A Quick Look at Cognitive Theory  
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Introduction
There are many questions about multimedia development that seem to be appropriate to frame as issues of cognitive psychology. This very brief introduction to some of the principles of cognitive theory is intended primarily to provide a framework for understanding one origin for some recommendations concerning interface design and choice of illustration. A couple of other more focused papers should provide further insights.

The Human Information Processing Model of Memory and Cognition
There have been many “psychologies” that have attempted to explain behavior (in particular, learned behavior). The most recent major school to develop came about in an attempt to model aspects of human memory that could not in any way be directly measured. The model chosen by such researchers as Atkinson & Schiffren (1968) is based on a simple computer. The computer has several levels of memory, each having particular characteristics of capacity and permanence. The Human Information Processing Model proposes a similar hierarchy of human memory. Sensory memory is fleeting, constantly barraged by environmental stimuli. Some of the stimuli manage to attract attention and are subjected to some sort of organization, at which point the signal enters Short-Term Memory (also called Working Memory).

Information in Short-term Memory (STM) can only be sustained through rehearsal, and the capacity of STM is limited. Rehearsal may involve merely repeating the information in STM (maintenance rehearsal), or it can be what Craik and Lockhart (1972) call elaborative rehearsal, which involves making some kind of connection with something already known—some knowledge retrieved from Long-Term Memory (LTM).

That information which is sustained long enough in STM will eventually be stored in LTM. If the information is used often enough, it becomes permanently encoded.

More Characteristics of Memory
The preceding thumbnail sketch of the learning process omits a great deal of information. For instance, considerable research has been done to further describe Sensory Memory. Auditory and Visual Sensory Memory have unique characteristics. Areas of study have included the effects of interference between the two sensory systems on recognition and attention, and the speed of recognition for brief visual stimuli. The studies are numerous and fascinating, and too numerous to attempt to summarize here.

STM, as stated above, is limited in capacity. Miller (1956) established the capacity of STM as 7 plus or minus 2 units (or chunks) of information. This result has been repeated often enough that “7+/–2” is a traditional maxim in the field. This figure may have repercussions for multimedia developers, for it suggests a basis for predicting cognitive overload by the presence of excess stimuli.

It is important to decide what a unit (or chunk) is. For a person just learning the alphabet, each stroke of a letter may represent one unit. Someone who knows the alphabet but is learning to read may see each letter as a chunk. For a basic reader,
individual simple words would each be a chunk, but a word such as “catabolic” might be three or four. An actor might represent an entire line as a chunk, and for a scholar of Shakespeare, Hamlet’s soliloquy may be so familiar as to be a single unit. The upshot of all this is that while the capacity of STM may be limited to five to nine “things,” the previous experience—the knowledge level—of the individual with respect to the material will greatly affect the capacity of information stored.

LTM is where human knowledge resides. In spite of the headache a student might have after a night of cramming for an exam, LTM in healthy individuals seems to have no real limit to its capacity. It is not easy to study, although several ideas as to its organization have been offered. One of these is that the organization of memory is somewhat like a series of nodes connected in an associative network. Each node is an idea, and the connections have to do with the relationships of nodes. Associations that are made frequently and have a strong emotional component make links that are stronger. According to this view, a person who has had a pet cat for many years is likely to associate the stimulus “cat” with a thought of the specific pet before making other, more general associations.

The associations made in a network might reflect a sort of taxonomic hierarchy for concepts that have been repeated experienced in such a way. For biologists the Linnaean taxonomy may well be recapitulated in the associative network in their brains. This idea may make some suggestions regarding the organization of multimedia products that present content that has some sort of conventional organization.

Conclusion

The previous paragraphs offer a very brief look at cognitive theory, and present a couple of ideas about how using cognitive theory might guide multimedia design and development. There is much more that may be useful—examinations of perception, specific tests of the capacity of the senses to attend to various stimuli, ability to recognize and recall under various conditions. This introduction is meant only to whet your curiosity.

Incidentally, if the notion of basing human cognition on such a simple model seems overly simple, and you are concerned that the actual physical processes may not fit the model, refer to the veritable tome, A View of the Learner and Learning for some further insights.

References
