Pennebaker, J.W. (1982).
The Psychology of Physical Symptoms
New York: Springer-Verlag

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Chapter 2

Perceptual Processes I: Competition of Cues

One of the most fundamental assumptions of this book is that the perceptual process required for the encoding of internal sensory information represents the same processes that have traditionally been implicated in the perception of external environmental events. In other words, factors that have been shown to influence the perception of auditory or visual information should also influence the perception of physical symptoms. Within this chapter, a brief overview of perceptual processes will be presented. The distinctions among orienting (or competition of cues), biased encoding, and inference will be discussed. The remainder of the chapter will be devoted to the initial part of the perceptual process: orienting. The studies that are presented deal with such questions as, In what settings will one be most likely to notice symptoms? What are the internal and external stimulus characteristics that influence the initial processing of sensory information? At what level is sensory information processed (i.e., is conscious processing necessary)?

The Perceptual Process

Before delving into the subtleties of perception and information processing, it is useful to cite a common example of how we perceive events in everyday life.

Imagine you are walking alone in the woods. All of a sudden you hear a rustle in some bushes. You immediately think that it is a snake and look at the base of the bushes. Seeing a long, slender object, you turn and run screaming "Help! A snake!"

of an external event (e.g., seeing a bear) will often result in increased internal information (e.g., racing heart, sweating). The corresponding increase in both sources of information should *not* increase the probability of noticing physical sensations, since such awareness is dependent on the *relative* processing of internal versus external cues.

Note that such a model would predict that awareness of internal state would be greatest *following* an aversive or stressful external stimulus event. That is, after the bear had run away, an intense game was over, or any physiologically arousing external event had abruptly ended, the person would have a high degree of residual arousal and virtually no external information to process. Hence, the *perception* of arousal or emotion would typically follow the event—the same sequence as suggested by William James (1890). This issue will be discussed in greater detail later.

Several experiments were conducted to assess the validity of the competition-of-cues idea. The first task was simply to test the idea under optimal circumstances. Our next task was to tease apart the relative contribution of attentional and physiological processes in symptom perception within a test of competition of cues. Because these studies relied to a great extent on self-reports, the third set of studies used a behavioral indicant of body perception—coughing—in order to test the idea. This line of research also demonstrated that only minimal processing (as opposed to higher order conscious processing) of information is necessary for the cue competition phenomenon to work. The final experiment in this series extended the idea to perception of emotion after viewing a traumatic event.

The Exercise Experiments

Many of the ideas in this book evolved from observation rather than from a grand theory. The competition-of-cues notion is no exception. A few years ago I became briefly addicted to jogging. During this time, I typically ran on a cross-country track. The track was a 5-mile trail that wound through the Virginia countryside. Following heavy rains, however, I would jog a comparable distance on a standard ¼-mile circular lap track. In alternating tracks, two things occurred. My running time was much *slower* and I became more quickly fatigued on the lap track. On one level, this was peculiar. The lap track was modern, with optimal surface. The cross-country course had hills and rocks, and threaded and wound around trees, fences, and other obstacles. Despite the miracles of modern technology, the cross-country course appeared to be a more efficient and enjoyable track to jog.

A fundamental difference between a lap and cross-country course is the degree to which the jogger must process external environmental information. On the cross-country course the person must remain highly attentive to the trail. Failure to do so can result in tripping, colliding with an obstacle, or veering off the track. A lap course, on the other hand, requires minimal processing of environmental information. Virtually all aspects of the course are constant. In Berlyne's (1960) words, the lap course would be considered redundant, simple, and not unique. According to the competition-of-cues idea, then, the person should have a higher probability of noticing physical sensations on the lap than on the cross-country course, since potential internal cues (i.e., physiological activity) should be relatively comparable. To test this idea, Jean Lightner and I conducted two experiments (Pennebaker & Lightner, 1980). The first was a jogging study, the second a more controlled laboratory experiment using a treadmill.

