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The Psychology of Physical Symptoms



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To Ruth

Preface

Physical symptoms are fascinating phenomena to examine. We all experience them, use them as signals to guide our behavior, and usually assume that they accurately represent underlying physiological activity. At the same time, we implicitly know that bodily sensations are often vague, ambiguous, and subject to a variety of interpretations. It is not surprising, then, that there is often a disparity between what we think is going on in our bodies and what is objectively occurring. In short, phenomena such as physical symptoms are the stuff of psychology.

My own research into physical symptoms started by accident several years ago. In a hastily devised experiment dealing with the effects of noise on behavior, I had to write a post-experimental questionnaire that would be long enough to allow the experimenter time to calibrate some equipment for a later portion of the study. I included some physical symptoms on the questionnaire as fillers. The experiment was a total failure, with the exception of the symptom reports. People's perceptions of symptoms were easily influenced by our manipulations, even though their actual physiological state had not changed. And so began the present inquiry.

Despite the pervasiveness, importance, and sheer amount of time and money devoted to discussing and curing common physical symptoms and sensations, very little empirical work has been devoted to examining the psychological and perceptual factors related to sensory experience. Occasional papers have tested a specific theory, such as cognitive dissonance, wherein physical symptoms served as an interesting dependent measure. Similarly, clinical researchers have often studied symptoms as tools with which to affect biofeedback training. Most others who have examined them have simply considered them a necessary problem in attempting

to understand the more basic physiological processes they supposedly represent.

This book is the culmination of several years of research aimed at understanding the nature of physical symptoms among relatively normal and healthy individuals. What psychological processes are implicated in the perception of sensations? What is the link between perceived and actual physiological activity? What roles do developmental, personality and cultural differences play in the perception and cognitive organizations of body state? In an attempt to answer these questions, my students and I have uncovered a number of intriguing and often unanticipated answers. By the same token, we have also stumbled across a number of additional questions that have yet to be addressed.

This is a book of theories, data, and speculations. In attempting to understand physical symptoms, we have devised a number of theories and mini-theories that represent a general cognitive-perceptual perspective. Because of the complexities of the topic, we have also drawn on several seemingly unrelated approaches ranging from learning theory to psychoanalytic models. The dozens of experiments that we have conducted have forced us gradually (and, on occasion, abruptly) to alter and update our theoretical framework. Any explanatory schemas that are presented in this book, then, will undoubtedly be modified by us and others in the future. Nevertheless, we hope that this project will serve as a departure point for future investigations related to the psychology of physical symptoms.

A research project such as this has relied on dozens of people. Among those that have contributed their time and energy in conducting many of the experiments, I am especially indebted to Andy Skelton, Linda Gonder-Frederick, Greg Brittingham, David Epstein, Claudia Hoover, Cobie Hendlar, Ginny Maycock, Ella Harbour, Terry Kerler, Herb Stewart, and Melissa Conrad. My thinking on symptoms has been influenced particularly by Darren Newtson, whose insight and breadth of perception will always be appreciated. I also wish to thank the many others with whom I have spent literally hundreds of hours discussing the research topics in this book, including Audrey Burnam, Bella DePaulo, Tim Wilson, Rob Roberts, Billy Barrios, and Dan Cox; and a number of people who have read versions of this book and have made extremely helpful comments: Mihalyi Csikszentmihalyi, Bella DePaulo, Andy Skelton, and Dan Wegner. Finally, I wish to thank Debbie Mundie for her invaluable aid in typing the multiple drafts of the manuscript.

August 1982

James W. Pennebaker

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Chapter 1

Introduction and Overview

Although we are all familiar with headaches, tense muscles, racing hearts, and other bodily sensations, we rarely consider the factors involved in their definition or perception. A physical symptom or sensation¹ is a perception, feeling, or even belief about the state of our body. The sensation is often—but not always—based on physiological activity. Above all, a physical symptom or sensation represents information about internal state. As such, symptoms are related to virtually all behaviors, whether drinking, eating, sleeping, taking drugs, or health seeking. Sensations, then, are both causes and effects of behavior. They often initiate activity as well as signal that an activity has occurred. In short, the processes of noticing and reporting symptoms are highly adaptive and functional for the individual. If people accurately perceived their physiological activity, there would be no need for a book on the psychology of physical symptoms. As will be discussed, symptom reporting is subject to a large number of perceptual biases and distortions. If we are to understand the failures of self-regulation as related to symptom reporting, we must first examine the nature of the symptom-reporting process in normally functioning humans.

As will be discussed in the following pages, symptoms are perceived in accordance with the same perceptual processes that have traditionally been implicated in the perception of external stimuli. The awareness of symptoms is dependent on a variety of internal and external cues, as well as on the sets or schemas that we hold. Because of this, it is

¹Throughout this book, the terms *symptom* and *sensation* will be used interchangeably. The concept of a physical symptom is not meant to imply the manifestation of some underlying physiological or psychological disorder.

critical to note that the awareness of internal sensations usually does *not* represent a one-to-one correspondence with actual physiological change. A good example of this can be seen in our perception of heart rate. Even though our heart rate may be equally accelerated in two different settings, the settings themselves will greatly influence the *perception* of how fast we think our heart is beating.

The lack of one-to-one correspondence between actual and perceived physiological change may appear to be inconsistent with the basic tenet of psychophysics that states that “equal stimulus ratios produce equal sensation ratios” (Stevens, 1975). Such an approach is based on the assumption that all other variables are constant. In the real world this assumption is rarely, if ever, met. In studying the perception of internal stimulus events, we must consider the ever-changing roles of competing stimuli both within and external to the body, expectations, individual differences, and so on.

Throughout this book, several theories and hypotheses will be presented that explain portions of the symptom reporting process. Although no one general theory pervades, the studies that we have conducted fit into a broad cognitive/perceptual perspective. The sub-categories of this approach deal with (1) when we first notice sensations, (2) how specific sensations can be organized and searched for as a function of the beliefs or schemas that we hold, (3) how perceived and actual physiological activity correspond, (4) the nature of categorization processes in symptom and emotion perception, and (5) how symptom reporting can be considered an individual difference factor. Before presenting a theoretical framework, it is useful first to discuss a number of basic parameters surrounding the topic of physical symptoms. This chapter, then, begins with a number of important definitions and distinctions necessary for an understanding of symptoms. The remainder of the chapter will focus on some of the demographic variables and theoretical tacks that have historically been taken in the study of physical symptoms and sensations.

Boundary Conditions Surrounding Symptom Reporting

Encoding, awareness, and reporting of sensations. Physical symptoms or sensations are by definition private and subjective experiences. In studying these phenomena, our research strategy must be varied, since it is often difficult or impossible to measure objectively the internal stimuli responsible for a symptom’s occurrence. In studying sensations and symptoms, the researcher must distinguish between the encoding, awareness, and reporting of internal state, since each can be influenced by different processes.

At the most basic level, we are constantly processing sensation information. The bulk of this information is not consciously processed—although it may be potentially available to consciousness. For example, while reading this book you are undoubtedly processing information from your back, neck, muscles, and the like. In most cases you are not aware of these sensations until you are asked to become aware of them. Sensory information is being processed nonetheless—whether cortically, subcortically, or even within the spinal cord.

A dramatic example of the nonconscious processing of sensory information has been reported by G. Ádám (1980). In his work, a small rubber balloon is inserted in the small intestine of an experimental subject. During the experiment, the balloon is inflated and deflated while cortical activity (EEG) is recorded from the awake subject. Even though the subject does not feel any sensations, marked EEG patterns accompany inflations of the balloon. Interestingly, with training, subjects can be taught “to become conscious of intestinal stimuli that had been unconscious before the conditioning procedure.” Ádám also reports on the work of G. V. Gersuni, who has demonstrated that subthreshold sounds (which trigger EEG changes) can serve as conditioned stimuli. Recent work by Davidson and Schwartz (1978) has extended these findings by indicating that subthreshold visual and auditory stimuli are differentially processed as a function of manipulated focus of attention.

Although sensation encoding is occurring continuously, our awareness and subsequent reporting of sensations are dependent on a variety of additional psychological processes. Our awareness of internal sensations is a function of the relative magnitudes of internal receptor stimulation, amount of available external information, and the beliefs that we may hold that cause us to selectively attend to internal state, as well as of our general propensity to attend internally. In other words, processes other than the mere encoding of internal information influence the awareness of sensations.

The jump from symptom awareness to symptom reporting implicates a new set of variables. In natural settings, the person who is aware of a given symptom may either not report it or overreport it, depending on potential reinforcement or punishment from others. Distorted symptom reporting may also be motivated by self-image concerns. In many settings, the reporting of symptoms may result in the person’s appearing and/or feeling weak or sick. In other settings—such as in an encounter group—the failure to report internal state can lead to perceptions of being repressed or not being in touch with self.

Clearly, the encoding, awareness, and reporting of sensations are not isomorphic processes. As researchers in this area, we typically must rely on self-reports and hope that such reports approximate symptom encoding and awareness. As with any self-reports, the study of physical symptoms is akin to problems associated with the Heisenberg principle

in physics. That is, measuring the phenomenon may be radically altering the phenomenon itself. Merely asking subjects which sensations they are aware of prompts them to attend to their bodies in ways they might not normally have done.

In a sense, this book is concerned with encoding, awareness, *and* reporting of internal state. Although we have not been able to measure encoding per se, some of the studies to be discussed have used behavioral measures that indicate that sensory information is being differentially encoded as a function of our manipulations. The majority of experiments have relied on self-reports, on the assumption that we are tapping the awareness domain. By minimizing differential reinforcement and self-presentational concerns from the subjects' perspective, we think that we are truly tapping symptom awareness with our measures. Fortunately, our research strategy has been sufficiently broad in scope in that we have employed a variety of converging measures—both behavioral and self-report. By and large, experiments that have found differences in self-reports have, in other studies, found comparable differences in encoding as measured by our overt behaviors (see Wolff, 1953 for additional examples). The distinctions among encoding, awareness, and reporting within the various studies will be addressed in later chapters.

Differences in the labeling of symptoms. When I first began studying symptoms, I naively assumed that all people shared relatively common labels for body experiences. Early studies and intensive interviews with subjects indicated that this was not the case. Self-reports of such common sensations as shortness of breath, racing heart, and tense muscles have different meanings to different people. Further, individuals differ radically in how they perceive these states. For example, shortness of breath or breathlessness means shallow and/or fast breathing for some and slow and/or labored breathing to others. The perception of tense muscles can variously be defined as tightness in the shoulders, neck, back, or stomach, or even as the awareness of a clenched jaw. In other words, individuals often attend to different parts of their bodies in order to define the same sensation. These various definitions and strategies of perception point to some of the problems in attempting to get standard physiological measures of symptoms. Such problems further indicate that the researcher—and even the physician attempting to diagnose a problem—must be extremely specific in asking the subject or patient about his or her sensory experiences.

Comparability of symptoms. Throughout this book you will note that the symptoms that we have studied have varied tremendously from experiment to experiment. Whereas some experiments have focused on a single symptom such as nasal congestion, warm or cold hands, or

heart rate, others have dealt with large constellations of symptoms. At first glance, a psychophysiologist might be appalled. After all, different symptoms may represent different parts of the respiratory, digestive, cardiovascular, or other system. Further, the symptoms may vary in the degree to which they reflect sympathetic, parasympathetic, or even central nervous system activity. In fact, we have consistently found that any given psychological manipulation that can alter the perception of one symptom is equally powerful in changing the perception of another symptom, despite radical differences in the anatomical substrates of the symptoms. A good example of this will be discussed in detail in Chapter 3. Briefly, we employed comparable attentional manipulations in four separate studies dealing with perceived heart rate, warmth of hand, nasal congestion, and finger pain. Although the manipulations were aimed at different symptoms, comparable changes in self-reports for the target sensory systems were found.

That there is a comparability of symptoms has major ramifications. Above all, it points to the importance of a unified perceptual system. The processes by which we experience sensations in our head, toe, or even external environment are one and the same. Although the type and quality of afferent information may vary as a function of immediacy, intensity, and so on, the general strategy by which our brains process these different sources of information is remarkably similar.

Demographic and Cultural Comparisons

Headaches, nasal congestion, and other ailments are features of every person's life. The prevalence of physical symptoms within the American population at any given time is remarkably high. Further, the probability that a symptom will be reported varies as a function of demographic (e.g., age, occupation, sex) and cultural factors. Instead of going into exhaustive detail concerning each of these factors, we will present a general summary of findings. These data are important because they point to large and systematic differences in the ways individuals perceive and report internal sensory experiences. These data will also give the reader a flavor for the pervasiveness of symptom reporting in the general population.

In the last decade, several large surveys investigating symptom reporting have been conducted among a variety of populations. Perhaps the single best series of general surveys has been conducted by the National Center for Health Statistics (NCHS). Although each of the surveys has been based on large samples, the ways in which the data have been broken down demographically have varied from report to report. Consequently, some of the demographic data to be presented are based on

selected symptom reports (e.g., NCHS, 1970; 1980a), days of self-reported restricted activity due to illness (NCHS, 1979a), aspirin use (NCHS, 1979b), and medical records based on presented symptoms (NCHS, 1979c). Additional demographic data to be presented have come from a regional survey among individuals between 58 and 62 years of age for perceived health (Wan, 1976), symptom self-reports from an urban area (Schwab, Fennell, & Warheit, 1974), and symptom reports among college students (Greenley & Mechanic, 1976; Moos & Van Dort, 1977; Comstock & Slome, 1973). Although it is not possible to compare the results of the various studies, since different symptoms, scales, and time frames were used, the general patterns are consistent.

In all studies, indicants of symptom reporting suggest that a large percentage of Americans both are aware of and seek to remedy internal sensations. For example, in a national survey asking respondents to note if they have been bothered by 12 selected symptoms such as headache, palpitating heart, and dizziness, 78% responded affirmatively to at least one symptom (NCHS, 1970). In addition, average Americans report having their activities restricted as a result of symptoms 9.7 days per year (NCHS, 1979a). An indirect measure of symptom awareness—aspirin use—indicates that 23% of adults use aspirin at least once a week, and an additional 52% report using aspirin occasionally (NCHS, 1979b). Finally, the average American visits a physician 2.7 times per year. Of these visits, physicians estimate that 51% of the visits are not at all serious, and an additional 31% are only slightly serious (NCHS, 1979c).

Among college students, investigators have found that 70% of students report headaches, colds, or sore throats at least once during each academic year (Comstock & Slome, 1973). Other surveys indicate that up to 50% of students report that more than one illness-related symptom has occurred within the previous month (Moos & Van Dort, 1977). Over the last 5 years, we have routinely required large classes of introductory psychology students (minimum class size = 177) to check the degree to which they were currently experiencing each of 12 common symptoms or sensations along 7-point scales, where, for example, 1 = no headache and 7 = headache. Across all samples, 79.6% report experiencing some degree of at least one symptom (see Appendix A for properties of sample symptom checklist).

Clearly, symptom reporting is a pervasive phenomenon. Of particular interest, however, is the fact that the incidence of symptom reporting varies considerably as a function of demographic factors. Some of these are mentioned below, since later chapters in the book will offer useful explanations of some of the differences.

