

Visual Interface to Assess the Human Memory Organization in HCI

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Abstract— Memory is the fundamental component of humans as well as systems. In the computer system the memory is organised in well organised format and all the elements are suited according to the applications and desired output. Similar classification is also been used for the human memory as described by different psychologists. In this article we categorize the stages of human memory and their conversion from one stage to another as used for direct interaction with computer system. The categorization of memory has basic form as sensor memory and intermediate form as short term memory and final stage as long term memory used to describe the realistic phenomenon of memory organization. We create an interface to categorize the users' memory in various memory forms by using the applications of lookalike images and identifying whether the images are similar or having some difference as identified by the human memory and recorded the time taken by the user. We also conclude our proposal in by defining the terminology used for transformation of one form of memory into other and its future application.

Index Terms— HCI, Human Memory, Memory organization, sensor Memory, STM (Short Term Memory), LTM (Long Term Memory).

1 INTRODUCTION

Human-computer interaction (HCI) is the discipline involving human and computers focusing on the mechanisms by which they interact with each other. It is the study of how people devise, deploy and use interactive computer systems and how computers affect organizations, individuals and society. HCI is an interdisciplinary area concerning several disciplines, each with different emphases: computer science (application design and engineering of human interfaces), psychology (the application of theories of cognitive processes and the empirical analysis of user behaviour), sociology and anthropology (interactions between technology, work, and organization) and industrial design (interactive products). [1, 4, 6, 10] HCI also known as Man-Machine Interaction or Interfacing, since the concept of Human-Computer Interaction/Interfacing (HCI) automatically represented with the emerging of era computer, and since the most sophisticated machines are worthless unless they can be used properly by men. The main terms that should be considered in the design of HCI: functionality and usability [2, 7, 9, 11].

Input/output channels in Humans:

Humans have limited capacity of processing information available to them through various input channels. After inception, the information is stored in memory depending upon the type of interaction, time duration of interaction, concentration level etc. These factors pose important implications for design of interfaces for effective human-computer interactions.

Information is received and responses given via a number of input and output channels: [8]

- Visual channel
- Auditory channel
- Haptic channel
- Movement

Information is stored in memory:

- Sensory memory
- Short-term (working) memory
- Long-term memory

Information is processed and applied for:

- Reasoning
- Problem solving
- Skill acquisition
- Error

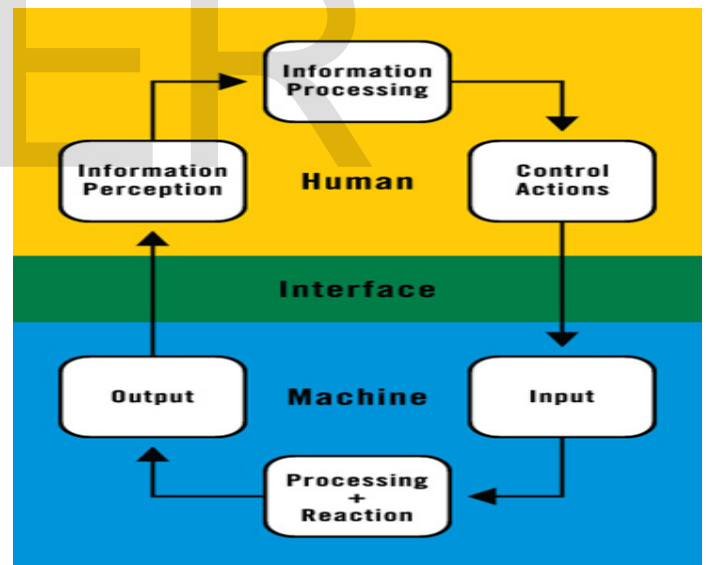


Fig.1 HCI phenomenon

2 OBJECTIVE

Research does not limit itself to innovation of new things rather it may also advocate the improvements in existing technology in suitable manner for betterment in already existing features. Considering this aspect of research, we are motivated to furnish research into prediction and analysis part of existing terminology in regards to improvements of technological aspect. The human memory concept has been discussed and commented upon from time to time. We are organising such an approach to compliment it with reality. The following set of objectives has been considered in this article:-

- a) Base lining the basics of human memory concept.
- b) Organising human memory in an estimable manner.
- c) Predict the reality.