The jogging study. In the first test of the competition-of-cues idea, we constructed two outdoor jogging courses on level dirt surfaces. The cross-country course was an 1800-m trail through a wooded area. The lap course was a 200-m oval path around a small field. Subjects were required to run 1 lap on the cross-country and 9 laps on the lap track. In the study, 13 beginning joggers who had been recruited from an introductory psychology class ran on one of the two courses on alternate days for 2 weeks (excluding weekends).[1] Half of the subjects began on the cross-country and half on the lap course. Heart rate and blood pressure were measured daily both before and after jogging. In addition, subjects completed a symptom and fatigue questionnaire following each day's run. The symptom checklist was composed of 10 common symptoms (e.g., racing heart, shortness of breath, headache) along 7-point unipolar scales (see the appendices for a discussion of the scalar properties of the symptom checklists). Finally, the experimenter recorded the time taken by the subject to complete the course.

One of two predictions was made concerning the jogging study. The first was that subjects would run at equivalent speeds on the two courses but would report more fatigue and physical symptoms on the lap track. Recall that the lap track is lacking in external information (relative to the cross-country), thus resulting in a higher probability of subjects' noticing sensory information. The alternative hypothesis was based on the assumption that people set their jogging pace in line with their perceptions of fatigue. That is, rather than maintaining a constant pace while suffering from pain and fatigue, the jogger would slow down. If this occurred, subjects should run faster on the cross-country course but should report equivalent levels of fatigue and symptoms on the two courses.

The results of the study supported the second hypothesis. Although

[1] An additional 11 subjects (6 males and 5 females) started in the study but failed to complete it. Six refused to continue after the first day; the remaining five stopped between the 3rd and 7th days because of illness or injuries unrelated to the study.

there were no differences in self-reported fatigue and symptoms between the two courses, there were large and significant differences in running time. When subjects ran on the cross-country course, their average time was 9.2 minutes, whereas the mean time for the lap course was 10.1 minutes (see Figure 2.1). In fact, 11 of the 13 subjects consistently ran faster on the cross-country course. One jogged at equivalent speeds on the two courses, and one jogged consistently faster on the lap course.

One particularly interesting finding is that there were no differences for heart rate or blood pressure between courses, even though subjects ran the cross-country course 1 minute faster. At this point, we have only one explanation for the lack of physiological differences: Subjects accelerated and ran as hard and fast as possible for the last few hundred feet of both courses, thus masking the long-term physiological differences.

The jogging study raises several questions and problems. The most basic one concerns how we know that the two courses resulted in differential processing of internal versus external information. Although self-report measures indicated that subjects thought the cross-country course was more interesting, less tedious, and so on than the lap course, we cannot determine where they were focusing attention. In fact, this will be a recurring problem in this book. Unlike measures of eye tracking, we simply do not have the means to assess whether a person is attending to internal state or not.

Another interesting aspect of looking at competition of cues in an exercise setting has been raised by Morgan and Pollock (1977). These researchers have studied the attentional strategies of beginning and elite marathon runners. Whereas beginning marathon runners typically use distraction (i.e., thinking of objects, events, etc. unrelated to body while running), the elite runners are highly attentive to internal state while

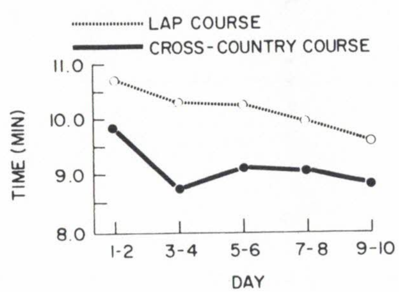

Figure 2.1 Mean jogging time (in minutes) as a function of type of course. From J.W. Pennebaker & J.M. Lightner, Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 1980, *39*, 165-174. Copyright 1980 by the American Psychological Association. Reprinted with permission of the publisher and authors.

exercising and racing. By monitoring their bodies, the more professional runners can consciously control such things as breathing rate and gauge their physical output relative to the distance they must run. In other words, they are using attention to body in order to self-regulate their physiological systems (cf. Carver & Scheier, 1981; Schwartz, 1979).

The treadmill study. The jogging study tended to support the cue competition idea. As noted above, however, no measures of attentional focus or relative processing of internal versus external information were employed. In addition, the model of symptom awareness was not directly tested, since jogging pace—rather than self-reported symptoms and fatigue—was the more sensitive measure.

A second, more controlled, experiment was conducted wherein attentional focus was manipulated while actual physical exertion was held constant via a treadmill. In order to vary the type of information subjects were processing, subjects either heard themselves breathing, listened to distracting street sounds, or heard nothing over headphones while on the treadmill. In line with competition of cues, it was predicted that subjects would report the most symptoms and fatigue after hearing themselves breathe, and the least after listening to the distracting street sounds.