Age. Among national surveys, older individuals report more symptoms than younger (e.g., NCHS, 1970). This pattern is consistent for physician

visits (NCHS, 1979b), weekly aspirin use (NCHS, 1979c), and days of restricted activity due to illness (NCHS, 1979a). Within college samples, however, the trend is reversed. That is, first-year college students report the greatest number of symptoms and fourth-year students the least (Comstock & Slome, 1973; Greenley & Mechanic, 1976; Moos & Van Dort, 1977).

Sex. Virtually all studies indicate that females experience more symptoms than males. Similarly, women tend to have higher rates for aspirin use (NCHS, 1979c), physician visits (NCHS, 1979b, 1980a), days of restricted activity due to illness (NCHS, 1979a), and expenditures for both prescribed and nonprescribed medication (NCHS, 1967). These data are consistent across all ages with the exception of people under 15 years of age. Comparable sex differences emerge among college samples employing retrospective symptom reports (e.g., Comstock & Slome, 1973). Similarly, our own instrument, the PILL (from Pennebaker, Burnam, Schaeffer, & Harper, 1977), which taps the frequency of occurrence of 54 common physical symptoms, also finds higher reporting among females. Interestingly, the college samples have typically asked subjects to rate the degree to which they have experienced selected symptoms within the past week, month, or year. A particularly intriguing finding, however, is that when we ask subjects to report the degree to which they are *currently* experiencing each of 12 common symptom items, no consistent sex differences emerge (Pennebaker & Skelton, 1978).

Marital status. National surveys and college samples consistently find that unmarried persons report more symptoms, take more aspirin, and perceive themselves to be in worse health than married. This finding is especially pronounced for individuals who have been formerly married (divorced, separated, or widowed). Interestingly, those who have never been married tend to be more similar to married than formerly married respondents (e.g., NCHS, 1970, 1979a, 1979b, 1979c; Wan, 1976).

Residential status. Perceived health problems are also a function of the number of people living together. Unlike other demographic variables, however, this is a curvilinear rather than a linear relationship. Individuals living with one to three others report the fewest symptoms and claim to be in the best health (NCHS, 1977; Wan, 1976). Interestingly, indicants of increased symptom awareness are greatest for those living alone and for those living with four or more other people in the same dwelling.

Occupational status. Whether or not a person is employed, keeping house (or otherwise not in the labor force *not* because of illness), or currently unemployed is also related to perceived symptoms, poor health,

and aspirin use. As would be expected, individuals who are employed report the fewest symptoms. Less intuitive, however, is the fact that individuals who are currently unemployed and looking for work report being in better health and taking less aspirin than those not in the labor force (NCHS, 1970, 1979c; Wan, 1976). Note that these statistics exclude individuals who are disabled.

Socioeconomic status (SES). Indicators of SES—income and education—are identical in their relationships to symptoms and health and will simply be referred to as SES. Higher SES is linearly related to fewer symptom reports (NCHS, 1970), perceptions of better health (Wan, 1976), and less aspirin use (NCHS, 1979c). Unlike the demographic information discussed thus far, however, is the fact that higher SES individuals visit physicians more regularly (NCHS, 1979b).

Racial and subcultural differences. The majority of studies indicate that blacks report symptoms to a higher degree (e.g., Wan, 1976), report more days of restricted activity due to illness (NCHS, 1979a), and take more aspirin (NCHS, 1979c) than whites. As with the SES data, however, whites visit physicians more often than blacks (NCHS, 1979b, 1981a).

Among American samples, large differences in symptom reporting and responses to pain have been found among ethnic groups. Zola (1966), for example, found that Irish-Americans were more likely to seek medical attention for symptoms than Italian-Americans. Further, the symptoms for which they sought medical attention were different. Whereas the person of Irish descent was likely to complain of eye, ear, nose, and throat symptoms, the Italian-American typically sought aid for symptoms associated with other parts of the body. Similarly, large differences in response to pain have been found between American-born Jews, Italians, Irish, and Yankees of British descent (Sternbach & Tursky, 1965; Tursky & Sternback, 1967; Zborowski, 1952, 1969). Interestingly, these subcultural differences emerge for perceptions of aversiveness, overt complaining, and even autonomic activity in response to standardized experimentally induced pain. The various researchers have attributed these differences to the different meanings each group ascribes to pain. That is, where one group—Jewish—interprets pain as signaling danger, another group, such as the Yankee, interprets pain in a more benign, something-to-be-endured fashion.

Cross-cultural differences. As might be expected, anthropological studies indicate tremendous variability in symptom reporting from culture to culture. Margaret Mead (1950) noted that among the Arapesh, pregnant women did not show signs of morning sickness. According to Mead, this was due to their total denial of pregnancy. Raper (1958) initially assumed that peptic ulcers were a rare occurrence among members of the African

tribe he was studying, since tribal members never noted or complained of accompanying symptoms. Later autopsies, however, revealed that peptic ulcers were present in the tribe in virtually the same proportions as in England. Apparently the African tribesmen, not unlike the Arapesh women, were perceiving their internal sensations in different ways than their Anglo-Saxon counterparts. An interesting corollary is that Israeli immigrants from various cultures differ radically as regards the types of complaints for which they take their infants to the hospital (Harlap et al., 1975).

A final striking example of cultural differences concerning physical symptoms was conducted among the Panopeans in the Caroline Islands (Fischer, Fischer, & Mahony, 1959). In that culture the eating of a forbidden, or totem, animal often results in a metaphorical symptom acquisition. For example, a person's ingesting his totem food, such as a turtle, "causes him to gasp for air like a turtle . . . or to be subject to a compulsion to flap his arms like a turtle's flippers. An informant, whose sib totem was the eel, reported that his cheeks swelled up like an eel's gills when he violated his taboo."

Summary of Demographic and Cultural Variables

The preceding list of correlates of symptom reports is far from exhaustive. Many of the findings cannot be evaluated in a causal sense. For example, the individual who tends to report a high number of symptoms may have difficulty in finding or keeping a job or spouse. Other psychological variables undoubtedly mediate the demography-symptom reporting relationship. For example, various social or occupational circumstances may engender negative moods or anxiety which, in turn, result in symptom formation and reporting. Many of the ethnic, social class, and cultural differences could be ascribed to variations in diet or in the availability of medical facilities; to genetic, hormonal, or immunological differences; or even to differential prevalence of viral or bacterial agents.

Although there may be physiological differences among individuals in different demographic or cultural categories, the conglomeration of findings indicates that there are also clear differences in the ways people *perceive* their bodies. A simple illustration of this can be seen by looking at the data concerning males and females. Across all ages, females report more symptoms, take more prescribed and nonprescribed medication, and visit physicians more often than males. Nevertheless, males have shorter life expectancies and higher diagnosed rates of hypertension (NCHS, 1980b), ulcers (NCHS, 1979d), and cancer (NCHS, 1981b). In other words, the higher prevalence of disease among males would indicate that they should, in fact, have greater physiological activity than females. Nevertheless, females appear to be more attentive to internal state, and

to subsequently seek medical attention based on their perceptions of their symptoms. Clearly, if symptoms represented a simple one-to-one correspondence with physiological change, we would expect males to report more symptoms and to be more frequent users of aspirin and available medical facilities than females. Similar arguments could be made for virtually every demographic and cultural variable that has been discussed thus far.

Experimental and Theoretical Approaches

Despite the prevalence of symptom reporting and the numerous behavior domains affected by the perception of internal state, the lack of experimental and theoretical work dealing with factors influencing the perception of sensations is surprising. The vast majority of studies in psychosomatics and psychophysiology has been concerned with the effects of psychological events on actual physiological change rather than with the perception of change. By and large, most research dealing with the perception of internal state has evolved from one of three general perspectives: medical, biofeedback, and cognitive social psychological. Whereas the medical (including psychodynamic) approach has been concerned with the role of symptoms as representations of "deeper" problems—either physical or emotional, the biofeedback view has been to consider symptoms as signals that can be used by the patient in learning to control various autonomic functions. Finally, the cognitive social psychologists have begun to examine symptoms as either components of the broader construct of "arousal" or as products of a perceptual process. Each of these approaches will be discussed separately.

The Medical and Psychodynamic Tradition

Both medical and psychodynamic clinicians have viewed physical symptoms as useful, but often frustrating, representations of underlying problems presented by a patient. Generally, the symptoms themselves are viewed as part of a puzzle which, when completed, will present a coherent picture of the patient's physiological or psychic processes. Although both medical and psychodynamic traditions share the same definitions of symptoms, the two approaches have studied them in different ways.

Medical approach. Within medicine, it is understood that physical symptoms are imperfect indicants of physiological processes. Among most medical personnel, the extraction of symptom information from the patient serves as an important clue concerning the possible "true"

problem. Usually, but not always, the primary goal is to cure the problem, which in turn will cause the symptoms to diminish or disappear. Although physical symptoms have not been studied as separate phenomena, a number of common assumptions concerning symptoms are apparent in both medical training and the literature. For example, any one physical symptom can usually have multiple causes. Patients vary considerably in the ways that they present symptoms for the same disease. Despite these differences among patients, most diseases evoke relatively similar constellations of symptoms from person to person. Consequently, influenza symptoms will usually be distinguishable from heart disease symptoms for the vast majority of patients. In sum, although a number of beliefs about symptoms exist within the medical field, the nature of symptom perception among healthy individuals has been outside the research domain.

Psychodynamic approach. In both psychiatry and psychology, physical symptoms have been of interest to the clinician. It has long been known that the presentation of physical symptoms can signify more basic psychological disturbances of the patient. Although many psychotherapists share the medical view that physical symptoms are the surface signs of deeper problems, their view of symptoms is different for a number of reasons. Unlike medicine, the same physical symptoms can represent completely different emotional states. Further, the same presumed emotional state can produce totally different symptoms in different people. In other words, there is relatively little correspondence between particular physical symptoms and the underlying problems that they represent. In recent years, a number of disorders characterized by the reporting of physical symptoms (with no apparent physiological bases) have been discussed. Although the rooted psychological mechanisms are contested among various psychodynamic traditions, some of the disorders are briefly discussed.

The presentation of physical symptoms and somatic problems occurs in a number of neurotic disorders that are associated with anxiety. For example, the states of generalized anxiety (Taylor, 1953), diffuse anxiety (Kutash, 1965), and somatic anxiety (Schwartz, Davidson, & Goleman, 1978) are all associated with vague complaints of such symptoms as heart palpitations, dizziness, fatigue, headache, nausea, and various aches and pains. Of particular relevance are the somatic disorders of conversion reaction and hypochondriasis. Conversion reactions have been considered problems wherein the patient presents physical symptoms associated with the loss or alteration of functioning of a physiological system (American Psychiatric Association, 1980). The symptoms, which can serve to achieve secondary gains, are said to represent somatic outlets for repressed conflicts (Kutash, 1965; Jones, 1980). In an excellent review of conversion reaction, Jones (1980) notes that the symptoms

that are expressed vary from culture to culture. In addition, the physical symptoms that occur reflect conflict, physiology, and situational and learned cultural patterns. In short, Jones' work indicates that the psychological processes related to the perception and reporting of symptoms associated with conversion reactions represent underlying deeper causes (e.g., conflict, anxiety) as well as more immediate causes (e.g., physiological state, expectations for reinforcement, and other situational factors). Whereas conversion reactions are more common among females, cases of hypochondriacal reactions may be more frequent among middle-aged men. The hypochondriac is an individual who is obsessed with bodily functions and sensations (Meister, 1980). Although psycho-dynamic explanations for the disorder vary, most agree that the hypochondriac is reacting to a disappointing life and may be using the symptoms as a defensive reaction to avoid responsibility (cf. Ladee, 1966).

Conversion reactions, hypochondriases, anxiety, and a number of related somatization reactions and their associated physical symptoms have long been of interest to clinicians. The physical symptoms themselves, however, have usually not been examined in great detail because of their diffuse nature. Further, when symptoms have been reported by patients, basic perceptual issues related to sensory information have not been of primary importance.

The Clinical-Biofeedback Tradition

One goal of many clinicians is to encourage the client to become more aware of internal sensory information, including emotions and feelings of anxiety. The underlying assumption of this approach is that if the person can accurately evaluate when he or she is hungry, anxious, or emotionally distraught, appropriate corrective behaviors can be taken. In an excellent review of clinical approaches to visceral perception, Brener (1977) notes that, to date, attempts to evaluate factors influencing perception of sensory information in clinical settings has produced interesting but only tentative results.

One of the first systematic approaches in assessing accuracy of sensory perception was undertaken by Cannon and Washburn (1912). In their research, perceptions of hunger were correlated with measures of stomach contractions. It was found that the more intense the contractions, the greater the perception of hunger. In a series of systematic studies along the same lines, Stunkard and his colleagues (e.g., Griggs & Stunkard, 1964; Stunkard & Koch, 1964) sought to learn if obese individuals were less accurate at perceiving stomach contractions than the nonobese. The authors hypothesized that failure to discriminate stomach contractions among obese could account for their excessive eating. In the research, obese and nonobese people were required to swallow a gastric balloon

that could detect the degree of stomach activity or contractility. It was found that the nonobese were superior to the obese in detecting whether or not their stomach was contracting. Ironically, neither group was overwhelmingly accurate. When their stomachs were not contracting, both obese and nonobese reported being hungry about 38% of the time. During times when their stomachs were contracting, reports of hunger by the obese increased to 48% and by the nonobese to 71%. The results, then, indicated that although there were differences between groups, the general ability to sense stomach contractions as measured by self-reports of hunger was far from perfect. Of course, this research was interested in the perceptions of hunger rather than in perceptions of stomach contractions per se.

A related line of research dealing with visceral perception has been undertaken by Mandler and his associates (e.g., Mandler & Kahn, 1960; Mandler, Mandler, & Uviller, 1958). In an effort to learn what individuals are most aware of internal sensations and why, Mandler et al. (1958) constructed the Autonomic Perception Questionnaire (APQ). The APQ consists of three sections tapping responses to feelings associated with anxiety and pleasure, estimates of physical symptoms associated with anxiety and pleasure, and subscales from the Manifest Anxiety Scale and MMPI pertinent to reports of internal bodily stimulation. Overall, the authors found that high-APQ scorers displayed greater heart rate, skin resistance, and respiration variability than low-APQ scorers. In addition, high-APQ scorers tended to overestimate, whereas low scorers underestimated, perceptions of autonomic activity relative to the actual autonomic measures. Later research sought to learn if, in general, high and low APQ scores were related to accuracy of perception of internal state. In fact, no consistent patterns have been found between perceptions of internal state and actual autonomic state (cf. Donelson, 1966; Greene & Nielsen, 1966; McFarland, 1975; Whitehead, Drescher, & Blackwell, 1975).