3 MEMORY ORGANISATION

As Memory provides the ability to store, retain and subsequently recall information and past experiences in the human brain. It general it may be thought of can be thought of a means which uses the past experience to affect or influence the current behaviour.

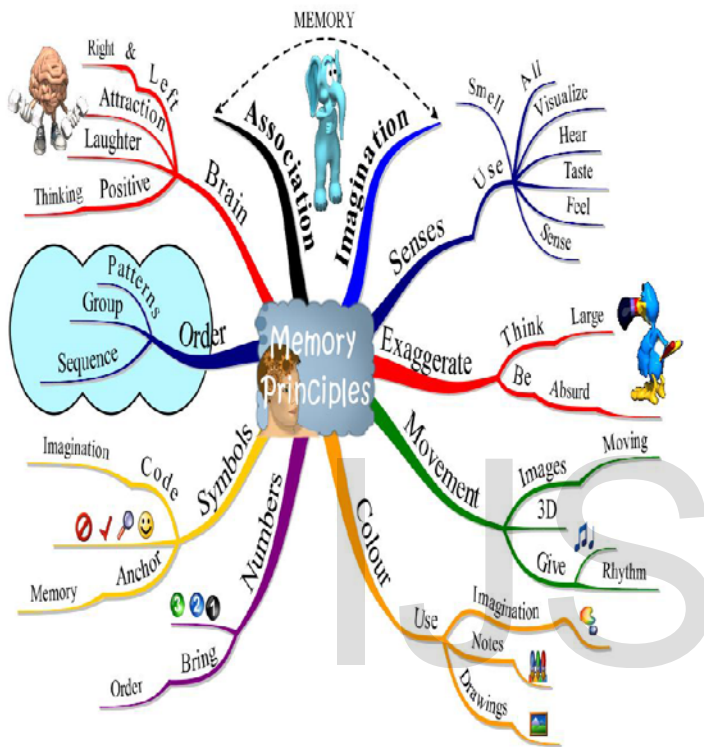


Fig. 2 Memory principal three

In physiological terms, memory at its simplest is a set of encoded neural connections in the brain. It is the re-creation or reconstruction of past experiences by the synchronous firing of neurons that were involved in the original experience.

Memory is the assimilation of what we remember and gives us the capability to learn and adapt from previous experiences as well as to build interactions. [3]

Sensory memory is the shortest-term element of memory. It has the capability to preserve the information for very short period of time after the original stimuli have ended. It acts like a buffer for signal received from the five senses of touch, smell, taste, hearing and sight but for a very short duration of time. For example the ability to retain and remember something by looking at that just for a fraction of seconds is an example of sensory memory.

Sensory memory is the initial stage of memory. In this stage, the information perceived from the environment is stored for a very brief period of time i.e. not more than a half-second for

visual information and 3 or 4 seconds for auditory information. We concentrate on only certain aspects of this sensory memory, allowing only some of this information to pass into the next stage - short-term memory. [5]