In the 3×2 between-within design, 56 male subjects walked on a treadmill on 2 days a week apart. On Day 1, all subjects walked for 11 minutes wearing headphones but hearing no sounds. A week later, on Day 2, subjects were randomly assigned to one of the three headphone conditions. In the sounds condition, subjects heard a variety of moderately interesting street sounds while they walked on the treadmill. The street sounds were designed to simulate sounds a person might hear while walking from building to building (e.g., passing cars, portions of conversations). In the breathing condition, subjects heard their own breathing piped over the headphones. The control condition subjects heard nothing over the phones. On both days of the study, blood pressure and heart rate were measured before and after walking on the treadmill. Finally, as in the jogging study, self-reports of physical symptoms and fatigue were taken immediately after the treadmill task on both days.

Although there were no differences in heart rate or blood pressure between conditions, large and significant self-report differences were found. As can be seen in Figure 2.2, the degree of symptom reporting was greatest for the breathing and lowest for the sounds conditions. In other words, when subjects were forced to process internal sensory information, such as their breathing rate, they reported a large number of symptoms (headache, racing heart, sweating, etc.) relative to subjects in the other conditions. Although there was a significant overall decline in symptom reporting from Day 1 to Day 2, it was most pronounced for the sound subjects. Comparable results were found for self-reports of fatigue.

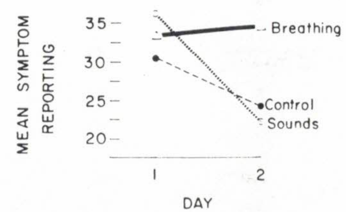

Figure 2.2 Mean symptom reporting by condition on Days 1 and 2. From J.W. Pennebaker & J.M. Lightner, Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 1980, *39*, 165-174. Copyright 1980 by the American Psychological Association. Reprinted with permission of the publisher and authors.

The treadmill study provides additional support for the competition-of-cues idea. When potential physiological information was held constant, subjects differed substantially as regards the degree to which this information was processed. For example, sound subjects had proportionately less time and capacity to encode any sensations that were related to the exercise. Breathing subjects, on the other hand, were forced to process internal sensations. Their labored breathing was apparent over the headphones. Consequently, they devoted a great deal of time to attending to all sensations related to exercise.

Both the jogging and treadmill studies manipulated potential external information. No differences in potential internal information—as measured by heart rate and blood pressure—were found. One difficulty is that we are unable to assess the degree to which subjects are truly attending to internal state in each of these studies. The following studies attempted to manipulate and measure the relative degree of internal versus external information.

The Person-Environment Fit Studies

The concept of person–environment (P–E) fit deals with the relationship between a person's abilities, interests, or goals and the demands of his or her occupation (Jaques, 1966; French, 1973). The relationship between the person's abilities and job demands can be expressed along a continuum ranging from settings where P>E (i.e., the person's abilities exceed job demands), to P=E (where abilities and job demands are well matched), to P<E (abilities are below demands). The beauty of the P–E fit concept is its relationship to symptom reporting, absenteeism, and reported job dissatisfaction among workers in the real world. Specifically, in settings where P>E (underload setting) or P<E (overload setting), health and morale problems are most severe (e.g., Coburn, 1975; Caplan, Cobb, French, Harrison, & Pinneau, 1975). Of particular relevance to the symptom awareness model is that although P–E fit researchers typically find a U-shaped relationship between degree of P–E fit for self-reports of symptoms, physiological measures typically find increased autonomic activity only in overload settings (e.g., Sales, 1970; Caplan et al., 1975).

The previous findings dealing with P–E fit indicate that the differential symptom reporting may be due to changes in the ratio of internal to external information for the worker. That is, when P>E, both internal and external information is low; when P<E, both types of information are high. Only in the P=E setting would potential external information be *relatively* greater than internal. In other words, in underload and overload settings, there is a constant ratio of internal to external information, resulting in comparable levels of symptom reporting. However, when there is a match between task demands and the person's abilities, external information would be processed at the expense of internal, thus resulting in reduced symptom reports.