The majority of clinical studies dealing with visceral perception have been more concerned with the ultimate control of various autonomic indices than with the processes of perception per se. In recent years, an important debate has arisen among biofeedback researchers as to the relationship between the ability to perceive an autonomic channel and the ultimate control of that channel. Brener (1977), for example, observed that accurate visceral perception skills would increase the ability of the patient to control physiological activity. It is of interest that Brener's theory has received only weak support (e.g., Blanchard, Andrasik, Neff, Jurish, & O'Keefe, 1981; Clemens & MacDonald, 1976). In fact, the majority of researchers have found that the ability to perceive an autonomic process is independent of one's ability to control the process (e.g., Dale & Anderson, 1978; Whitehead & Drescher, 1980). Because of the growing number of studies that have not confirmed

Brener's theory, Lacroix (1981) has posited an alternative theory suggesting that visceral control represents an efferent process that does not require the ability to discriminate visceral processes. Whereas each of these visceral perception researchers has been interested in the symptom-physiology link, none has focused on the general perceptual processes that can influence visceral perception.

It should be emphasized that biofeedback research serves as an interesting extension of visceral perception. Using simple principles of operant conditioning, the individual attempts to learn to control an autonomic parameter with the help of an external monitoring device. For example, in learning to control skin conductance (which is assumed to be an indicant of anxiety), the client must attend to a light, sound, dial, or other feedback device. The person then learns to control the *device*—as opposed to directly manipulating the sensory concomitant—by changing his or her mood, muscle tension, and so on. Although such procedures may make the individual generally more attentive to internal state, it is difficult to evaluate how biofeedback training alters the individual's general perceptual strategies in evaluating physical sensations over an extended period of time.

It is beyond the scope of this monograph to review findings and controversies within the biofeedback literature. The interested reader is referred to a series of reviews (e.g., Blanchard & Epstein, 1978; Miller, 1981) in order to evaluate the state of the art. Finally, the review of the clinical-biofeedback perspective has been extremely sketchy. More recent work concerning perception of heart rate and other parameters within this tradition will be discussed in much greater detail in chapters 4 and 6.

The Cognitive Social Psychology Tradition

Over the past three decades, social psychologists have become increasingly interested in factors related to perception of sensations and symptoms. Although the majority of studies dealing with internal perception have been more concerned with emotion or affect, these approaches nonetheless offer insights into how we perceive symptoms as well. Social psychological approaches to internal state can be broadly divided into two categories: cognitive labeling/attribution and more recent information processing theories. This somewhat arbitrary distinction is based on the theoretical precursors of each tradition.

Cognitive labeling/attribution approach. The cognitive labeling perspective evolved from the work on social comparison theory (Festinger, 1954). According to this view, we seek to validate or interpret ambiguous settings or information (i.e., social reality) by comparing ourselves with similar others. Schachter's (1959) research on affiliation was the first

important step in learning how we evaluate internal state. That is, "emotions or feelings, like opinions or abilities, require social evaluation when the emotion-producing situation is ambiguous or uninterpretable in terms of past experience" (Schachter, 1959, p. 129). In a series of studies, subjects were made either highly or mildly anxious. Typically, highly anxious subjects were more likely to compare their feelings with others (Schachter, 1959) or affiliate with similar others (Wrightsman, 1960; Darley & Aronson, 1966).

In a refinement of this notion, Schachter and Singer (1962) proposed a theory of the cognitive labeling of emotion. The central idea of the theory was that when individuals are physiologically aroused and have no explanation for their arousal, they will seek to label this state and describe their feelings in terms of the cognitions available to them. Once an appropriate label is found, the person will no longer be driven to search for an additional label. In a series of well-known experiments, subjects were injected with epinephrine or with a saline placebo. In addition, an emotional label was manipulated by the presence or absence of a euphoric confederate. As predicted by the authors, subjects were more likely to label their arousal as euphoria if they had no reasonable explanation for their arousal and the euphoric confederate was present. A similar pattern of results demonstrating the labeling of anger with an "angry" confederate occurred in a second experiment. Although recent questions have arisen concerning the methodology and findings of the original research (Marshall & Zimbardo, 1979; Maslach, 1979), the number of theoretically consistent findings using similar paradigms has been impressive.

Subsequent research has demonstrated the cognitive labeling phenomenon in a variety of settings for *perceived* rather than actual arousal (e.g., Ross, Rodin, & Zimbardo, 1969; Valins, 1966). That is, the mere perception of a change in internal state—even though there is in fact no change—is sufficient to cause the labeling process to occur. This aspect of the labeling process will be discussed in greater detail below.

Over the years, the principles of cognitive labeling have been incorporated into a broad framework loosely called attribution theory. Rather than invoking a need state to explain why individuals label internal arousal, attribution theories simply state that all organisms seek causal explanations for their own and other's behavior (Jones, Kanouse, Kelley, Nisbett, Valins, & Weiner, 1971). According to the attribution perspective, the individual perceives arousal, which is then causally attributed to a particular object, event, or person. In truth, the substantive differences between the two approaches are trivial. Both make the same predictions about the use of internal information and the subsequent behavior.

The cognitive labeling/attribution perspective has evolved into a rich and intriguing theory to explain how and in which ways people label their internal states. As can be deduced from the theory, people can

label their internal sensations in a variety of ways beyond the initial examples of euphoria or anger. Within laboratory settings, researchers have shown that subjects can misattribute their perceived arousal to feelings of hunger (Schachter, 1971; Schachter & Rodin, 1974), need for smoking a cigarette (Herman, 1974; Schachter, Silverstein, Koslowski, Perlick, Herman, & Liebling, 1977), sexual arousal (Baron, 1979; Dutton & Aron, 1974), aggression (Baron, 1978; Berkowitz, 1974; Zillman, 1978), and crowding (Schaeffer & Patterson, 1980; Worchsel & Teddlie, 1976; Baum, Davis, & Aiello, 1978), as well as to other internal feelings.

Of particular interest is that people can also label their internal sensations as illness or disease. David Mechanic (1972) noted that when individuals become aroused, tense, or aware of ambiguous internal sensations, they can just as easily assume that they are sick as assume that their internal state is attributable to an emotion. If the aroused persons have access to a sickness label—such as when reading about a disease or after visiting a sick friend—they will be particularly likely to assume that they, too, have acquired the illness. In fact, Audrey Burnam and I (Burnam & Pennebaker, 1977) conducted a study that verified this reasoning. In the study, subjects either ran or walked in place for 2 minutes. A few minutes later they were escorted into an adjacent room and asked to complete a symptom checklist. Half of the subjects were casually told that “as you know, this is the time of the year when we are surrounded by flu and other illness-producing organisms.” In line with the cognitive labeling prediction, subjects reported the greatest number of symptoms if they had been aroused by running and if the label was present. This effect was particularly pronounced for flu-relevant symptoms (see Chapter 3).

The cognitive labeling perspective has proven to be a powerful explanatory device—not only for the labeling of emotion, but for the labeling of a variety of other states as well. A basic shortcoming of this approach is that it fails to specify the situations in which a label will be used. In addition, it is unclear when the person becomes aware of the internal signs of arousal in the first place. Similarly, once the internal state is labeled as emotion or something else, does the person have a different perception of the internal sensations themselves? Finally, the general nature of the perceptual process itself is ambiguous. A second social psychological approach has attempted to deal with some of these issues.

Information processing approach. The information processing approach to body perception evolved from cognitive and perceptual psychology and the computer sciences. This perspective has been concerned with the process by which a stimulus is encoded and eventually represented in perception. Various models seek to map the pathways by which stimulus information impinges on receptors and is transmitted, organized, and stored within the central nervous system.

Without question, the most relevant models to symptom perception within this tradition have been advanced by Howard Leventhal (1975; Leventhal & Everhart, 1979; Leventhal, Meyer, & Nerenz, 1980). According to Leventhal, a group of receptors in the body may fire in response to thermal, chemical, or mechanical stimulation. As this stimulus information is transmitted along the various neural pathways, various processes begin to organize and elaborate the information. For example, orienting or other motor changes may occur. Hypotheses or plans which are the result of schematic memory may also affect the incoming information. This process will ultimately result in the person's becoming aware of the informational properties of the receptor stimulation. At the same time that the informational properties of the stimulus are being processed, a parallel processing of the emotional aspects of the stimulus may also occur. For example, if the sensations are painful or distressing, these aspects of the sensory experience are processed independently of (and often more quickly than) the informational aspects of the sensations.

Leventhal's model is unique in that it posits a parallel processing (as opposed to sequential processing) of the informational and emotional aspects of the sensory experience. Nevertheless, it shares several properties with other information processing approaches. Emphases within each of these traditions are placed on each of the following: receptor activity and neural transmission; preattentive and attentional mechanisms (e.g., orienting); cognitive organization of sensory information along all levels of information processing; conscious awareness; memory. Additional issues include the roles of learning and development, and the innate bases of the processing of information.

Despite the brevity of this overview, it can readily be seen that information processing approaches represent a paradigm from which to understand perception rather than a unitary theory. Separate theories are currently being advanced to deal with each level of information processing. The primary strength of this general perspective is that it attempts to address all aspects of the perceptual process. Although each link within the process is under investigation by dozens of researchers, the outcome of much of this research can simply be incorporated into the broad model. The major weakness of information processing models is that they often do not make specific predictions about perception or behavior. As noted earlier, this problem is common to virtually all perspectives in the field.

Summary

This book will borrow ideas and methods from each of the perspectives that have been presented. Many of the basic questions that have been raised by clinical researchers interested in medicine, psychophysiology, biofeedback, or personality development are directly relevant to symp-

tom perception. The theoretical bases from cognitive social psychology will serve as starting points toward a better understanding of symptom reporting. As will be seen in Chapters 2 and 3, some of the basic mechanisms that have evolved from information processing perspectives are invaluable in understanding how we perceive our bodies. In short, each perspective that has directly or indirectly addressed symptom perception contributes to our understanding. Although each approach suffers from certain problems (e.g., lack of specificity or vague theoretical bases), by carefully selecting each approach's assets, we can begin to understand many of the basic issues surrounding symptom perception.

Plan of This Book

The following chapters deal with the psychological bases of physical symptoms. Whereas Chapters 2, 3, and 4 address the factors that are implicated in the perception of specific symptoms, the later chapters are more concerned with the organization of symptoms into broader categories and the development of these organizations. Chapters 2 and 3 point to the factors that are related to our first noticing sensations and, once we are aware of these sensations, how they can be interpreted. In addition, these chapters will examine how our beliefs or interpretations about symptoms can influence where and how we monitor our bodies in order to find additional sensory information. Chapter 4 addresses the question of accuracy of symptom reporting relative to objective physiological measures of symptoms. As will be seen, the measurement and interpretation of accuracy in the laboratory provide a number of paradoxical findings. Following the accuracy discussion, Chapters 5 and 6 examine how symptoms can be organized into broader categories. Chapter 5 indicates that reports of emotions can be viewed as constellations of physical sensations. Interestingly, separate emotions appear to covary with unique groups of symptoms. Chapter 6 provides evidence that symptoms can be organized in line with general physiological changes. As will be seen, coherent clusters of symptoms are highly related to such measures as blood pressure and blood glucose levels—both within and outside the laboratory. A number of theoretical, methodological, and practical issues are raised by these findings. Chapter 7 takes an in-depth look at the development and personality of the symptom reporter. Why do some people constantly report a variety of symptoms and sensations, whereas others appear to be completely unaware of their bodies? Finally, Chapter 8 discusses the various research findings within the broader context of health. Implications of our understanding the psychological bases of physical symptoms for physicians, clinicians, and researchers are raised.

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!”

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

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 $\frac{1}{4}$ -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

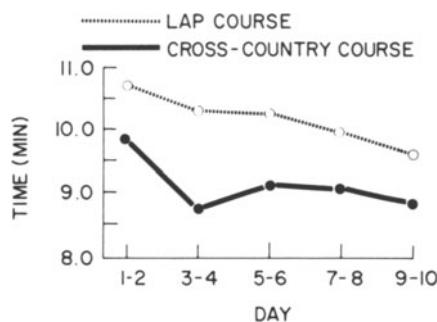


Figure 2.1 Mean jogging time (in minutes) as a function of type of course. From J.W. Pennebaker & J.M. Lightner, Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 1980, 39, 165-174. Copyright 1980 by the American Psychological Association.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

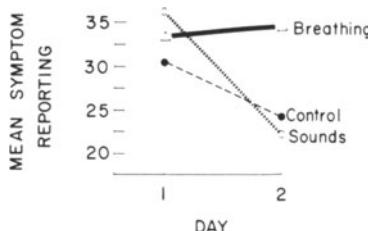


Figure 2.2 Mean symptom reporting by condition on Days 1 and 2. From J.W. Pennebaker & J.M. Lightner, Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 1980, 39, 165-174. Copyright 1980 by the American Psychological Association. Reprinted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

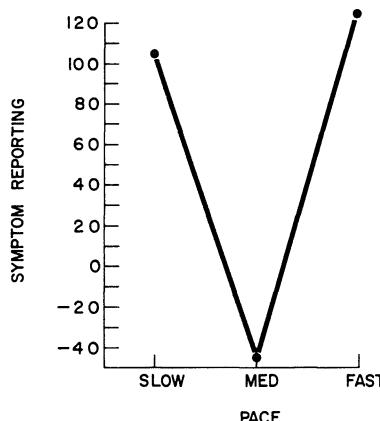


Figure 2.3 Change in degree of symptom reporting from first to second sessions of the person-environment fit experiment. From J.W. Pennebaker & G.L. Brittingham, *Situational and attentional factors influencing health: Person-environment fit*. Paper presented at the American Psychological Association,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

tom 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

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.

between physiological activity and emotion, symptom specificity, and related controversies can be temporarily set aside.

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 in-

crease 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) \times 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

Condition	Total deadtime (sec)		
	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.

Chapter 3

Perceptual Processes II: Schemas, Selective Search, and Inference

Whether the individual processes internal rather than external cues represents only a portion of perception. We do not passively wait for stimuli to bombard our receptors. Rather, we are active information seekers attempting to understand our internal and external environments. Given the quantity of potential information available to us at any given time, we must organize and reduce the incoming data. This can be accomplished in at least two ways. The first is to restrict the information that is encoded in the first place. In other words, information search must be guided. The second way of reducing potential sensory data is by cognitively restructuring, synthesizing, and organizing incoming information. These hypothetical cognitive structures—which are variously called sets, expectancies, tentative or working hypotheses (Snyder, 1979; Swann & Read, 1981; Taylor & Crocker, 1981), schemata or schemas (Leventhal, 1975; Markus, 1977), or scripts (Abelson, 1976)—guide our search for information and organize the incoming data gleaned from the search.

Returning to the snake vignette presented in Chapter 2, we noted that adoption of the snake hypothesis resulted in our selectively looking for snake-relevant information. One can readily see some of the biases and distortions that can occur with such an active perceptual process. First, individuals will be more inclined to look for hypothesis-relevant than hypothesis-irrelevant information (see Taylor & Crocker, 1981). Consequently, if we hold a snake hypothesis concerning the rustling in the bushes, we will be less likely to encode information indicating that the wind caused the rustling. Second, we will be biased toward confirming our hypothesis. This bias will be positively correlated with the ambiguity of the extent information. Again, we would be more likely to perceive

a long stick at the base of the bushes as a snake if we held the snake hypothesis than if we held a snake-unrelated hypothesis. Finally, the more potential information that is available in any given setting, the higher the probability that we will be able to confirm *any* given hypothesis we adopt.