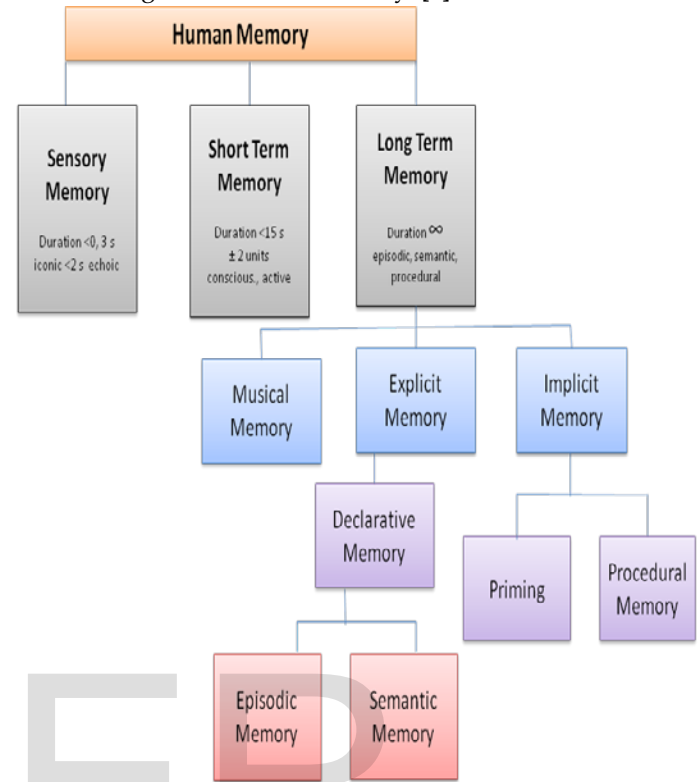


Fig. 3 Organizing Human Memory [7]

Short-term memory can be thought of as a kind of “scratch-pad” used for temporary recall of the information which is being processed at any instance of time and is referred to as “the brain’s Post-it note”. It can be thought of as the ability to remember and process information at the same time. It can hold a small amount of information (approx. 7 items or even less) in mind in an active, readily-available state for a short period of time (typically from 10 to 15 seconds, or sometimes up to a minute). Short-term memory or active memory stores the information that we are currently aware of or thinking about. In Freudian psychology, this type of memory is referred to as the conscious mind. Devoting attention to the information stored in sensory memory generates the information in short-term memory. [3, 5]

Long-term memory is used for storage of information over a long period of time. In spite of the impersonation of forgetting with everyday going, the long-term memory actually perish very little with time, and can store a seemingly unlimited amount of informational almost forever. [3] Short-term memories can become long-term memory through the process of consolidation involving rehearsal and meaningful association like social implications or development of interest or bringing it in habit. Long-term memory refers to the long-lasting storage of information. In Freudian psychology, long-term memory can be called as the preconscious and unconscious. This information is beyond our consciousness, but can

be called into working memory to be used when needed. Some of this type of information is fairly easy to recall, while other memories may be much more difficult to access. [5]

The memory is forgotten or lost by biological factor or antecedent processes.