In order to test this line of reasoning and to attempt to devise a measure of attention to body, Greg Brittingham and I conducted two laboratory analogues of P–E fit (Pennebaker & Brittingham, 1979). The studies differed in that the first experiment did not assess physiological change or directly measure attention to body, since any such measures may have artificially forced subjects' attention to internal sensations. In the studies, subjects worked on simple arithmetic problems (e.g., $6 + 4 - 2$) presented serially on a memory drum. After subjects had selected a comfortable pace for working the problems, the experimenter later randomly assigned the subjects to work at one of three paces: 50% faster than their predetermined preferred pace (fast condition), the same speed (moderate), or 50% slower (slow). Subjects completed a symptom checklist after selecting their own pace and again after working for 5 minutes at the pace selected by the experimenter. It was predicted and found that slow and fast subjects reported physical symptoms to a greater degree than did moderate subjects.

Although the first P–E fit study demonstrated the phenomenon, it did not point to the underlying causal mechanisms. A second experiment was conducted to examine the hypothesized roles of attentional and physiological processes in the P–E fit paradigm. In the experiment, subjects again worked on two sets of simple arithmetic problems. Unlike the first study, measures of skin conductance and attention to body were employed during the second series of working on the problems. The measure of attention to body was based on the subjects' abilities to recall six subtle bursts of air that were delivered to the subjects's forearm during the course of the study. If subjects were attentive to their bodies, they should be more likely to notice how many air blasts they received.

As can be seen in Figure 2.3, symptom reports were again significantly

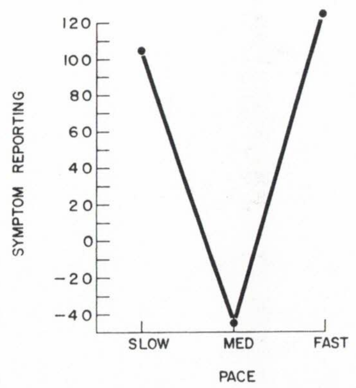

Figure 2.3 Change in degree of symptom reporting from first to second sessions of the person-environment fit experiment. From J.W. Pennebaker & G.L. Brittingham, Situational and attentional factors influencing health: Person-environment fit. Paper presented at the American Psychological Association, New York, 1979.

higher in the slow and fast conditions relative to the moderate cell. In terms of skin conductance, fast subjects evidenced greater autonomic activity than slow. Moderate subjects' conductance levels, which were midway between the other two conditions, did not differ statistically from either the fast or slow levels. In terms of accuracy of recall about air blasts to the arm, only slow subjects were consistently accurate. Both fast and moderate subjects were equally poor at recalling the number of air blasts that they received.

These data, then, indicate that moderate subjects did not differ from slow subjects in terms of their arousal level and, hence, had only moderate levels of potential internal information. Further, they were sufficiently preoccupied with the task that they did not notice the air blasts. Slow subjects were not greatly aroused but, unlike the moderate subjects, had so little potential external information that they were extremely attentive to the blasts (and presumably *any* internal cues). Fast subjects had to process information from a variety of sources. They had a great deal of potential internal and external information. Even though the fast subjects were poor at recalling the number of air blasts, the blasts represented only a portion of the potential internal information.

There are two general problems with the P-E fit studies. First, we have been relying on self-reported symptoms *after* the subjects had participated in the task. We cannot know if the subjects really were experiencing the reported sensations or if they were looking back at the task and inferring or making an educated guess about their internal state. This is most problematic in considering the fast condition. The second problem concerns the suppression, exaggeration, or accuracy of symptom reporting in the various cells. That is, are subjects in the slow condition most accurate (as indicated by the air blast recall data) or simply exaggerating perceived level of sensations (as suggested by the low level of skin conductance)? Internal analyses indicated no differences between conditions for correlations between perceived symptoms and *either* air blast or skin conductance measure. The first issue—concerning the validity of self-reports—is addressed in the following cough study. The second issue, dealing with accuracy versus distortion in reporting, will be discussed in detail in Chapter 4.

The Coughing Research

As most accomplished lecturers or performers (if, indeed, there is a distinction) will attest, people in an audience do not cough randomly. Coughing rate appears to be dependent on the talk, symphony, movie, or play that individuals are attending. If these observations are true, coughing rate could be an excellent unobtrusive measure by which to test the competition-of-cues idea without having to rely on self-reports.