How do these principles relate to the perception of physical symptoms? In many, if not most cases, we have available to us a large number of internal sensations that are vague, diffuse, and subjective. Given their ambiguous nature, their perception and interpretation will be greatly influenced by the hypotheses we adopt. Further, the hypotheses that we adopt will have a high probability of being confirmed. An example of the selective search process biasing perception occurs with “medical students’ disease,” wherein 70% of first-year medical students adopt the symptoms of one of the diseases that they study (Hunter et al., 1964; Woods et al., 1966). All of the prerequisites for perceptual bias are present. The students are under stress from studying, tests, lack of sleep, and the like. The various stresses undoubtedly result in heightened autonomic activity, thus causing a large number of physical sensations (e.g., headaches, racing hearts, sweating, fatigue). In addition, studying about a large number of diseases sets up various disease schemas which cause selective search for confirming information. For example, reading about kumquat syndrome, which has accompanying symptoms of nausea, dizziness, and spots in the visual field (that resemble kumquats) may cause the student to ask, “Do I have that disease?” (i.e., schema). He or she then selectively attends to the stomach for signs of nausea, to the head for signs of dizziness, and so on. With a large number of potential sensations, the person will have an increased probability of finding sensory information that will fit the illness schema. Further, the person will tend to ignore schema-inconsistent information.

Of particular import is that the selective monitoring process occurs at several levels of analysis. The schemas that we adopt can shape the perception of a single, relatively discrete sensation, a constellation of sensations, or broader categories of sensations, such as perceptions of illness, emotion, or hunger, and events, such as the health of others. In addition, the perception of any given body state can substantially vary in quality (e.g., pleasant versus unpleasant) as a function of the schema. Finally, body-related schemas can be adopted, discarded, or replaced relatively quickly depending on the source of the schema and the amount and quality of verifying sensory information, as well as on previous exposure to the schema.

In this chapter, several studies that deal with various aspects of schemas and selective search will be briefly presented. The first studies point to the roles that schemas play in the perception of single physical symptoms as well as provide evidence for selective monitoring. This process will then be shown to generalize to perceptions of ambiguous external stimuli.

A third series of experiments will demonstrate that broader illness and emotion schemas can effectively organize large constellations of sensations. These findings will then be discussed in light of our knowledge of demand characteristics and of such phenomena as mass psychogenic illness and placebo effects.

Selective Monitoring of Specific Sensations

The most basic question dealing with schemas and selective search concerns how the same person can perceive identical sensory stimulation in radically different ways at different times. The idea of selective monitoring suggests that individuals can selectively encode different aspects of the same event. Furthermore, that which is encoded must fit into some preexisting schema. Evidence for these assumptions comes from several related lines of research. In this section, three brief studies are presented conducted by Andy Skelton and me (Pennebaker & Skelton, 1981) that demonstrate how induced and imposed schemas lead to selective search of sensations. The first experiment, using perceived finger temperature, indicates that a schema set up by a bogus stimulus claimed to influence skin temperature results in increased monitoring of specific skin temperature signs. The following two studies directly *imposed* search strategies, thus producing altered perceptions of nasal congestion and heart rate. The next series of studies will address the thorny problem of pain and its relationship to schematic organization and search.

Finger temperature. In the first of the selective monitoring studies, 38 subjects participated in an experiment which they were told dealt with the effects of (bogus) ultrasonic noise on later task performance. Within the three-cell design, the experimenter noted that ultrasonic noise might cause skin temperature to increase or decrease. Both the increase and decrease groups received elaborate rationale concerning the effects of the noise on vasodilation or constriction of arteries and capillaries in the finger and how these changes influence skin temperature. A third group (control group) was simply told that their skin temperature would be monitored, but received no suggestion concerning ultrasonic noise effects.

Following the schema manipulation, subjects were escorted to a second experimenter who was blind to their condition. He attached a thermister to the subjects' hand in order to get a continuous measure of skin temperature throughout the study. After 2 minutes of baseline recording of skin temperatures, subjects were informed that the ultrasonic noise would be delivered over headphones connected to a tape recorder. Sub-

jects actually heard a low-volume (62 dbA), medium-pitch (2,000 Hz) pure tone which gradually increased in pitch for 15 sec until it was no longer audible. The remaining 1 minute and 45 sec of the tape was blank. At the tape's end, subjects were asked to complete a short questionnaire "before we begin the task." In fact, following completion of the questionnaire, the experiment was terminated.

The two most important questions concerning the finger temperature study were (a) Did subjects selectively attend to sensations that verified their expectations about the effects of the noise? and (b) Did the selective search result in differential reports of skin temperature?

The role of subjects' tentative hypotheses in guiding their search for verifying information was assessed in two ways. First, two questionnaire items asked subjects to indicate how much they had attended to sensations of increasing and of decreasing skin temperature (1 = not at all; 100 = a great deal for both items). Increase subjects reported attending significantly more to sensations of increasing skin temperature and less to sensations of decreasing skin temperature than did decrease subjects (see Table 3.1). Moreover, control subjects reported attending about equally—and very little—to sensations of either increasing or decreasing temperature. Without a schema concerning effects of ultrasonic noise on skin temperature, then, control subjects failed to monitor skin temperature-related sensations to any great extent, while increase and decrease subjects tended to monitor only those sensations consistent with their suggestion-induced hypotheses.

A more objective and interesting way to examine selective monitoring is to compare the recordings of subjects' actual skin temperatures with their ratings of perceived skin temperature. Actual skin temperatures

Table 3.1 Self-Reports of Finger Temperature and Related Data

Measure	Condition		
	Increase (n = 13)	Decrease (n = 12)	Control (n = 13)
Self-reported finger temperature	69.6	48.1	57.8
Attention to warmth	66.5	33.5	29.9
Attention to coolness	21.3	42.5	24.8
Correlation between self-reported temperature and temperature fluctuations	+ .48	- .49	+ .11

Note. Self-reported finger temperature ranged from 1 = finger became cooler to 50 = no change to 100 = finger became warmer. The two attention items required subjects to rate the degree to which they attended to warmth (coolness), 1 = not at all and 100 = a great deal. From Pennebaker and Skelton (1981).

did not differ as a function of condition and failed to correlate with subjects' ratings of how warm or cool their fingers felt. Consequently, the *number* of times each subject's skin temperature fluctuated across the experimental session (i.e., the number of times the subject's temperature increased then decreased, and vice versa) was counted. A fluctuation, according to this definition, indicates that the subject has potential sensory data concerning the fact that temperature is both increasing *and* decreasing. If selective monitoring of changes in bodily sensations amounts to schema-guided use of available data, subjects would use the change information available in a fluctuation that was consistent with their hypothesis and ignore hypothesis-inconsistent information.

This is precisely what occurred. Collapsing the data over groups, we found that the correlation between number of temperature fluctuations and ratings of perceived skin temperature was negligible and non-significant. Correlations calculated within each group, however, showed that subjects were interpreting temperature fluctuations in very different ways, depending on their schemas or tentative hypotheses. Increase subjects' correlation between number of fluctuations and self-reported skin temperature was +.48 (i.e., the more fluctuations a subject experienced, the warmer he or she rated skin temperature). Decrease subjects' correlation was virtually the mirror image of increase subjects' ($r = -.49$). The more decrease subjects' temperature fluctuated, the cooler they rated their skin temperatures. These correlations were significantly different. Fluctuations in temperature were unrelated to finger temperature ratings for control subjects ($r = .11$). Thus, subjects who held a suggestion-induced schema about ultrasonic noise effects on skin temperature used available information selectively to support their respective hypotheses.

Finally, and most important, subjects' perceptions of skin temperature were greatly influenced by the schemas they held. As can be seen in Table 3.1, increase subjects rated their finger temperatures as becoming warmer than did decrease subjects. Ratings made by the control group fell between those of the other subjects.

One of the more intriguing results was the pattern of within-cell correlations between temperature fluctuations and self-reports of temperature. These data indicate that subjects were not randomly perceiving body state. Rather, they appeared to be encoding *change* information—as opposed to chronic levels of temperature. As will be discussed in Chapter 4, we may typically encode *only* change information in the perception of both internal and external events.

In sum, the results of this study indicate that the experimenter-induced schemas resulted in selective search and changes in the perception of relevant sensations. Although correlations between selective search and change in temperature perception were attained, two simple replications were undertaken in order to verify the causal link among these variables

more directly. In addition, we sought to extend the findings to two diverse sensations.

Nasal congestion and heart rate. The two partial replications (from Pennebaker & Skelton, 1981) of the finger temperature study were similar. Rather than establishing a schema and assuming selective monitoring, the replications directly imposed a search strategy for the subjects.

In the first experiment, 48 subjects were randomly assigned to one of four attention conditions. In the study, subjects were told to attend to sensations of nasal stuffiness and congestion (congestion increase group), sensations of free breathing through the nose (congestion decrease), sensations occurring while breathing through the nose without specifying what sorts of sensations (congestion neutral), or a nonbodily distractor—the Rotunda of the University of Virginia (distraction).

Prior to the instructions, subjects completed a checklist of seven common physical symptoms, including a rating of present degree of nasal congestion. After completing the questionnaire and hearing one of the four attention instructions, the subject was told to close his or her eyes and to begin concentrating. Concentration lasted for 1 minute, after which the experimenter returned and had the subject complete a second questionnaire before being escorted to another experimenter, who debriefed the subject.

Preconcentration ratings of nasal congestion were subtracted from postconcentration ratings to correct for initial differences. As can be

Table 3.2 Self-Reports from Heart Rate and Nasal Congestion Experiments

Sensation	Condition			
	Increase	Decrease	Neutral	Distraction
Heart rate	11.0	-9.4	-1.9	
<i>n</i>	11	10	10	
Nasal congestion	21.2	-13.3	7.0	0.1
<i>n</i>	12	12	12	12

Note. Heart rate means from the first replication of Experiment 1 are difference scores for self-reported heart rate, where 1 = heart rate much slower than usual and 100 = heart rate much faster than usual. The higher the number, the greater the increase in perceived heart rate from before to after the manipulation. Nasal congestion means from the second replication are difference scores from before to after the manipulation for self-reported congestion, nasal blockage, and difficulty in breathing, where 1 = not at all and 150 = a great deal. The higher the number, the greater the increase in perceived congestion. From Pennebaker and Skelton (1981).

seen in Table 3.2, congestion increase and decrease groups' perceptions of congestion changed significantly and in the predicted direction. Neutral and distraction subjects changed very little and were not significantly different from each other.

Two informal findings are also of interest. During the debriefing session, 3 of the 12 subjects in the congestion increase group actually blew their noses; no other subjects did so. In addition, one subject in the decrease cell noted that her nose felt clearer after the study than it had in weeks, even though she had been using decongestants. She even suspected that we had sprayed the room with a powerful decongestant!

The second experiment was similar to the congestion study but dealt with heart rate perception. Thirty-one subjects were told that the experiment concerned the effects of concentration. Prior to receiving one of the three attentional instructions, subjects inserted the middle finger of their left hand into a photoelectric cardiotachometer in order to measure heart rate. Explaining that the apparatus required a short time to calibrate, the experimenter asked the subject to complete a short symptom questionnaire. While completing the questionnaire (which included an item requiring subjects to estimate heart rate along a scale from 1 = much slower than usual to 100 = much faster than usual), the subject was having his or her heart rate recorded by the experimenter, who was seated behind a partition.

On completing the questionnaire, subjects were randomly assigned to one of three concentration conditions. Subjects in the heart rate increase group were told to monitor any sensations they experienced of an increase in heart rate. Heart rate decrease subjects were told to attend to sensations of a decelerating heart rate. The remaining neutral subjects were merely told to monitor heartbeat sensations without further elaboration. All subjects were asked not to attempt to alter their heart rates via concentration, relaxation, or other means. Heart rate was recorded by the experimenter at 10-sec intervals during the 45-sec concentration period. After the task, subjects completed a second questionnaire.

As depicted in Table 3.2, change in perceived heart rate from before to after the experiment was significantly influenced by the instructions. As in the congestion experiment, the neutral group did not change in either direction to any great extent. Analyses of subjects' actual heart rates revealed no difference between groups and no significant change over the course of the experiment. Thus, subjects' *actual* heart rates, unlike their *perceived* rates, were not affected by the selective monitoring instructions.

Attention and pain. Each of the studies presented thus far has demonstrated that attention to a given sensation within the context of a schema or selective search instructions results in a perceptual change of the

sensation. Of equal interest is that attention alone is not sufficient to alter sensory perceptions. These findings are analogous to those of Tesser and his colleagues (e.g., Tesser & Conlee, 1975) concerning attention and polarization of attitudes. Specifically, attending to either a positively or negatively valenced object results in more extreme ratings of that object. One's attitude concerning a neutral object, however, is unaffected by attentional instructions. Within the present context, polarization of attitudes or symptoms appears to be the direct result of the selective monitoring of information which is consistent with the subject's schema or hypothesis.

One apparent problem with this reasoning deals with attention and pain. Specifically, attention to pain appears to exaggerate the aversiveness of pain. For example, Kanfer and Goldfoot (1966) had subjects place their hand in a jar of 2°C water (i.e., cold pressor test) while they described either the pain or scenes that they were viewing. Attention to the pain caused subjects to endure the cold pressor test the least amount of time. Similarly, two experiments in our lab corroborate these findings (Pennebaker, Skelton, Wogalter, & Rodgers, 1978).

In the first experiment we simply required subjects to undergo a cold pressor test until they first reported feeling pain. Subjects were randomly assigned to one of three conditions. In the hand condition, a mirror was situated behind the ice water jar. When subjects placed their hand in the water, their immersed hand was reflected. In the face condition, the subjects' face, rather than hand, was reflected during the test. The third group was a no-mirror control. Basically, we found that subjects in the hand condition reported feeling pain significantly sooner than face or no-mirror subjects. The means for the hand, face, and no-mirror groups were 17, 27, and 24 sec, respectively.

In a second experiment (and a replication), attentional focus was manipulated more directly. In addition, it occurred to us that pain itself may serve as a schema by which to organize sensory information. Specifically, if we expect something to be painful or aversive, we will perceive it in a very different way than if we have no such expectations (Holmes & Houston, 1974; Lazarus, 1966). Consequently, subjects were randomly assigned to one of four attentional/set conditions. In the attention cell, subjects were told to pay close attention to their hand while it was in the water. In the dissociation condition, subjects were also instructed to attend to their hand. However, in an effort to break the pain schema, subjects were also told to try to detach themselves emotionally from any feelings of pain. Subjects assigned to the distraction condition were told to think about the Rotunda. Finally, the control subjects were given no attentional instructions.