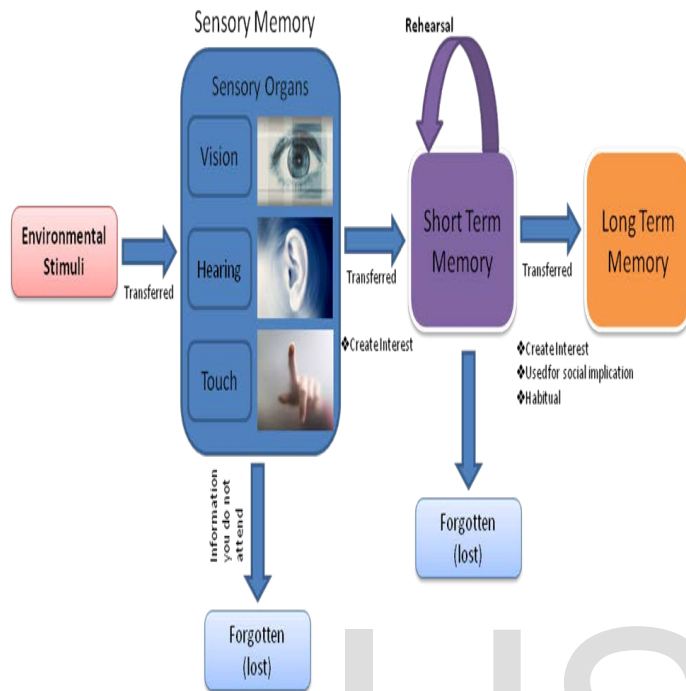


Fig. 4 Human memory fundamental

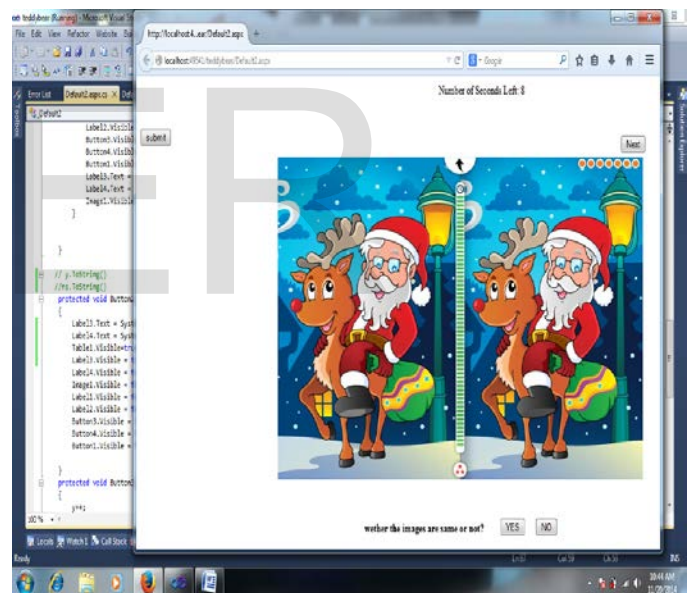
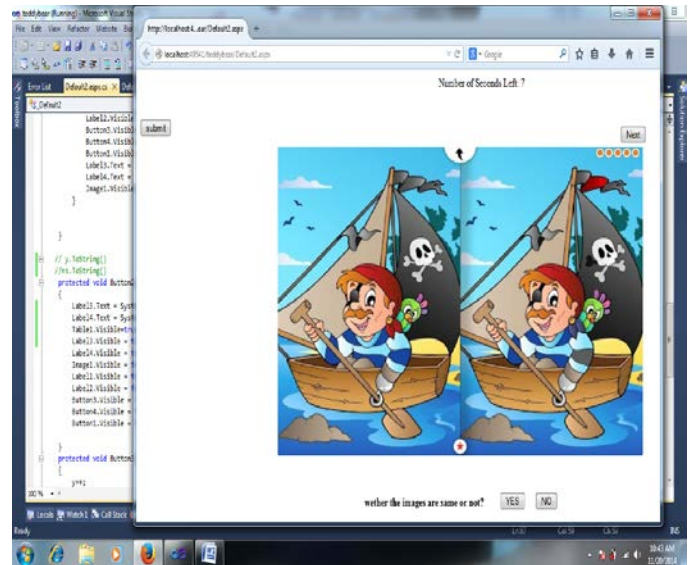
4 RESULT