By definition, an internal sensation is a private event that cannot be directly monitored. Unlike self-reports, a few behaviors such as coughing, sneezing, yawning, and scratching serve as automatic or reflexive indicants of the perceptions of internal state. Of particular relevance is that coughing is an easily monitored reaction to the perception of an itching or tickling throat (Beecher, 1959). In one of the first of several studies on coughing behavior (Pennebaker, 1980), 50 subjects, in groups of 3-9, viewed a 17-minute movie entitled *Conflict* which dealt with approach-avoidance. Every 30 sec during the movie the subjects rated how interesting the movie had been during the previous 30 sec along a 7-point scale ranging from 1 = not interesting to 7 = interesting. From the first part of the study, then, mean interest ratings for the 34 time blocks were computed.

The movie was then shown to three introductory psychology classes of 200, 90, and 40 students. Total number of coughs in each class was recorded every 30 sec, corresponding to the same intervals that the initial 50 subjects had rated for interest value. The mean number of coughs per 30-sec interval was then correlated with the mean interest ratings.

It was predicted that during the interesting portions of the movie subjects would process proportionately more information from the movie and less information about their irritated throats. Boring parts of the movie, on the other hand, offer less potential external information for the viewer, which should increase the probability of each person's attending to his or her throat and subsequently emitting a cough. In fact, the data support this reasoning. The correlation between number of coughs and interest rating was a highly significant −.57. That is, the more interesting the movie, the fewer the number of coughs.

One reason the coughing research is important is that it indicates that the processing of bodily information occurs at a very low level. In fact, after conducting portions of this research, my students and I would interview some of the coughers. The majority did not recall coughing themselves nor hearing others cough. Another example of minimal processing was reported to me independently by two sets of parents with three and four children, respectively. Both noted that contagion of coughing has occasionally occurred among their children when asleep. If one child begins coughing, the others will often do so as well, even though, in one case, the children sleep in adjacent rooms.

The Emotion Deadtime Study

Although the primary focus to this point has been on perception of specific sensations or symptoms, other self-perceptions such as emotion, hunger, or illness should be related to competition of cues. As will be discussed in greater detail in Chapter 5, perception of internal state can be viewed hierarchically. The most molecular elements of body perception include specific and direct sensations. Groups or constellations of sensations are often synthesized into broader categories. For example, my saying I have a cold is a summary statement for experiencing congestion, headache, sore throat, and the like. Similarly, the perception of emotion is often based on the labeling of a large number of sensations within the context of specific environmental events.

Even though an emotion is a broader label for identifying internal state, our awareness of emotions should be partially dependent on the quantity and type of external and internal information. Indeed, most theories of emotion have dealt with the relative roles of the two sources of information. Strictly speaking, the competition-of-cues idea poses an interesting paradox for emotion perception. If a person is in an emotion-provoking situation, such as in a room with a bear, the person *must* devote some attentional capacity to internal sensations to feel fear or other emotion. Complete attentiveness to the external object will not result in emotion *perception* (even though it should cause appreciable physiological change). Once the bear has disappeared or the person is out of danger, however, the most salient source of potential information will be internal state. In other words, emotion perception will be greater when external information is suddenly reduced.

This sequence of events is similar to that proposed by William James (1890). Note, however, that I am simply referring to emotion perception.[2] Hence, at this point, the issues of one-to-one correspondence between physiological activity and emotion, symptom specificity, and related controversies can be temporarily set aside.

[2] A major problem in comparing the various theories of emotion (e.g., James, 1890; Cannon, 1931; Alexander, 1950; Schachter & Singer, 1962; Ekman & Friesen, 1975; Plutchik, 1980) is that emotion does not have a common definition. Some researchers define emotion as the physiological change itself, the expression of the emotion, the perception of the physiological change or expression, and so forth. This issue will be discussed in greater detail in Chapter 5.

An experiment was conducted by Ella Harbour and me to test the role of cue competition in the perception of emotion. The study was based on the reasoning that the awareness of emotion should be most pronounced following an emotion-provoking event if the person was given the time to process internal (as opposed to external) information. In order to test this idea, subjects viewed one of three versions of an ongoing videotaped film. The only difference in this film was the insertion of a 0-, 3-, or 8-sec period when the screen went blank immediately following a graphic shop accident scene. The blank period, or "deadtime," provided virtually no external information and, hence, would increase the probability that subjects would notice their emotions following the accident.