As can be seen in Table 3.3, the attention and dissociation groups differed considerably in their perceptions of the onset of pain in the study

Table 3.3 Mean Time (in Seconds)
for Self-Reports of Pain Onset

	Condition			
	Attention	Distraction	Dissociation	Control
Experiment	24.9 ^a	37.9 ^b	43.9 ^b	26.1 ^a
<i>n</i>	12	11	11	11
Replication	14.5 ^a	30.5 ^b	34.1 ^b	27.9 ^{a,b}
<i>n</i>	9	8	9	9

Note. The higher the number, the longer the subject's hand is immersed in the water. Means with different superscripts differ at $p < .05$.

and a subsequent replication. Although both groups attended to their hands, the attention subjects encoded more of the sensations as aversive and painful. Comparable findings have been reported by Leventhal, Brown, Shacham, & Enquist (1979)¹ and McCaul & Haugvedt (1982).

Each of the above studies suggests that pain or even the expectation of pain affects the encoding of sensory information. Pain by its very nature is aversive and unpleasant. The mere act of attending to a known unpleasant event results in most of the information related to the event being encoded in line with its unpleasantness. If, for example, you are asked to smell a rotten fish (knowing that it will smell bad), the more you attend to it, the more information you will receive verifying its foul smell. The more information you receive, the more extremely you rate the smell. This idea is related to attitude polarization (e.g., Tesser & Conlee, 1975), polarization of affect under self-awareness or self-consciousness (e.g., Scheier & Carver, 1977), or related work on attention and affect (cf. McArthur & Post, 1977; Taylor & Fiske, 1978).

If pain can work as a schema, then so could pleasure. This would suggest that certain sensations could be perceived as either painful or pleasurable, depending on the schema held by the individual. In fact, Doug Anderson sought to test the general idea that *pain* and *pleasure* may function as alternative interpretations of identical sensory data (Anderson & Pennebaker, 1980). In the experiment, 49 students placed their middle finger on a small piece of sandpaper that was attached to a vibrator for 1 sec. Prior to beginning the experiment, subjects had signed

¹ Leventhal et al. (1979) found that their attention group reported the least distress while undergoing the cold pressor test—which appears to be contradictory to the present findings. Closer inspection of the actual manipulations used by Leventhal et al. indicates that their attention instructions were similar to our dissociation instructions.

a consent form which conveyed a manipulation of the sensations subjects might expect to experience while touching the emery board. Subjects were divided randomly into one of three groups, based on the wording of the consent form, which read: "I understand I will come into contact with a stimulus which has been found to produce a degree of pain" (pain interpretation), an identical statement in which the word *pain* was replaced by the word *pleasure* (pleasure interpretation), or no statement concerning the painfulness or pleasurableness of the stimulus (no-interpretation control).

After touching the vibrating emery board, subjects rated the stimulus on a 13-point pain-pleasure scale, where lower ratings indicated that the stimulus was experienced as painful. The differences in the pain-pleasure ratings of the three groups were modest but highly significant. The mean rating of the pain group was -1.00, that of the pleasure group was +1.01, and the no-interpretation group rated the stimulus as +0.13 (i.e., very close to the neutral, or 0, point). Postexperimental interviews with the subjects revealed that none thought the sensations created by contact with the stimulus could have been differently perceived from the way subjects perceived them. That is, pain subjects did not believe the stimulus could have felt pleasurable, and pleasure subjects did not believe it could have hurt. Clearly, then, subjects' expectations about the stimulus affected the way in which the stimulus was perceived, and their perception confirmed their expectations.

This experiment indicates that expectations of either pain or pleasure can affect the perception of ambiguous sensory information. Obviously, there are limits to the degree to which bodily data may be interpreted as painful versus pleasurable. As has been discussed elsewhere (Skelton & Pennebaker, 1982), the limits may not be so strict as one might suppose. Consider the sexual deviation known as masochism. Here, the individual has come to associate painful stimulation, often induced by a variety of torture-chamber devices, with feelings of intense sexual pleasure. One would expect, however, that the association of pain with sexual arousal in masochism is highly context dependent. The masochist who cuts himself with a kitchen knife while preparing dinner would not consider the incident to be sexually arousing. The interpretation of pain as sexually enjoyable is very likely restricted to explicitly sexual contexts. Thus, the context in which sensory data occur will affect the person's hypotheses and interpretations of those data.

To this point, the roles of schemas have been shown to influence the perception of highly specific sensations. Sets or hypotheses manipulated by the experimenters influenced search strategies and the perceptions of the sensations themselves. Although we have shown that this process can occur for specific and relatively discrete sensations, it is important to extend these findings to broader categories of body states.

Selective Monitoring of Categorical or Higher Order Body States

Although we occasionally perceive cold fingers, racing hearts, or nasal congestion, we also perceive broader states such as the flu, fatigue, hunger, or emotion. In a sense, body perception can be viewed hierarchically. The elements of any body state include specific sensations or symptoms. These elements are often synthesized into broader categories. If we have not eaten all morning, we are more likely to say (and to perceive) that we are hungry than to note that our stomach is rumbling, our heart is pounding, and we feel dizzy. The label or category of hunger, then, is based in part on a conglomeration of sensations. It must be noted that hunger—like most body states—is also partly dependent on nonbodily information (e.g., time of day). Claiming that broader categories of body state reflect a given constellation of elementary sensations is an oversimplification. The strengths and weaknesses of this approach can be seen by considering the perception and categorization of external stimulus objects.

Outside my neighbor's house is a large pile of firewood that he uses in his wood stove. The pile consists of 128 separate pieces of wood. In describing and perceiving his firewood, I am aware of the *pile* as opposed to the separate pieces of wood. In other words, I am perceiving something other than 128 sticks. This, of course, is the classic Gestalt concept that an entity is more than the sum of its parts. Nevertheless, the perception of a given entity requires that a minimum number of elements be present. I would probably perceive the same pile of wood if there were only 80 pieces of wood. However, if there were only 5 pieces of wood or if the 128 pieces were strewn over my neighbor's entire yard, I would *not* perceive the pile.

A final point concerning categorization and elements relates to inference. If, for whatever reason, I perceive a *pile* of wood today and am asked to describe it tomorrow, I will not be particularly accurate about the separate pieces of wood that constitute the pile. Even though I may have seen only the pile, I can make an educated guess about the shape, color, and cut of the constituent elements. In other words, I will infer the nature of the elements based on my knowledge of the broader category—*pile*.

Categorical body states such as hunger or fatigue are perceived in an analogous fashion to the pile of wood. In arriving at the perception of one of these broader states we often process constellations of internal sensory as well as external data points. At other times we might adopt a tentative hypothesis concerning a given categorical state and then selectively monitor a constellation of sensations to verify the hypothesis. Evidence for this process for both illness and emotion will be briefly presented.

Selective monitoring of illness symptoms. In order to test the selective monitoring of symptom constellations, Audrey Burnam and I conducted two similar experiments (from Burnam & Pennebaker, 1977). In the first experiment 185 college students completed a symptom checklist after reading one of two sets of instructions. One set—which was intended to make subjects more attentive to flu-related symptoms—was headed with the statement “As you know, this is the time of the year when we are surrounded by cold- and flu-producing viruses and other illness-producing organisms.” In the no-illness condition, the statement was omitted. After reading the instructions, subjects rated the degree to which they were currently experiencing 12 common physical symptoms—half of which were flu related. (A separate sample of 24 students rated each of the symptoms as being either flu related or exercise related. Mean agreement rate was 79%.)

In the study it was found that subjects reading the illness statement reported more symptoms than no-illness subjects. Of particular interest, however, was that the illness \times type of symptom interaction attained significance such that illness subjects reported proportionately more flu than nonflu symptoms relative to the no-illness subjects.

In the second experiment, 49 students participated in a 2×2 laboratory experiment wherein they either walked or ran in place for 2 minutes (arousal manipulation). Following the manipulation, subjects were escorted to an adjacent room to “participate in an unrelated study.” An experimenter entered and asked subjects if they minded completing a short questionnaire that was needed for a class project. As the 12-item symptom checklist was handed to the subject, the experimenter noted (to half of the subjects), “As you know, this is the time of the year when we are surrounded with flu virus and many people aren’t feeling very well.”

As in the first experiment, subjects’ symptoms were divided into flu versus exercise symptoms and subjected to a $2 \times 2 \times 2$ between-within analysis of variance (ANOVA). As predicted, two main effects emerged such that those running in place reported more symptoms than those walking. Further, illness set subjects reported more symptoms than no-illness subjects. Finally, the arousal \times type of symptom interaction was highly significant such that those running in place selectively reported arousal symptoms relative to flu symptoms.

Taken together, these studies indicate that subjects were selectively reporting sensations in line with the hypotheses induced by the experimenters. These experiments can be criticized on the grounds that they merely reflect the experimental demands of the situation. Rather than discussing this issue at length here, the demand issue will be discussed following a brief presentation of recent research concerning the selective monitoring of emotion-related sensations.

Selective monitoring of emotion-related sensations. The bulk of Chapter 5 will be devoted to the relationship between specific emotions and specific constellations of sensations or symptoms. A particularly important study that will be presented in that chapter—but that bears on the issue at hand—will be briefly sketched here. In two related experiments, subjects were brought individually into the laboratory. In the first experiment, subjects were told to try to make themselves feel one of several emotions (anger, joy, embarrassment, guilt, sadness, and fear). They were told that they could do anything they wanted as long as they felt that particular emotion (e.g., think of an incident that arouses that emotion). After giving subjects 2 minutes to feel one of the emotions, the experimenter returned and told the subject to try to stay in that particular emotional state and to fill out a symptom checklist. Basically, we found that each emotion was associated with a unique constellation of physical sensations. In a second experiment, a separate group of subjects was brought into the lab and given one of the six constellations of symptoms. They were told to do anything to try to make themselves feel that particular group of sensations. After 2 minutes, the experimenter returned and gave the subject an emotion checklist. As we had predicted, we found that subjects reported the emotion that had originally been derived from the first experiment (for four of the six emotions). In other words, there appears to be a one-to-one correspondence between perceived emotions and perceived constellations of symptoms.

Both the emotion studies and the flu experiments indicate that individuals selectively report constellations of sensations that they believe and/or perceive to coexist with broader categories of body states. As had been suggested earlier in this chapter, some very thorny conceptual problems surround the issues of schemas and selective search. These problems include demand characteristics as an alternative explanation, that subjects are exhibiting their abilities to infer symptoms as opposed to directly perceiving them, and the ultimate problem concerning the relationship between perceived and actual physiological change.

Inference of Physical Symptoms

To this point, we have dealt almost exclusively with the direct perception of internal state. As discussed earlier, the encoding of sensory data may be the result of selective search. Alternatively, subjects may simply have been making educated guesses concerning their sensations rather than perceiving them at all. For example, in the emotion studies that were just discussed, subjects may have felt the manipulated sensations and then inferred the emotion rather than feeling it. Note that an inference process indicates that the subject is reporting physical symp-

toms in a nonrandom way based on information other than the presumed sensory source. A person could listen to loud uncontrollable noise and, when asked, report a large number of symptoms that he felt during the noise (Pennebaker et al., 1977). His reporting of these symptoms may well have been based on the fact that he knew that he had been hearing a stimulus typically associated with "arousal," or he may have noticed one particular sensation (e.g., tense muscles) and then assumed that he must have been experiencing other sensations as well.

The entire problem of inference versus direct perception is intimately tied to the problem of accuracy (which will be discussed in great detail in the following chapters). That is, if we can demonstrate at least a reasonable correlation between a symptom report and an objective sensory or autonomic concomitant, then in most cases we can assume that the person is directly using that sensory information. Of course, as the finger temperature study indicated, *how* we measure the autonomic concomitant can be tricky (especially if people are more prone to encode change information). Alternatively, we can demonstrate the existence of an inference process if we can show that a symptom report correlates highly with a nonbodily stimulus but not a bodily one. The one time that these statistical techniques will lead to a false conclusion is if the nonbodily stimulus correlates extremely highly with an autonomic measure that is related to the symptom in question.

Do people infer symptoms? If so, when and how often? What information do they base inferences on? Some of these questions were inadvertently answered after conducting two experiments using a different paradigm involving heartbeat tracking. Such a technique requires subjects to continuously press a button at the rate at which they think their heart is beating at the same time that their actual heart rate (HR) is measured. This paradigm has been used by others (e.g., McFarland, 1975) and is considered a particularly strong indicant of the ability to perceive body state (e.g., Carroll, 1977). Part of its beauty is that the researcher can get an ongoing reading of the subject's HR and perception of HR and, at the same time, can manipulate certain situational variables. In addition, unlike questionnaire responses, the tracking technique allows for comparable scaling between the perception and autonomic measures.

In the first of two experiments (Pennebaker, 1981), subjects continuously tracked their HR while watching 20 separate slides for 20 sec each with 10 sec of darkness between each slide. The slides, which varied along a number of dimensions, had been rated by a separate group of students along the dimensions of interest and pleasantness. Overall, it was found that subjects' estimates of their heart rates were far more related to the characteristics of the slides than to their own heart rates. In other words, estimated heart rate (as measured by button-pressing rate) correlated with the slides' interest rating and with the slides' pleasantness rating. Estimate of HR, however, only correlated .20 with actual

HR. In other words, estimates of HR were far more related to the slide characteristics than to actual HR.

A second experiment replicated these findings. In the study, subjects participated in five diverse tasks (listening to loud noise, hearing interesting street sounds, viewing peaceful and sexually arousing slides, and being interviewed by the experimenter) and 7 baseline periods, each of which lasted 2½ minutes. Again, correlations between estimated and actual HR were low and nonsignificant.

These studies point to the fact that inference can and does occur. One reason that it was so striking in this research was because HR perception is difficult to do. Most people are usually not aware of their heart rates except after strenuous exercise, and simply have not had the experience of constantly attending to it. In other words, when we are forced to report on extremely vague sensations (i.e., internal cues for which we have virtually no information), we will use whatever information is available to us in order to give an intelligent response.

This series of studies raises a major question concerning symptom research. Specifically, when are people inferring symptoms as opposed to perceiving them directly? Do the people themselves know? Based on the heart rate studies, the answer is probably no. In fact, when subjects were asked if they were attending to their bodies to determine their heart rates, all subjects answered affirmatively. When asked how accurate they thought they were (along a 7-point scale, where 7 = accurate) the mean response was 3.2 in the first study and 3.4 in the second. Correlations between perceived and actual accuracy were negligible.

A related question deals with the relationship between inference and behavior in the real world. That is, how often do we infer physical symptoms in the real world? If we are not required to fill out symptom checklists, will we infer symptoms? Does the inference of symptoms influence behavior? This entire issue plagues virtually all of psychology (or any field that relies on self-reports). A particularly close analogy can be seen in the history of attitude research. For example, Bem (1972) posits that individuals often infer their attitudes based in part on their behaviors. In some circumstances this inference process undoubtedly occurs with symptom reports. As will be discussed in later chapters, it may be impossible to disentangle inference from direct perception in most cases. Both processes, however, appear to be correlated with behavior.

Generality of Schema-Directed Search

In this chapter, evidence has been put forward to indicate that individuals selectively search for sensations that are related to the hypotheses they hold. Further, this search can be aimed at either specific discrete sensations or at larger constellations of sensations. Finally, this process can be influenced by inference—which is also based on the given schemas

held by the individual. All of these issues have dealt specifically with self-perception of internal state. A clear implication of the perceptual process, however, is that body-related schemas should also influence our perception of events and objects in the external environment as well. That is, if the individual holds an illness schema about himself, he may be more likely to interpret other events in illness-related tones as well. Some recent studies by Andy Skelton (1980) provide strong evidence for this process.

