

she constructs of the sentence must be meaningful and make connections with related knowledge already in long-term memory. For example, her previous experience with azaleas and wide streets may allow her to construct an image of what this sentence describes. Her image then becomes a useful retrieval cue when she is asked to recall what she has read.

It may be evident from this example that processing does not truly occur in the unidirectional, linear way in which it is often depicted (e.g., in Figure 3.1). Instead, the representation Sarah constructs of the sentence is determined both by the information itself (data-driven, bottom-up processing) and by her prior knowledge (conceptually driven, top-down processing). The degree to which either type of processing dominates seems to depend on the nature of the learning task itself and the amount of prior knowledge the learner brings to it.

Little has yet been said about the control processes influencing information flow. Whether these are thought of as comprising a system component (e.g., Gagné, 1985; Andre & Phye, 1986) or as processes modifying information flow within and between components (e.g., Atkinson & Shiffrin, 1971), they have the same effect. In some way, an executive monitor keeps track of the information flow and makes decisions about processing priorities. This may occur in a conscious, strategic fashion or in an unconscious, automatic way. For example, Sarah may have very deliberately chosen to associate an image with the sentence she read, because she has found imagery to be a very effective study strategy. On the other hand, suppose the story had previously described only camellias adorning villagers' lawns. Sarah may then have developed an expectation that could cause her to mistakenly perceive "camellias" instead of "azaleas" in the target sentence. In either case, a control process has modified the information flow and what was ultimately understood and learned.

The sections that follow focus on each of the major stages and processes of the human processing system. As you read them, keep in mind two things. First, the computer provided a concrete metaphor for human information processing and, thus, a language for describing and integrating a variety of learning phenomena. Second, for instruction to be meaningful and relevant, it must build upon learners' prior knowledge and help learners to construct cognitive connections between what they already know and what they are being asked to learn.

### Sensory Memory

The existence of some sort of perceptual store in the information-processing system that registers information and holds it very briefly was demonstrated in a series of experiments conducted by Sperling (1960). Sperling presented subjects with a visual array of twelve letters (arranged in three rows of four letters each), such as the one shown in Figure 3.2. He flashed the array on a

#### Long-Term Store

Large  
Episodic/semantic

Permanent  
Effective encodings  
from STS  
Irretrievability