In the experiments, introductory psychology students viewed a 5-minute edited version of the movie *It Didn't Have to Happen*, which dealt with shop safety and included a scene where one of the characters explains that he was once careless when working with a lathe. The viewer is then treated to a flashback close-up of the character's finger being severed. Following a 3-sec scene of blood spurting from the nub, the camera returns to the present so that the character can emphasize shop safety. The deadtime (3 or 8 sec) was inserted immediately after the blood-squirting scene.

In addition to the three levels of deadtime, half of the subjects were forewarned about the shop accident and half were not. This manipulation—which turned out to be quite important—was included because of an egregious error in pilot testing. With most of my research, I pilot test in a very quick and admittedly crude manner in order to assess the general validity of the idea being tested. For example, in the emotion study, pilot subjects were run in groups of three or four while watching one of the three deadtime conditions. The pilot experiment worked perfectly, with the no-blank subjects being the least affected by the accident. The "real" experiment (which was actually the second pilot) was then conducted; in it subjects were tested individually while heart rate, GSR, and finger pulse volume were measured. The pattern of the results for this study was in the opposite direction from that of the first pilot. That is, subjects with the blank times reported the movie to be least upsetting. In debriefing the experimenters for the two studies, one glaring difference was that in the pilot study subjects were not told anything about the nature of the film. In the second study, the experimenter went into great detail with the subjects about the content of the movie before the experiment began.

Although the two studies varied along several dimensions, forewarning about an event should give the event's occurrence very different meanings. If you do not expect an aversive event, when the event does occur it will signify the unpredictability of the movie. Further, it should increase your expectations that additional gory events are to come. If, on the other hand, you expect a gory scene or event to occur, its arrival signals the *end* of worrying, anxiety, and unpredictability. In other words, an aversive or gory scene signals the beginning of your problems if you have not been forewarned and the end of them if you have. These effects should be exaggerated with deadtime.

The third and final experiment, then, was a 3 (deadtime) × 2 (forewarning) between-subjects design. The 48 male subjects were tested individually by a male experimenter. On arrival at the lab, subjects were told that the study involved "physiological reactions to various stimuli." Electrodes were attached to the volar surface of the first and third fingers of the left hand in order to measure skin resistance. A finger plethysmograph was placed on the second finger of the same hand in order to measure heart rate and vasodilation. Following a 5-minute baseline period, the experimenter returned and explained that the movie was about to begin. At this point, half of the subjects were told, "By the way, I thought I'd warn you that during the movie you will see a very gory shop accident." The remainder of the subjects were not forewarned. The movie was then shown. When the film was over, the experimenter returned, detached the electrodes, and escorted the subject to an adjacent room. In the room, subjects completed a postexperimental questionnaire. The primary question required subjects to respond to the item "How upsetting did you find the shop accident?" along a 7-point scale ranging from "not at all" to "a great deal." Subjects also responded to two open-ended questions asking them to describe what happened in the 10 sec following the accident and what they were thinking about during this time.

On completing the questionnaire, subjects were carefully debriefed. Two of the first debriefing questions asked subjects to explain what happened immediately after the accident. If subjects did not mention the blank, the experimenter noted that some subjects viewed a version with a blank after the accident. He then asked if they recalled seeing the blank. If subjects responded that they had seen the blank, they were asked to guess how long the screen had remained blank.

The results of the study were generally supportive of the hypothesis. As can be seen in Table 2.1, both the forewarning main effect and the interaction attained significance. Of particular interest is that the competition-of-cues effect was most pronounced in the 3-sec condition. A related finding concerned the recall of the blank. Although the forewarning manipulation had no effect, 83% of the subjects in the 8-sec, 16% of those in the 3-sec, and only 1 (6%) subject in the 0-sec condition reported seeing the blank. Of those who recalled the blank in the 8-sec condition, their median estimate of the blank time was 3 sec (as opposed to .8 sec for the 3-sec condition). In other words, most subjects in the 3- and 8-sec condition appear not to have been processing external in-

Table 2.1 Self-Reported Upset from Viewing Shop Accident Scene by Condition

	Total deadtime (sec)		
Condition	0	3	8
No forewarning	4.25	5.50	4.87
Forewarning	4.50	3.25	4.50

Note. The higher the number, the more upsetting the shop accident was rated. These data are based on 8 subjects per cell.

formation for 3-5 sec after the accident. What kinds of information were being processed?