In the first of these studies, Skelton was interested to learn if high symptom reporters would be more likely to interpret a variety of ambiguous words as symptom or illness related. Based on the work of Markus (e.g., 1977) and others, he assumed that the existence of an illness schema would ready the perceiver to encode a variety of stimuli in line with the schema. In the first of two studies, Skelton required introductory psychology students to complete a large symptom inventory (the PILL—see Appendix B) at the beginning of the semester. Later, subjects were asked to rate the degree to which each of 60 words was related to health. A third of the words (such as flu, gangrene, nausea) were directly related to health or illness. Another third were ambiguous (e.g., pull, temperature); and the remainder were unrelated to health (professor). Skelton found that subjects who were high symptom reporters (i.e., high PILL responders) rated all the words as being more health related.

In a related study, subjects were asked to complete the word list while waiting at the Student Health Center. Among those who were waiting, about half were sick and the remaining respondents were waiting for a checkup, a friend, birth control, and the like. In line with the first study, those individuals who reported being sick perceived the words as being far more health or illness related than those who were not sick.

These studies are consistent with observations and reports of hypochondriacs (e.g., Ladee, 1966), who tend to interpret a large number of both internal *and* external stimuli in illness-related terms. Consequently, the reason that Aunt Bea—who always has some ailment when you visit her—immediately notices that you look tired and run down is that she is using the same schemas for interpreting your behavior as she does in interpreting her own. Similarly, the individual who adopts a given hypothesis about illness or other body state should be far more likely to actively search for information in the external world that would be pertinent to the schema. Just as the symptom reporter should spend more time than normal inspecting the grocery aisles containing the health aids and reading the health columns in the newspapers, a person holding other types of schemas will be motivated to search for information related to his or her own hypotheses. Illness, health, and other body schemas represent only a portion of the schemas which we adopt. Just as some individuals chronically adopt these schemas to a greater extent than

others (and may overuse health facilities, medications, etc.), others may fail to adopt illness schemas when they should and ultimately suffer major health problems, shorter lives, and so on.

Implications and Conclusions

Perception of internal state is active and ongoing. The schemas or hypotheses that we adopt influence our perceptions of symptoms and our behavior. Both this and the previous chapter have attempted to provide an overview of the perceptual process as it relates to sensory information. Whereas Chapter 2 focused on how individuals initially orient to sensory stimulation, this chapter was more concerned with the roles of schemas and selective search. As noted at the beginning of Chapter 2, the two aspects of perception are complementary.

Several important points have been presented in this chapter which will be encountered again in the book. First and foremost, schemas serve to organize sensory information and to direct search for additional information. As such, the schemas we adopt must continuously change or be updated as new information becomes available. The entire process of schema-guided search is prone to certain biases and distortions in perception. For example, we will be more likely to search for schema-related than -unrelated information. We tend to weigh schema-consistent information more heavily than when information is inconsistent. The more ambiguous the information, the more important the role of schemas in selecting out relevant information. This is particularly important in evaluating body-related sensations, since we always have access to a large number of specific sensations which can confirm a large number of potentially competing hypotheses.

Although this chapter has dealt with the nature and the ultimate effects of schemas, very little has been said about the development of schemas or hypotheses. Where do they come from? As indicated in some of the experiments, schemas can be manipulated by having subjects read or hear about a particular body state. Similarly, past experience with body states plays a major role. For example, if I have become sick to my stomach every time that I have eaten at the Hideaway Diner, the next time I visit the Diner I will probably be extremely attentive to food-poisoning sensations. In other words, having experienced certain salient sensations in a given setting will result in the formation of a schema concerning the existence of those same sensations whenever I am in a similar setting in the future. In addition to past experience with illness or other body state, schemas can be learned at a very early age. As with any individual difference variable, our parents or other significant others may make us orient to certain body states. Constant refer-

ences to specific ailments such as stomach problems, or even emotion labels such as guilt or embarrassment, may cause the individual to chronically attend to sensory information that would be congruent with these labels (see also Bower, Gilligan, & Monteiro, 1981). Recent empirical evidence for this process will be discussed in Chapter 7, which deals with developmental factors related to symptom reporting.

Body schemas, then, can be adopted and discarded extremely quickly—such as in a laboratory experiment—or can develop over several years and thus be used with greater frequency. The more confirming sensory information available at any given time, the more enduring the schema should be. One implication of this process is that it may be extremely difficult to dissuade an individual that his or her schema is inaccurate or maladaptive. Simply telling a hypochondriac that he is not really sick is not effective. Such a person always has some sensations which can verify the illness schemas that he holds at the time. As researchers in perception and social psychology have emphasized, a schema can be quite persistent (e.g., Ross, Lepper, & Hubbard, 1975; Massad, Hubbard, & Newtonson, 1979). Clinical approaches that systematically attempt to alter or restructure body schemas and then aid the person in garnering confirming sensory information may be most effective in treating such disorders.

The schema approach is directly related to a variety of phenomena that have long intrigued psychologists and medical personnel. Two such examples include placebo effectiveness and mass psychogenic illness (MPI). In addition, the schema research is relevant to issues surrounding demand characteristics. Each of these issues is briefly discussed.

Placebos. Placebos have long been known to be powerful agents in relieving discomfort and a variety of symptoms (e.g., Jospe, 1978; Rickels, 1968). Although recent evidence indicates that there may be naturally produced analgesics, called endorphins, that are secreted by the body when placebos are ingested (Levine, 1980), these effects may account for only a small portion of placebo effects (Evans, 1980). There is little doubt that one reason placebos are effective is that they change the way that individuals process sensory information. Individuals who are sick and anxious about their illness will, after taking a drug, change from focusing on sensations that represent illness to sensations that signify improved health. Such a change in schema-guided search would be greatly aided if the person believed in his or her physician and the presumed drug *and* if the person had access to a great number of ambiguous sensations. In fact, these factors have consistently been found to be positively correlated with placebo effectiveness (Rickels, 1968). Note that *any* drug—whether placebo or not—will have a greater chance of being perceived as effective if the individual organizes sensory data appropriately.

Mass psychogenic illness. Another phenomenon that can be influenced by schemas and selective search is mass psychogenic illness (MPI). MPI is a phenomenon that occurs in businesses, schools, convents, or other places where a large number of people are together, usually during periods of stress. Typically, many of the people will become ill with vague symptoms such as dizziness, headache, nausea, and the like. No organic bases to the symptoms are found. In most cases, when one person in the setting becomes overtly sick (vomiting, fainting), others, who are friends of the affected individual, will then notice that they too are experiencing illness-related symptoms. These people will then report being sick as well. MPI has occurred for centuries in a variety of forms—from dancing mania to cases of mass hallucinations (see Kerckhoff & Back, 1968; Sirois, 1982; Markush, 1973). Although the symptoms may differ from culture to culture, the antecedent conditions are similar (e.g., Phoon, 1982).

A good example of this process occurred in a summer school class that I taught in 1978. During the 2½-hour class, the air conditioner broke, sending the room temperature to about 87°F. If anyone had distributed a symptom checklist during the lecture, most people would have reported that they felt dizzy, tired, hot, and sweaty (and also hungry, since the class went over the lunch period). After about an hour of the lecture, a student in the front row raised her hand and said that she thought that she smelled gas escaping from one of the gas jets. As soon as she said that, I noticed that I was on the verge of fainting and felt nauseated. About two-thirds of the students in the class reported similar experiences. (No gas was escaping.) Those who did not experience the gas-related symptoms thought that I had set the entire thing up as a class experiment!

Note that in this case we all held heat-related schemas prior to the incident. We all noticed highly specific (and logical) sensations that one would expect in a very hot room. However, once an alternative schema was suggested, we reorganized the incoming data, and selectively noticed and interpreted sensations in line with the new tentative hypothesis. Feeling tired now became “faintness.” Hunger became nausea. One can easily imagine how effective this would have been as a manipulation if the person in the front row had collapsed, muttering “Gas” from her blue lips as she expired. (See Colligan et al., 1982, for an in-depth coverage of MPI.)

Demand characteristics. Within an experiment there are often a number of situational cues that tell the subject what is expected of him or her. Because of the presence of these cues, or demand characteristics, the subject may bias his or her responses in order to please the experimenter. There are two characteristics of experimental demands that are particularly relevant to the studies presented in this chapter. The first

assumes that symptoms which are not experienced are reported nonetheless; the second is based on the belief that the subjects report symptoms because they are not certain whether they are experiencing the sensations or not. Whereas the first process probably does not occur with great frequency, the second is more common and, in fact, accentuates the power of the schema concept. Examples of these two processes are illustrated below.

In a number of talks that I have given to both professional and student groups, I have discussed a study that we conducted wherein experimental confederates went to various libraries in order to study itching and scratching behavior. Our confederates would sit next to a potential subject and then begin scratching their arm, nose, or other part of the body. As might be expected, over 50% of the subjects also began to scratch. A discussion of this study typically results in scratching behavior by 30–60% of the audience. Are these people really *not* itching and merely attempting to please me? If you, too, have an urge to scratch at this time, I may be pleased—but there is probably an itching sensation that you are perceiving nonetheless.

This example suggests that the various symptom-reporting studies may reflect experimental demands in the sense that we have caused the subjects to organize and selectively search their bodies in line with our instructions. Nevertheless, evidence from debriefing and related behavioral data (e.g., sneezing in the nasal congestion study; asking if our measuring equipment had manipulated their heartbeat in the heart rate study) indicates that the subjects honestly perceived the manded sensations.

A more subtle issue is apparent in examining those self-report studies wherein subjects reported the degree to which they experienced relatively ambiguous sensations. For example, subjects in the “ultrasonic noise” study were led to believe that the noise influenced finger temperature, which we were monitoring. It is possible that subjects truly could not tell whether their finger temperature was changing or not but, because they feared we could “catch” them with our objective equipment, they biased their responses in the manded direction. In other words, subjects were not deceiving us (or even themselves); rather, they were making an educated guess—or perhaps inference. That the experimenter-induced schemas can function as demands in bringing about changes in perception is a fundamental point. The effectiveness of placebos, roles of suggestion, and the powers of a faith healer are all examples of environmental demands placed on an individual. Schemas, then, are fundamental constructs that explain both the reporting of ambiguous sensations and, on a broader level, the processes underlying demand characteristics themselves.

A final comment on schemas. The use of the schema concept is very powerful in explaining a large number of phenomena related to body

and symptom perception. Therein, of course, lies its weakness. As with most broad concepts in psychology (reinforcement, label, drive, expectancy, etc.) it cannot be precisely defined. Virtually any behavior can be explained in a *post hoc* manner by invoking the term. In later chapters, some of the ways by which schemas are related to the organization of information will be introduced. Nevertheless, the reader should be wary of the all-encompassing nature of the term.

Chapter 4

Accuracy of Perception Relative to Physiological State

The previous chapters have dealt with perceptual factors related to symptom reporting. An implicit assumption has been that individuals are not accurate about symptom perception relative to objective measures of physiological state. For example, several of the studies have shown that perceptions of body state can easily be manipulated when physiological state has remained constant. Does this mean that perception of physiological state and actual physiological state are independent of one another? This question lies at the heart of the present chapter.

In this chapter, accuracy refers to the correspondence between a given physiological state and the perception of that state. In assessing accuracy, then, it is necessary to objectively measure both the physiological stimuli and the person's self-reports relevant to the stimuli. The present chapter is divided into four parts. The first section discusses the methodological problems that are inherent in the measurement of accuracy. The second section is devoted to assessing some possible situational and individual difference correlates that may be related to accuracy of body perception. The third section deals with the issues of the unidimensionality of accuracy. That is, is a person who is accurate about one physical symptom more likely to be accurate about other symptoms as well? The final portion of the chapter points to several general theoretical problems and implications of understanding accuracy in both the laboratory and the real world.

Measurement of Accuracy: Between-Subjects Versus Within-Subject Approaches

The concept of accuracy has had a long and thorny history within psychology. One of the first attempts to address the accuracy concept was initiated in the 1930s by a group of social and personality psychologists who were interested in accuracy of person perception (e.g., Vernon, 1933; Estes, 1938). These and later researchers were interested in the degree to which judges could accurately assess the personalities or emotions of others. Among the problems in the research were the criterion of accuracy (i.e., who is to judge when the person is accurate or not) and a variety of scaling problems. Several of these issues were highlighted by Cronbach (1955), whose influential article greatly curtailed this line of research for almost two decades (see Schneider, Hastorf, & Ellsworth, 1979). Many of these same problems have surfaced in recent attempts to understand accuracy of symptom perception. As will be discussed below, the researcher's choice of methodologies is critical if we are to get a coherent picture of the relationship between physiological change and the perception of the change.

In general, two types of methodologies have been used in assessing accuracy: between-subjects and within-subject designs. The between-subjects approach involves a large number of subjects wherein a single measure of a given physiological index and a self-report is collected from each subject. These two measures are then correlated across subjects. The within-subject approach requires multiple physiological and self-report measures from each subject over time. Separate correlations are computed for each subject on a case-by-case basis. Some recent findings and problems with both approaches are discussed below.

Between-Subjects Approach

Historically, the between-subjects approach has been psychologists' paradigm of choice (Aronson & Carlsmith, 1968; Campbell & Stanley, 1963). Although it effectively controls for most random variation in laboratory settings, it is a poor methodology for understanding accuracy of symptom perception. Nevertheless, between-subjects correlations between self-reports and various physiological measures have yielded some interesting and relatively consistent results.

Internal analyses of several studies that we have conducted over the years indicate that the mean between-subjects symptom-physiology measure correlations have hovered around +.30. For example, across at least five separate experiments we have found correlations between

measures of skin conductance and self-reported "sweaty hands" that have ranged between .10 and .44, averaging .28. Correlations between actual and perceived heart rate have ranged from -.11 to .28, averaging .21. Correlations between perceived and actual finger temperature have ranged from .12 to .51, averaging .33. Comparable correlations have been found between perceptions and actual measures of nasal congestion, breathing rate, and pain threshold.

Other researchers using between-subjects designs (or between-within mixed designs) have found comparably low correlations. For example, Whitehead and Drescher (1980) required subjects to swallow a gastric balloon and indicate whether a flashing signal light coincided with stomach contractions. Overall, the authors found that subjects were correct on only 58% of the trials (where 50% was chance level). Similar results were obtained for subjects' estimations of heart rate. For a review of studies indicating low symptom-physiology correlations among subjects not trained to discriminate internal state, see Blascovich and Katkin (1982).

Why are these correlations so consistently low? Three major problems are immediately apparent. First, our subjects differ tremendously in their use of self-report scales. Whereas some tend to use only the bottom half of the scale, others may use only the middle or top portions. Second, there are large differences in our subjects' baseline physiological readings. A classic example of this problem can be seen with two people who have baseline heart rates of 60 and 90 beats per minute, respectively. If, for some reason, they both had a heart rate of 75 beats per minute in our experiment, one would claim that his heart rate was fast and the other would accurately report that it was slow.

