Chapter I
Attention Capture and Effective Warning

INTRODUCTION

The term "attention" in psychology is defined as (1) the act or state of attending, especially by applying the mind to an object of sense or thought, and (2) a condition of readiness for such attention (Attention, 2007).

Drawing on research carried out for decades in psychology that explores the human attention mechanism to understand a variety of attentional phenomena, such as attention to dimensions and objects, selective listening, task switching, and so forth (e.g., Bundersen, 1990; Heinke & Humphreys, 2003; Logan, 2002; Luce, 1963; Ratcliff, 1978; Ratcliff et al. 1999; Reeves & Sperling, 1986; Shepard, 1957; Shih & Sperling 2002), we examine how attention might be captured and thus identify factors that characterize the effectiveness of a warning advisory. In this context, we use attention to describe awareness, a concentration of the mind on a single object, and a state of consciousness characterized by such concentration and the capacity to maintain selective concentration. Asking a person to pay attention to something implies that the person is aware of this "something" first, and then concentrates his or her mind on it. Therefore, we begin our discussion by defining awareness in this section.

AWARENESS AS A PERCEIVED PATTERN OF PHYSICAL ENERGY

Nothing exists except atoms and empty space: everything else is opinion.
— Democritus (ca. 400 BC)

The nature of awareness is a process in which the body functions as a sensory organism filled with receptors that perceive everything outside the body. Everything outside the body is the environment, which itself represents a pattern of physical energies that directly affect receptors (Landauer, 1991; Clare & Halligan, 2006; Styles, 2006). For example, the visual environment provides a changing pattern of radiant energies that act on the retina. A sound is a changing pattern of vibrations transmitted to auditory receptors.

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Awareness varies in its sensory quality and intensity. Sensory quality measures the degree to which a person can discriminate an outside stimulus. For example, a person sees a red box and can determine whether the red is bright; another person feels pain in a finger and can discriminate that pain as sharp. Thus, humans possess different forms and ranges of sensitivity that match biologically significant variations in environmental energies. Even when the quality is constant, a pain experience may be heavy or light. Therefore, sensory intensity indicates the degree to which a stimulus signal is strong or weak. Empirical observations and existing evidence from neurophysiology suggest that any momentary quality of awareness involves the activity of nerve fibers at a specific locus in the material brain (Boring, 1933; Clare & Halligan, 2006). That is, human brains sense qualitative differences in structure or function when they receive a stimulus and can feel the corresponding energy changes, which enables them to react appropriately. These nerve signals move to the central nervous system and brain cortex, where (1) a concept of "knowing" about the occurrence of a stimulus forms, (2) a difference in excitation occurs, or (3) a difference emerges on which discriminatory behavior can be established.

Nervous systems are limited in their qualitative and intensive coverage of physical energies that abound in the environment. That is, all sensory systems in people's body have some type of thresholds for perceiving or sensing a stimulus. For a change in the environment to be perceived, the incremental increase or decrease in physical energy of the target environment, applied to the receptors of the body, must be greater than a certain minimal threshold. For example, if the light illumination of a room constantly varies by small amount, these changes may not be noticed by an occupant.

Awareness thus reflects a reaction of people's bodies; specifically, the receptors under the body's surface react to various forms of energies in its external and internal environments. If attention implies or includes awareness, can one's attention be captured?

ATTENTION CAPTURE

Using human visual perception as an example, we illustrate how attention is captured. In our discussion, we do not consider, however, how each nerve tissue or materials in the fiber may be excited by a stimulus.

The human eye is designed such that light waves fall on the retina, where their energy is translated into electrical form, presumably by means of photochemical substances in the rods and cones. Impulses generated in this manner in the receptors appear in electroretinograms. The interaction between a photon of light and the retina causes the molecule to go through isomerization, which then changes the membrane potential of the rod or cone. The rods or cones excite the bipolar cells, which in turn excite the ganglion cells. After the ganglion cells are excited, the electrical signals travel over the optic nerve to the optic chiasm. Through a series of transmissions, as the signal is transmitted to the upper layer of cortex, the information from both eyes mixes to create a binocular vision. Therefore, any object in the environment or an outside signal perceived by a vision system can be considered light waves with energy. These light waves are converted into electrical signals that cause the brain cortex to generate consciousness and make appropriate judgments or reactions (see Figure 1.1).

Similarly, theories of hearing (e.g., place theory, rate theory) suggest that an auditory message comes down to patterns of impulses in the auditory cortex (Beament, 2003). The frequency of these energy changes excites nerve fibers in auditory system, which senses signals and transmits them to the brain cortex to achieve consciousness or meanings, as shown in Figure 1.1.

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