Dual-Code Models of LTM. Ask anyone what imagery is, and the response is likely to be, "pictures in my mind." Does this mean that imaginal information is represented in some way different from verbal information? How do we account for the variety of imaginal information, especially since there is more to imagery than just visual representations? We can imagine the tune of a favorite song, or the feel of a kitten's fur against our skin—examples of auditory and tactile imagery, respectively. In the same way, it is possible to generate examples of olfactory imagery ("Is that a hot apple pie I smell?") as well as kinesthetic imagery, which is often used in relaxation training.

Despite our subjective impressions of imagery, not all psychologists have been convinced of its existence as a separate form of information storage (e.g., Pylyshyn, 1973). Some investigations of visual imagery, for example, have shown that people remember a picture's meaning, rather than its visual attributes (e.g., Bower, Karlin, & Dueck, 1975; Light & Berger, 1976). This supports a unitary view of visual and verbal coding, which means that information about pictures is assumed to be represented in the same way as verbal information.

Other research, however, has challenged the unitary view. In a series of experiments conducted by Shepard and his associates (reviewed in Shepard, 1978), subjects appeared to mentally rotate images of three-dimensional figures in order to find their match among sets of distractors. That is, the amount of time it took to find a match was directly related to the number of turns required to rotate the test figure to the position of its match. This result held true even when subjects were given verbal instructions so that they had to rely on information in memory to generate the images.

The superiority of memory for concrete words over abstract words also poses problems for a unitary view of memory representation. People find it much easier to remember words like *sailboat, apple,* and *zebra* when they appear on a list than words such as *liberty* and *justice* (see, for example, Paivio, Yuille, & Rogers, 1969). If a dual-code or dual-systems approach is taken, however, these results are easy to explain. According to the dual-systems view (Paivio, 1971, 1986, 1991), there are two systems of memory representation, one for verbal information and the other for nonverbal information. Thus, for input such as concrete words, two codes are possible. The meaning of the words can be represented by the verbal system, but images of the words can also be represented by the imaginal system. With two memories available at recall, as opposed to one for abstract words, subjects should remember concrete words better.

Exactly how the imaginal system operates to store visual or other imaginal information is not known, although dual-code theorists agree that mental images are not exact copies of visual displays. Images tend to be imprecise representations, with many details omitted, incomplete, or, in some cases, inaccurately recorded. They also require effort to maintain and have parts that fade in and out (Kosslyn, 1980). Think of someone you know well,