The third, and most interesting, problem with the between-subjects approach is that subjects *define* symptoms in very different ways. Recently Terry Kerler and I interviewed a large number of subjects, asking them to introspect in order to tell us what cues they used in reporting each of 18 common physical symptoms. For example, we asked each person how he or she "knew" that they were experiencing "shortness of breath." About half of the subjects noted that shortness of breath meant fast and shallow breathing. Most of the remaining subjects defined the same symptom as slow and labored breathing. Perceptions of the symptoms of "racing heart" were variously defined as the presence of a pounding heart, a fast pulse, or even tense muscles. In fact, not one of the 18 symptoms was perceived in an identical way by all of our subjects. Each of the above problems indicates that a more sensitive measure of accuracy should be used. One procedure—called the within-subject approach—should bypass most of these measurement and definitional problems. As the following section indicates, however, strong correlates of accuracy remain difficult to find.

Within-Subject Approach

The within-subject approach circumvents most scaling, baseline, and definitional problems in assessing the link between perceived and actual physiological state. The major drawback of this approach is that many self-report and physiological measurements must be collected for each subject. Two general within-subject paradigms have been used that address the accuracy issue. The first, which is characteristic of the field of psychophysics, attempts to hold all possible situational variables constant and manipulates a given stimulus dimension. The subject then reports his or her perception of the changing stimulus. The second approach manipulates the situation over time and attempts to bring about physiological changes to which the subject responds. This approach is more concerned with real-world changes in situations and physiological state.

Psychophysical research has demonstrated that there appears to be a one-to-one correspondence between a given stimulus change and the perception of that change (Stevens, 1975). On a theoretical level, this is both interesting and important. On a practical level, however, this approach is limited in helping us to learn about accuracy of symptom perception in the real world. On a day-to-day level, our situations and physiological state are constantly changing. Indeed, it is encouraging to know that if *everything* is held constant, symptom perception is logarithmically related to physiological state. Nevertheless, we simply need a deeper understanding of accuracy. A psychophysical analogue of our problem would be having a person judge varying intensities of a light bulb across a variety of settings ranging from a darkened closet to a sun-drenched beach.

The alternative within-subject approach examines subjects' perceptions of internal state over a wide variety of settings (see Epstein, 1979). One approach is to manipulate physiological state via an injection of a substance such as insulin (e.g., Cameron, 1980), inflation of a gastric balloon (e.g., Stunkard & Koch, 1964), or electrical stimulation of some aspect of the brain (e.g., Penfield, 1969; Heath, 1963). During or after the physiological manipulation, the subject reports his or her bodily perceptions. Although similar to the psychophysics approach, the researcher has less control over the physiological variables. In addition, these experiments may last several hours, so that from the subject's perspective the situation is also changing.

In recent years, several researchers have begun using within-subject correlational designs wherein subjects report their perceptions of given sensations at the same time that physiological concomitants of the sensations are measured. Typically, this approach involves the subjects' participating in several tasks that "naturally" manipulate physiological state. Examples of this approach can be seen in research that has taken

place in both real-world settings and the laboratory. Some basic findings using this paradigm will be presented.

One of the first attempts to relate self-reports of physical state and actual state dealt with novice and experienced parachutists (Epstein & Fenz, 1965; Fenz & Epstein, 1967). In the first study, the parachutists rated the degree to which they felt afraid from before to after jumping on 14 occasions. In another study with similar subjects, actual measures of skin resistance, heart rate, and respiration rate were taken at each of these points. Comparisons of the self-reports with the physiological measures across the two studies produced several interesting findings. First, neither group was completely accurate. After-jump ratings deviated from the physiological records to a great extent relative to prejump ratings. Second, the *novice* jumpers were relatively more accurate in their self-reports than the experienced jumpers. Fenz and Epstein (1967) note that the experienced jumpers have learned to suppress their awareness of their true physiological state. This is highly adaptive, since these jumpers must perform complicated maneuvers while falling. It must be noted that the researchers were more interested in global ratings of fear than in self-reports of highly specific sensations that were related to their physiological measures. In addition, these data were compared across separate studies so that within-subject correlations between self-reports and physiological measures could not be computed. Nevertheless, these data are of interest in pointing to factors that may influence accuracy.

In recent years, we have conducted several within-subject correlational studies that have examined specific self-reported symptoms and their physiological concomitants. In the first major study (which will be described in detail below), subjects participated in a series of tasks during which time heart rate, skin temperature, skin resistance, and systolic and diastolic blood pressure were measured. During or following each task, subjects reported the degree to which they were experiencing each of seven physical sensations (fast pulse, warm hands, sweaty hands, heavy breathing, tense stomach, tense muscles, and pounding heart). For each subject, correlations were computed between the physiological measures and self-reports. In the second series of studies, we used a heartbeat-tracking technique wherein subjects continuously pressed a button at the rate that they thought their heart was beating while actual heart rate was measured. While actual and perceived heart rate was monitored, subjects either viewed a series of slides or participated in one of five different tasks. The heartbeat-tracking studies, then, relied on a behavioral estimate of internal state rather than a strict self-report. Because the findings of these studies will be addressed in various forms throughout the remainder of this chapter, the methodology of each is discussed in greater detail below.

The self-report studies. The first of two self-report studies (from Pennebaker, Gonder-Frederick, Stewart, Elfman, & Skelton, 1982) employed 15 male and 15 female introductory psychology students. In the 2-hour study, each subject participated in 20 tasks which were separated by 2-minute baseline sessions. During or following each task and baseline, self-reported symptoms and actual physiological readings were taken. In other words, each subject had 40 readings (20 task and 20 baseline) of each of the seven self-reported symptoms and five physiological indices. The tasks varied along a number of dimensions that attempted to manipulate physiological and mood state. Some of the tasks included watching slides (gory, sexually arousing, boring, peaceful), mental arithmetic, a cold pressor test, a finger maze, listening to interesting and aversive sounds, running in place for 2 minutes, and deep relaxation. Although the main purpose of the study was to examine how and when physical symptoms covary with blood pressure changes (see Chapter 6), the discussion of the findings will be restricted to three of the measures that are directly related to accuracy: actual heart rate (HR) and self-reported fast pulse; skin temperature as measured by finger pulse volume (FPV) and self-reported warm hands; skin resistance (GSR) and self-reported sweaty hands.

Each subject's data were analyzed separately. Simple Pearson correlations were computed between each self-report and its physiological concomitant. This procedure, then, yielded three simple correlations for each subject. Perhaps the most direct way to summarize the data is to note that people were not particularly accurate. The mean correlation between self-reported slow-fast pulse and actual HR was +.20, ranging from a high of +.67 to a low of -.21. Correlations between the objective measure of finger temperature and self-reported cool-warm hands ranged from +.68 to -.49, averaging +.17. Finally, correlations between GSR and self-reported sweaty hands ranged from -.44 to +.82, with the mean being +.05. Note that GSR is measured such that the higher the number, the less sweat on the skin. Consequently, high accuracy with GSR would be represented by a strong negative correlation with sweaty hands. Although GSR is not a direct measure of actual sweating, it has been shown to correlate with measures of palmar sweat—using a within-subject design—at levels exceeding -.80 (Wilcott, 1962). (See Table 4.1 for a summary of each of these correlations for each subject.)

In order to replicate the above findings, a related self-report study was conducted. In the experiment, 40 subjects (20 male and 20 female) participated in 17 different tasks. Self-reports of warm hands, heavy breathing, and fast pulse were collected at 47 intervals over the course of the study. Immediately prior to the self-reports, objective measures of actual skin temperature, breathing rate, and heart rate were also collected. Unlike the previous self-report study, these measures were taken

Table 4.1 Within-Subject Correlations by Subject
 Between Selected Self-Reported Symptoms
 and Their Autonomic Referents

Subject	Sex	GSR with sweaty hands	HR with fast pulse	FPV with warm hands
1	M	.37	.58	.48
2	M	.82	-.17	-.40
3	M	-.29	-.21	.63
4	M	.21	.67	.21
5	M	.12	.34	.68
6	M	.00	.35	.23
7	M	-.02	-.07	.46
8	M	.33	-.11	.22
9	M	-.36	.42	.18
10	M	.46	.59	-.02
11	M	.70	.41	.13
12	M	-.31	.01	.40
13	M	-.17	.41	.66
14	M	-.16	.16	.07
15	M	.20	.57	-.49
16	F	-.04	.16	.14
17	F	-.44	.52	-.45
18	F	-.40	-.11	-.12
19	F	.28	.07	-.14
20	F	.22	.45	-.02
21	F	.00	-.11	.02
22	F	.66	.02	-.24
23	F	-.08	.00	.17
24	F	.16	.14	.51
25	F	-.07	.05	.07
26	F	-.22	.34	.65
27	F	-.17	.45	.19
28	F	-.12	.07	.11
29	F	-.28	-.14	.38
30	F	.13	.06	.25

Note. Accuracy results are indicated if the correlations are negative for GSR (galvanic skin resistance) with self-reported sweaty hands, and positive for HR (heart rate) with self-reported fast pulse and FPV (finger pulse volume) with self-reported warm hands. For any of the correlations to be significant (one-tailed test, 38 df, corrected for experimentwise error rate), r must equal $-.31$ for GSR and $+.31$ for HR and FPV. From Pennebaker et al. (1982).

at 30- to 45-sec intervals rather than once every 2 minutes. Comparable results were obtained in terms of accuracy. Mean within-subject correlation between self-reported warm hands and actual skin temperature was +.07, between heavy breathing and actual breathing rate was +.20, and perceived and actual pulse rate was +.26. Between-subjects correlations among these measures for the same subjects produced comparably low correlations (from Pennebaker & Epstein, 1982).

A summary of accuracy correlations for both experiments is presented in Table 4.2. Although the majority of coefficients are statistically significant, most are of low magnitude. One anomaly in this pattern is the relatively high between-subjects correlation between perceived and actual finger temperature for both studies. We have no explanation for this finding. The data from both of these studies will be discussed in greater detail later in this chapter.

Table 4.2 Mean Within-Subject and Between-Subjects Correlations
Between Symptoms and Physiological Measures for
Two Separate Experiments

	Mean within subject	Between-subjects
Initial experiment with 30 subjects across 40 trials^a		
Self-reported fast pulse with heart rate	.20***	.21
Self-reported warm hands with FPV	.17***	.40**
Self-reported sweaty hands with GSR	.05	-.26
Replication with 40 subjects across 47 trials^b		
Self-reported fast pulse with heart rate	.26***	-.11
Self-reported warm hands with finger temperature	.07	.51**
Self-reported heavy breathing with breathing rate	.20***	.27*

Note. Test for significance for mean within-subject correlations are based on single sample *t*-tests that test the mean correlation against the null hypothesis that the mean of the correlation distribution does not differ from 0. Between-subject correlations are based on the mean self-reports and physiological measures for each subject.

^aFrom Pennebaker et al. (1982).

^bFrom Pennebaker and Epstein (1982).

* $p \leq .10$.

** $p \leq .05$.

*** $p \leq .01$.

The heartbeat-tracking studies. In two related experiments (from Pennebaker, 1981), subjects pressed a button at the rate at which they thought their hearts were beating while actual heart rate was continuously measured. In the first of two studies, 31 undergraduates viewed each of 20 slides for 20 seconds each while they tracked their heartbeat. The slides, which varied in interest and pleasantness, were rated by a separate group of subjects. For each subject, the number of button presses (i.e., estimated heart rate) and number of actual heartbeats were counted for each slide. In other words, each subject had 20 estimated–actual heart-beat data points. These numbers were then correlated separately for each subject. Again, the mean within-subject correlation between estimated and actual heart rate was low, averaging +.12 and ranging from +.70 to -.43.

One advantage of the heartbeat-tracking paradigm is that the scaling of the estimated and actual heart rates are comparable. In addition to looking at the within-subject correlations, we are also able to directly measure how many beats per minute the subject's estimated heart rate deviates from actual heart rate. In the first tracking study, an accuracy score was computed by looking at the absolute value of the difference between estimated and actual heart rate. Overall, subjects misperceived their actual heart rates by 21.8 beats per minute. Although a few subjects' estimates deviated by only 2 or 3 beats per minute, others overestimated their heart rate by as much as 25 beats per minute or underestimated it by as much as 40 beats per minute.

One problem with the first heartbeat-tracking experiment was that subjects had only 20 sec to evaluate heart rate. This may not have given subjects enough time to process both the slide information and their actual heart rates. Consequently, a second tracking experiment was conducted wherein subjects participated in five tasks and seven baseline sessions, each lasting 2½ minutes. In addition, after the 2½-minute baseline session, half of the subjects were instructed to feel their pulse for 20 sec in order to obtain a rough idea of their current heart rate. The tasks, which were randomly presented and separated by baselines, included listening to aversive bursts of unpredictable noise, viewing a peaceful boat scene, being interviewed by an experimenter, viewing a sexually arousing slide, and listening to interesting street sounds. The baseline sessions involved subjects sitting quietly with no external stimulation while they tracked heart rate.

The second tracking experiment yielded results comparable to those of the first study. First, subjects misperceived heart rate by 18.5 beats per minute. The mean within-subject correlation between estimated and actual heart rate was +.063. Of particular interest was that the manipulation requiring half of the subjects to feel their pulse for 20 sec did not increase accuracy.

As a final note, in both heartbeat-tracking experiments subjects were asked to complete a short questionnaire that included an item asking

them how accurate they thought they were in perceiving heart rate. Self-perceptions of accuracy were unrelated to actual accuracy in both studies. These findings parallel research evidence indicating that peoples' abilities to detect nonverbal deception in others is uncorrelated with self-reported abilities (DePaulo & Rosenthal, 1979).

Although the within-subject approach is theoretically much more powerful than the between-subjects one, the data indicate that people are not particularly accurate in judging internal state in general. Nevertheless, there is a great deal of variability from subject to subject. Taken together, it appears that the only within-subject approach that yields strong accuracy findings comes from psychophysics literature. Unfortunately, these results do not help in evaluating real-world settings when people must deal with changing physiological state as well as constant changes in their perceived environmental situations. In addition to the psychophysics findings, the only other study that suggested high within-subject accuracy involved the novice parachutists. Specifically, when extremely aroused, the novice parachutists appeared to be more accurate than the more experienced—who had apparently learned to suppress perceptions of anxiety and arousal. Finally, the laboratory studies hinted that some people may be accurate some of the time in certain settings. Before we can make any generalizations about accuracy, it is first necessary to address a series of questions concerning some of the parameters of accuracy.

Situational and Dispositional Factors and Accuracy

Are people more accurate about their symptoms in certain situations than in others? As will be recalled, symptom reporting is highly dependent on the quantity and quality of available external information. The two heartbeat-tracking experiments attempted to answer this question. In the first study, subjects tracked their heart rate while viewing 20 different slides. The slides were independently rated on their interest and pleasantness by a separate group of subjects. Basically, subjects' heart rate estimations (i.e., button presses) were highly influenced by the slide characteristics. Ratings of interest correlated +.53 with heart rate estimations, whereas pleasantness ratings correlated -.72. Although the perceived rate was highly influenced by the slides, accuracy levels were not significantly affected. In other words, the slides themselves did not change general accuracy levels whether interesting or boring, pleasant or aversive.