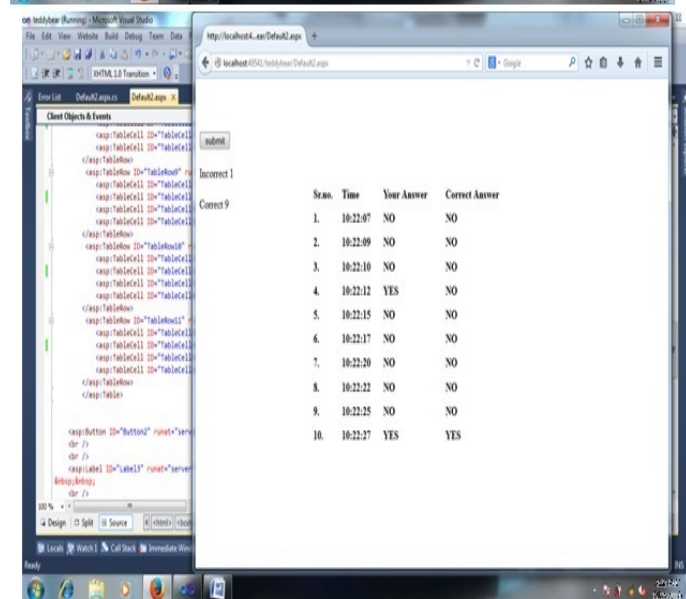
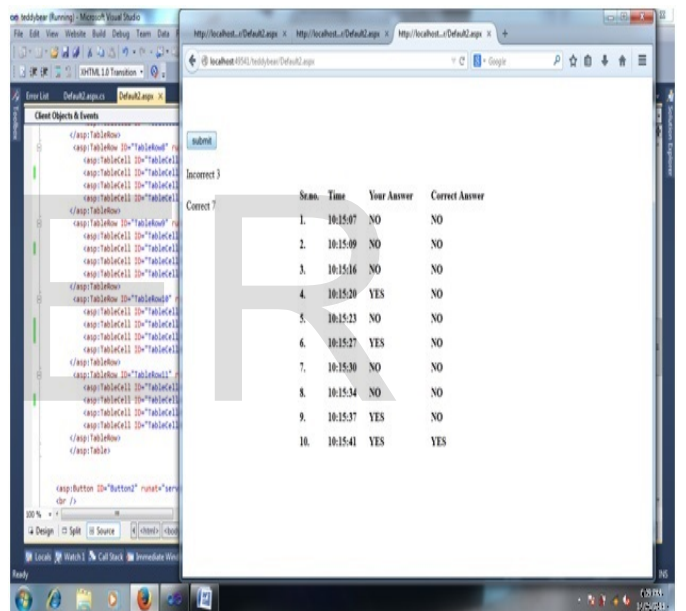
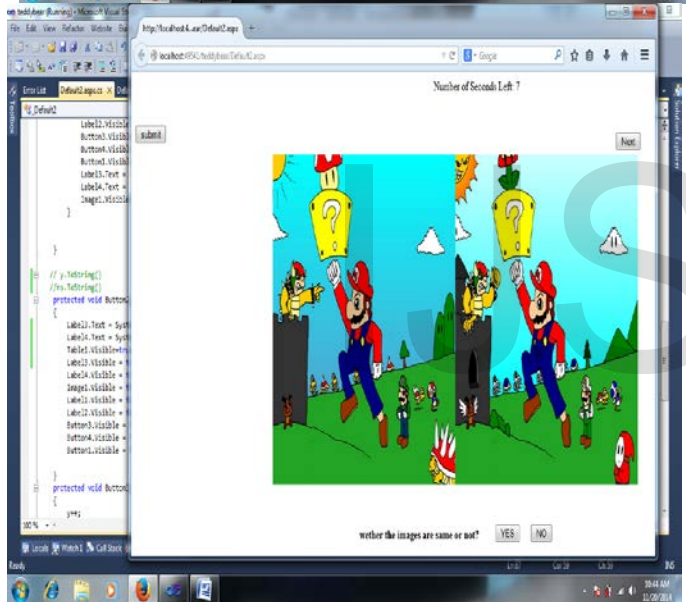
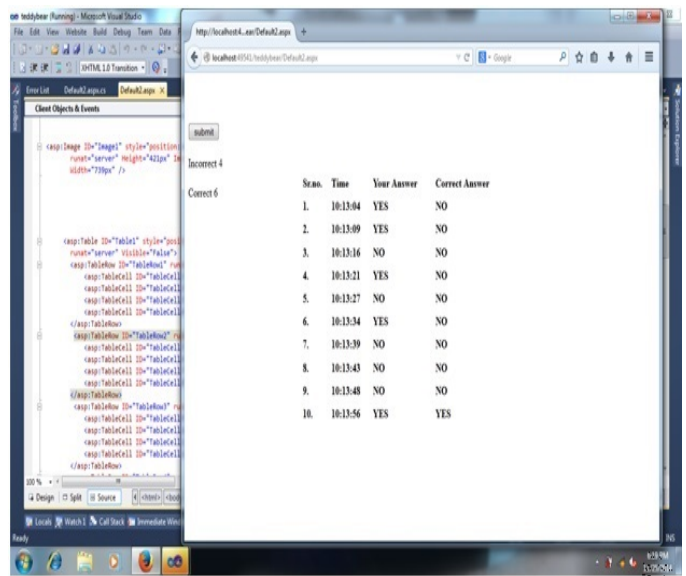
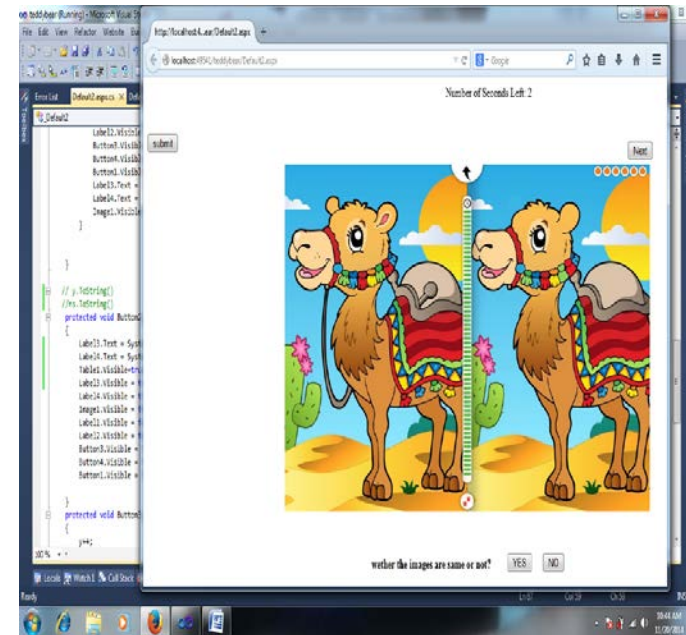
To categorize users' memory among the various forms of memory (sensory, short term or long term), we implement a basic interface where we observe the users' visual interaction to identify the similarity and differences in similar or lookalike figures or images. The sensory memory stores the information that has been perceived from user and stay during the instance of 1/3rd to 1/5th of a second. We also propose the basic terminology to convert sensory memory to long term memory. The initial sensory memory can be generated by visual, hearing and haptic. The classifier or organizer can define the level of duration for such type of object data that have been received from sensory memory. As few of the terms (data) are not essential for more than 20 secs to retain in memory, then it will be formulated in short term memory. If the classifier has been defined the sensory information must be retained for infinite time then they will follow the process of:

