Memory can hold a limited amount of information for up to approximately 30 seconds. Repeating or rehearsing information may increase this duration.

After Working Memory, the information may go into Long-Term Memory or simply be forgotten. Long-Term Memory is believed to be unlimited, relatively permanent memory storage.

After information has been stored in long-term memory, humans can retrieve that information via **recall** or **recognition**.

The accuracy of information recall is based on the environmental conditions and the way that information was initially encoded by the senses. If a human is in a similar sensory experience at the time of memory recall as he was during the encoding of a prior experience, his recall of that experience will be more accurate and complete.