In addition to processing internal sensory information during the blank period, subjects may have been thinking about the scene, similar events from their own experience, or irrelevant events (e.g., homework, friends). Content analysis of the questionnaire item concerning what the subjects were thinking about did not reveal any differences between conditions. Finally, no physiological differences were found for any of the measures between conditions.

In sum, the results indicate that a short period of deadtime allows the individual time to monitor internal state, with the effect of making the state more extreme. No deadtime or extended deadtime appears to mitigate the effect. In the case of no deadtime, the individual simply does not have adequate time to process internal information. With extended deadtime, however, one of two effects may occur. First, subjects may have more time to objectively assess internal state or the external cause of the arousal. Hence, the person may say, "it's only a movie, there is no reason to be upset." Alternatively, the 8-sec delay may allow enough time for the person's arousal level to moderate. The ultimate assessment of the aversiveness of the event may be based on the perceived end point (i.e., end of deadtime) of the accident sequence.

Concluding Remarks

In this chapter the role of the competition of internal sensory versus external environmental information has been discussed. When the external environment is lacking in information, the probability of encoding sensations, symptoms, and emotions increases. This general process may occur at a very low level—conscious awareness of the process is not a prerequisite. Although such an approach addresses *when* internal sensory information will be noticed, it does not explain *how* such information is encoded or interpreted. As the emotion deadtime study indicated, subtle differences in expectations concerning the accident scene resulted in very different perceptions of upset as a function of cue competition. The roles of sets, schemas, or expectations in the processing of internal information will be discussed in the following chapter.

Despite the limitations of the cue competition perspective, it is congruent with several of the demographic correlates of symptom reporting, aspirin use, and depression that were reported in Chapter 1. Individuals who are unmarried, live alone, or are unemployed report more symptoms, use more aspirin, and report having experienced more depression than people who are married or living with one or two others, or are employed. Individuals holding boring or undemanding jobs have higher rates of symptom reporting, absenteeism, and aspirin use. In all of these settings, there is a pronounced lack of external information. Individuals have more time to notice and subsequently dwell on subtle physical sensations. All things being equal, these individuals may tend to exaggerate the degree of physical symptoms and their overall impact on their behavior (cf. Taylor & Fiske, 1978).

Ironically, an individual who is completely immersed in his or her job, social world, or other aspect of the external environment may be at a higher health risk than the individual lacking in external stimulation. First, the person under constant external stimulation may evince greater levels of autonomic activity. Chronically elevated blood pressure, heart rate, and other physiological levels can be deleterious to health (e.g., Selye, 1976). Beyond this, however, is the fact that the immersed person will be less likely to notice sensations that could signal disease or bodily imbalance. Encoding too much internal or external information at the expense of the other is undoubtedly maladaptive.

Cue competition, distraction, denial, and suppression. The general concept of competition of cues is similar to the more popular ideas of distraction from, denial of, or suppression of body state. The major differences among these concepts are the underlying assumptions concerning body perception. For example, distraction implies a passive attentional process wherein the person "normally" attends to internal state unless distracted by an environmental event. In other words, the organism is at the mercy of external stimuli rather than actively searching for any type of potential information. Both denial and suppression presume awareness or encoding of internal state. Symptoms are not reported, however, because such an act could be damaging to the ego. Although these processes undoubtedly occur, to claim that they underly the empirical findings in this chapter would indicate that these defense mechanisms are constantly at work, being activated and turned off every few seconds (e.g., while watching a movie). In sum, distraction, denial,

and suppression are useful terms, but are limited in their assumptions about perception.

Cue competition and self-focused attention. Distraction is to external information as self-focused attention is to internal information. In recent years, similar theories of objective self-awareness (Wicklund, 1975), self-consciousness (Buss, 1980), and self-focused attention (Carver & Scheier, 1981) have blossomed. From this perspective, when individuals are aware of any aspect of themselves, they are more likely to behave in line with their ideal selves (e.g., to be more responsible, honest), to exhibit more extreme emotions, and to be more accurate about internal state. One could argue that lack of external information or heightened salience of internal state would make the person generally more self-aware. In fact, a clever study by Wegner and Giuliano (1980) lends support to this idea. Nevertheless, a self-focused attention perspective is quite limited in explaining the present results. For example, in the present studies, subjects in the lap (jogging study) and breathing (treadmill study) conditions would be considered more aware of self. Nevertheless, one would expect either (a) lap subjects to run faster or walk more doggedly (the ideal self does not dawdle), or (b) lap and breathing subjects to be more accurate concerning internal state relative to objective measures of heart rate, blood pressure, or breathing rate. Neither of these findings obtained. Consequently, this alternative explanation must be set aside for the time being.