- 1) Create the interest on sensory information
 - a) Forcedly
 - b) Representing in game form or some
 - c) Binding the information with some application domain.
- 2) Bringing the sensory information in habit to rewind the sensory information time to time for short term memory.
- 3) Use the sensory data for social implications.

We create a framework of different images to test whether

the set of images are similar or having some difference in them. The users' response is stored in database and the time taken by user in giving the response is also recorded.





The following behaviour has been noted and analysed:-

- 1) During first run of the application the response is low (no of incorrect answers are more)
- 2) If the process is repeated then the number of correct answers given by user increases. The reason being some answers or images has been stored in short term memory of user and recalled during process.
- 3) Then with third repetition if the user is convinced that this process is very interesting (providing some points as in games) or this will be used in future for some specific purpose (the same will be part of some examination or so) then the user gives more correct responses and the information is stored in long term memory.

5 CONCLUSION

The concept of memory organization can be tremendously helpful in design of HCI interfaces. Humans have limited capacity of processing information available to them through various input channels. After inception, the information is stored in memory depending upon the type of interaction, time duration of interaction, concentration level etc. The sensory memory retains information for a very brief period of time, Short term memory remembers for some long time but it is volatile in nature. Long term memory retains the information indefinitely but the retrieval of information may be difficult. So we propose the terminology for conversion of information from one memory form to another. We created a framework of different images to test whether the set of images are similar or having some difference in them. The users' response is stored in database and the time taken by user in giving the response is also recorded. The analysed result shows that the human computer interaction is affected by memory type and can be boosted by conversion of information from one memory form to another. This phenomenon may also be applied in design of interfaces for human computer interaction keeping memory limitations in mind.

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