This simple vignette points to several factors related to perception. For convenience, the vignette will be dissected into three components: hearing the rustle, adopting a hypothesis about a snake that results in selective scanning of the base of the bush, and inferring that you have seen a snake based on seeing a long slender object. These three facets of perception will be called (1) orienting, or competition of cues; (2) schemas and selective search; and (3) inference. Each of the components of perception are subject to distortion and bias. In dealing with orienting and competition of cues—the primary focus of this chapter—we are concerned with what stimuli are noticed and encoded by the organism. In other words, what factors alter the probability that an event will be picked up? The second component, schemas and selective search, addresses the broad issue of what may influence our adopting a given hypothesis or schema. In addition, once a schema has been adopted, how does it affect subsequent search behavior and the encoding of information? The third process, inference, deals with how the organism makes a judgment or inference about an event when verifying information is scant or nonexistent.

This general perceptual process is based on several assumptions. First, the organism is limited as regards the amount of information that can be processed at a given time. Although the capacity may vary from time to time (e.g., when on the verge of sleep vs. when moderately aroused), the capacity is always finite (e.g., Navon & Gopher, 1979). Second, potential information exists both within and outside of the organism. Consequently, the search for information can oscillate between external and internal stimuli. A similar assumption is proposed by researchers studying self-focused attention (e.g., Wicklund, 1975; Scheier & Carver, 1977).

A third assumption is that perception can be both active and passive. In essence, this means that the organism can passively encode stimulus information that impinges on its receptors as well as actively seek out information. Traditionally, students of perception have assumed that perception was either active *or* passive—Neisser (1976) representing the former, and traditional psychophysics upholding the latter, view. Note that these two approaches differ markedly in their focus on stimuli versus cognitive structures of the organism. Whereas the passive approach attempts to explain much of perception and attention by measurement and understanding of stimulus characteristics, the active approach is more concerned with learning or experience, expectations, and sets. In dealing with symptom perception, both approaches have proven to be useful for different components of the perceptual process. A passive model of perception is useful in understanding the initial orienting or noticing of physical sensations. The more active perspective can best explain schemas and selective search as well as inference.

The above assumptions deal with perception in general. The remainder of this chapter will focus on only one component of the process. The issues related to orienting or competition of cues draw heavily on the more passive models of perception. As such, I will focus on the nature of internal and external stimuli that compete for processing or attention.

Orienting and Competition of Cues

Under what conditions are individuals most likely to notice physical sensations? On a broader level, we should ask when we are likely to notice *any* given stimulus. Several research projects dealing with attention have addressed this problem. Two basic issues deal with the number of competing stimuli and the stimulus characteristics themselves.

The probability that a given stimulus will be encoded is dependent, in part, on the number of competing stimuli available at the same time. Consequently, an organism will be more likely to encode or orient toward stimulus X if no competing stimuli are present than if stimuli A, B, and C are also present in conjunction with X. Using the snake vignette, we will be more likely to notice the rustle if we are alone than if engaged in a conversation with a fellow hiker.

In addition to the *number* of competing cues, the nature or characteristics of cues must be examined. Certain stimulus dimensions are more likely to be heeded than others. In a series of experiments, Berlyne (1960) found that stimuli that are unique or moderately complex or display motion will be examined in greater detail than stimuli that are redundant, simple, or stationary.

Given that internal sensory stimulation represents one more potential source of information, we can now begin to predict in which settings we will have the greatest probability of noticing physical sensations, symptoms, or even emotion. In a general sense, the probability of noticing internal cues can be expressed as a function of the ratio of the quantity or salience of potential internal information to external information. Or,

$$\text{Awareness of internal states} = f\left(\frac{\text{internal information}}{\text{external information}}\right)$$

Although this expression may appear to add a little scientific respectability to this chapter, you should note that the equation is merely intended to express the general relationship among the variables involved. Nevertheless, such a relationship implies that when internal information is constant, the amount of potential external information will be inversely related to symptom reporting. Conversely, when external information is invariant, the degree of potential internal information will be positively correlated with symptom reporting.

It should be emphasized that the presence of potential internal and external information is not independent. For example, the perception