The second heartbeat-tracking experiment produced similar results. In the study, subjects participated in five tasks and seven baseline sessions, each lasting 2½ minutes. Although estimates of heart rate were strongly influenced by the tasks, subjects were no more accurate in one

setting than in another. This was particularly troublesome considering the nature of the baseline sessions. During these periods, subjects sat alone in a room with no external stimulation and tracked their heart-beat. Even though they had virtually nothing to focus on except their heartbeats, they were no more accurate.

It could be justifiably argued that these are poor tests of situational influences on accuracy given that subjects were attempting to perceive a relatively subtle sensation. By its very nature, heart rate perception may be too difficult for the untrained subject to master. If this is the case, one is tempted to ask what sensations—if any—would be perceived more accurately in laboratory settings? One clear possibility is that situations would be related to accuracy only when physiological state differed significantly from baseline, such as when the subject is extremely aroused.

As the above data may indicate, it is possible that very high or low arousal levels may be a prerequisite for accurate symptom perception. In fact, the parachutist data may indicate this. Recently, others have suggested that high arousal may be necessary for accurate heart rate perception (e.g., Jones & Hollandsworth, 1981; Katkin, Blascovich, & Koenigsberg, in press). Clearly, there is some truth to this idea. A person will be far more accurate about pain perception if he or she is severely injured than if pricked by a pin. This is in part a measurement issue. Within-subject correlations are more likely to be high if some of the readings deviate from the mean by a large magnitude. Beyond the scaling issue, however, is the problem of perception of physical symptoms and sensations in our daily lives during relatively “normal” fluctuations of arousal.

During most days of our lives we are not aroused to the same extent as the novice parachutists. Transient mood states or stress levels that occur naturally or in laboratory settings may produce measurable autonomic change, but—at least in our own studies—do not greatly enhance accuracy. A good example of this was seen in the first large self-report study wherein subjects underwent 20 tasks and 20 baseline sessions. Although finger temperature may have oscillated by 10°F, heart rate by 20 beats per minute, and systolic blood pressure by 40 mm Hg, accuracy continued to be low. The question then becomes, *How arousing must the situation be before the subject becomes significantly more accurate?* We are not in a position to answer this question at this point. The resolution of the issue may lie in a series of parametric studies that systematically manipulate arousal levels. Finally, as will be discussed in Chapter 6, high arousal states may be most important for subjects' establishing their *beliefs* about their bodies within the context of specific types of settings. This may suggest, then, that settings perceived as moderately arousing will result in the inference of arousal-relevant symptoms.

Personality Measures and Accuracy

In recent years several researchers have attempted to learn if any individual difference measures are related to accuracy of symptom perception. Measures that have been proposed to predict accuracy include the Autonomic Perception Questionnaire, symptom-reporting scales, self-consciousness scales, questionnaires assessing Type A and Type B personalities, and others such as the repression-sensitization scales. (For more information on the link between personality measures and symptom reporting, see Chapter 7.) Some of the basic findings for each approach are discussed below. It must be emphasized that each of the following lines of research has approached the accuracy question in different ways. Consequently, the underlying assumptions and theoretical orientations are often at variance.

Autonomic perception. One of the first approaches to visceral perception was put forward by Mandler and his colleagues (Mandler et al., 1958; Mandler & Kahn, 1960). In a series of creative and well-reasoned studies, Mandler suggested that people differed in the degree to which they were attentive to autonomic changes. In the research, subjects completed an Autonomic Perception Questionnaire (APQ) which consisted of three sections tapping responses to feelings associated with anxiety and pleasure, estimates of physical symptoms associated with anxiety and pleasure, and subscales from the Manifest Anxiety Scale (Taylor, 1953) and MMPI pertinent to reports of internal bodily stimulation. After completing the APQ, subjects participated in a series of tasks that were designed to be stressful relative to baseline sessions. During the tasks, various physiological indices were measured, including heart rate, respiration, and face temperature.

Although Mandler and his colleagues did not assess accuracy per se, they did learn that high-APQ scorers evidenced greater autonomic variability and also tended to overestimate autonomic changes relative to low-APQ individuals. The fact that high APQs were more labile on the various autonomic measures is particularly interesting. Large changes in a system such as heart rate or respiration may increase the probability that the person will orient to the changes. As will be discussed in the concluding section of this chapter, large autonomic changes may be far easier to encode than relatively static autonomic levels.

After the original work by Mandler, several researchers sought to learn if, in general, the APQ was related to accuracy of perception of internal state (see Brener, 1977, for review). This interest was motivated by the development of biofeedback techniques. Many of the researchers reasoned that a person who was particularly good and/or accurate at perceiving autonomic change should be able to control the change more effectively than one who was a poor perceiver. Unfortunately, the re-

search findings have produced no consistent findings. For example, some studies have found high-APQ scorers to be more accurate; others have found that moderate or even low APQs were more accurate (e.g., Donelson, 1966; Greene & Nielsen, 1966; McFarland, 1975; Whitehead et al., 1975). In addition, these and other researchers have not been able to demonstrate that an accurate perceiver is superior in learning to control various autonomic indices (Lacroix, 1981).

Symptom reporting. In 1977, we developed a 54-item checklist that taps the frequency and occurrence of 54 common symptoms and sensations (Pennebaker et al., 1977). The scale, called the PILL (i.e., Pennebaker Inventory of Limbic Languidness), requires subjects to rate each of the symptoms along a 5-point scale where, for example, 1 = never experienced the symptom to 5 = experience the symptom at least two or three times a week. As will be discussed in Chapter 7 and Appendix B, the PILL reliably taps a stable individual difference measure of symptom reporting.

The primary questions that we addressed concerned the difference between high and low symptom reporters in relation to accuracy. In all of the experiments reported in this chapter, there never was a significant difference in accuracy for any type of self-reported symptom with its physiological referent between high and low symptom reporters. This holds true when computing accuracy scores using within-subject or between-subjects methods. It should be emphasized that high PILL subjects report symptoms to a greater degree in these studies, but are no more or less accurate than low PILL subjects. These and a number of related findings will be discussed in Chapter 7.

Self-consciousness. Since the original formulation of self-awareness theory (Duval & Wicklund, 1972), a large number of researchers have begun to examine the link between self-focused attention and accuracy. One of the basic premises is that when an individual is aware of some aspect of self, he or she tends to become more accurate in terms of self-reported expectations and behaviors (Wicklund, 1975). An important extension of this approach has incorporated the concept of self-consciousness (e.g., Buss, 1980; Fenigstein, Scheier, & Buss, 1975; Scheier & Carver, 1977). According to this view, an individual who is privately self-conscious is presumably more accurate in reporting internal state than one who is low in self-consciousness (Gibbons et al., 1979; Mullen & Suls, 1982; Scheier et al., 1979).

In the heartbeat-tracking and self-report studies, we have found no evidence that the self-conscious individuals are any more accurate than the low self-conscious. As with the PILL data discussed above, we consistently find that high privately self-conscious (PSC) subjects estimate their heart rates to be faster and their magnitudes of most symptoms to

be greater than do low PSCs. Nevertheless, both within-subject and between-subjects analyses do not yield differences in accuracy (see also Gillis & Carver, 1980, and Levine & McDonald, 1981, for comparable results pertaining to accuracy).

Although these findings appear to be at variance with the many self-consciousness reports, closer inspection of the various studies yields an important difference in the paradigms. Those self-consciousness studies that have reported differential accuracy have typically given subjects a placebo or false expectation about an agent that manipulated internal state (e.g., Gibbons, Carver, Scheier, & Hormuth, 1979; Scheier et al., 1979). In none of these studies, however, was actual physiological state ever measured. Rather, it was shown that high PSC subjects were less persuaded by the manipulations than low PSCs. Similarly, in an interesting experiment on accuracy of taste perception (Scheier et al., 1979, study 2), the results indicate that high PSC subjects are less suggestible in relation to experimental demands. Note that this is a different issue than subjects' being more accurate about internal states. A recent study by Levine and McDonald (1981) supports this reasoning. Basically, they found that self-aware subjects were less susceptible to external demands concerning a placebo, *but* were no more accurate about internal state (relative to a physiological measure) than subjects who were not self-aware.

Other individual difference measures. Several other individual difference measures have been used in attempting to assess accuracy, including Type A-Type B, repression-sensitization, and sex. The type A individual is hard driving, competitive, time urgent, and aggressive (Dembrofski, MacDougall, & Shields, 1977; Glass, 1977; Friedman & Rosenman, 1974) and more likely to succumb to heart disease than the more easygoing Type B. Various studies have shown that the Type A is more likely to report symptoms when not engaged in a task (e.g., Skelton & Pennebaker, 1978) but is more likely to suppress internal state when actively involved in a problem (e.g., Weidner & Matthews, 1978; Carver, Coleman, & Glass, 1976). Although the Type A's appear to suppress symptoms in certain types of situations, we have found no differences in accuracy in the heartbeat-tracking experiments nor in the self-report studies.

Another recent measure that has been proposed to tap accuracy of body perception is the Private Body Consciousness Scale (Miller, Murphy, & Buss, 1981). The Private Body Consciousness (PBC) inventory taps the degree to which individuals are aware of autonomic changes (e.g., "I am aware of my heartbeat"). In a recent experimental study, Miller et al. (1981) found that high PBC subjects were less persuaded by a placebo than low PBC subjects. The authors concluded that high PBC individuals were generally more accurate about body state than lows. In the second self-report study discussed earlier, we found no differences

between high and low PBC subjects in terms of objective measures of accuracy. As with the PSC, the PBC scale appears to be measuring subjects' compliance with experimental demand rather than accuracy per se.

The measure of repression-sensitization has been shown to be related to symptom reporting and health center visits (e.g., Byrne, Steinberg, & Schwartz, 1968). Basically, the sensitizer is more likely to report symptoms than the repressor. In a recent pilot study assessing accuracy of skin temperature and heart rate, we have found no differences between repressors and sensitizers. Finally, females typically report more physical symptoms than males. Again, however, we have not found differences in accuracy between the two groups for any of the studies that we have run.

In summary, although the various individual difference measures are clearly related to perceptions of physical symptoms and sensations, none have been shown to predict accuracy relative to physiological state. The reasons for this may be in the nature of accuracy. As discussed in the next section, the commonsense belief that accuracy is a simple, monolithic construct may not be true.

Is Accuracy Unidimensional?

Often we tend to think of accuracy pertaining to internal state as unidimensional. Some people appear to be in touch with their feelings, whereas others may be characterized as substantially less aware. Various theoretical approaches within social, personality, and clinical psychology often explicitly or implicitly assume that certain persons are generally more accurate than others in reporting body state. Is this assumption true? Both empirical and logical considerations suggest that it is not.

Recall that the self-report studies discussed in the previous sections required subjects to report specific sensations over 40 or 47 trials while the physiological concomitants of the self-reports were measured. As can be seen in Table 4.3, there was no relationship between a person's being accurate for one symptom and their being accurate with the others. In fact, the relationships between the three indices of accuracy were nonsignificantly correlated in both studies. In other words, a person who was highly accurate in self-reports of heart rate relative to true heart rate was not necessarily accurate about perceptions of sweaty hands or warm hands.¹

¹ Recently, Whitehead and Drescher (1980) reported that a signal-detection paradigm using 20 subjects yielded a significant correlation between the ability to perceive stomach contractions and heart rate ($p < .05$). In their task, subjects were required to press one of two buttons indicating whether or not a signal light corresponded with stomach contractions (in one series of sessions) and later heart rate (in another session). Because subjects participated in six 2-hour sessions over several weeks, it is reasonable to assume that certain subjects became more adept at the paradigm and hence yielded data suggesting unidimensionality.

**Table 4.3 Correlational Tests of Unidimensional Issue
for Two Experiments**

<i>Initial experiment (30 subjects, 40 trials)</i>		
Correlation matrix	Warm hands-FPV	Sweaty hands-GSR
Fast pulse-HR	-.048	.098
Warm hands-FPV		-.290*
<i>Replication (40 subjects, 47 trials)</i>		
Correlation matrix	Warm hands-FT	Heavy breathing-BR
Fast pulse-HR	.022	.041
Warm hands-FT		.020

Note. These data represent the correlation coefficients between correlation matrices. For example, the fast pulse-HR with warm hands-FPV simple correlation is derived from correlating the two matrices HR with fast pulse and FPV with warm hands that are listed in Table 4.2 with each other. In other words, this is a between subjects correlation table based on within-subject correlations. HR = actual heart rate, FPV = finger pulse volume, FT = actual finger temperature, GSR = galvanic skin resistance, and BR = actual breathing rate.

* $p = .12$, two-tailed test.

These findings are consistent with research related to biofeedback. It has long been known that people vary in their abilities to learn to control a given autonomic system. However, the ability to control one system—such as heart rate—is unrelated to one’s ability to control another autonomic system such as skin conductance (e.g., Lacroix, 1981; Lacroix, & Roberts, 1978). Body control, like body perception, is not unidimensional. Note that these findings are based on subjects who have not undergone extensive biofeedback training. It is certainly possible that with enough training on several autonomic channels, people could learn to control and perceive several systems accurately.

In retrospect, the fact that accuracy of body perception is not unidimensional is logically consistent with findings in earlier chapters. Recall that one of the fundamental assumptions of this book has been that processes of perception are comparable when dealing with the perception of external environmental and internal sensory events. Is it reasonable to ask if some people are more “accurate” in perceiving the external environment than others? One person may be accurate in perceiving music, journal articles, or plant life; however, we would not expect that being accurate in perceiving one domain of the external environment would be highly correlated with accuracy in perceiving other domains of the external environment. If accuracy in perceiving

external events is not unidimensional, it would follow that accuracy in perceiving all physiological states would not be unidimensional either.

The fact that accuracy does not appear to be unidimensional is rather disquieting. On one level it undermines many of the assumptions surrounding accuracy. On another, however, it indicates that discussions of accuracy should be more symptom specific. Rather than continue to search for a general accuracy personality trait or setting, future research should seek to learn when and why accuracy is present for specific symptoms.

Conclusions and Future Directions Concerning Accuracy

Laboratory findings using both between-subjects and within-subject designs have found only low correlations between perceptions of physical sensations and their autonomic concomitants. To complicate matters, accuracy does not appear to be unidimensional. That is, a person who is accurate about one body system is not any more likely to be accurate about another body system.

Does all of this mean that people are not accurate about internal state? Logically, the answer has to be no. When we are hungry, we eat; when tired, we go to bed; when we have a headache, we may take aspirin or visit a physician. The mere fact that we can successfully regulate the body's needs suggests that we behave in an accurate fashion. Obviously, if we were completely inaccurate about body states we could easily starve to death, or collapse at any time as a result of fatigue, illness, or other physiological imbalance. Given that *by definition* we are usually accurate, why have all of the lab studies that we and others have done contradicted our common sense?

There are at least four interrelated reasons for the disparity between common sense and laboratory findings concerning accuracy: people cannot accurately verbalize sensory state; our methodologies and measurement approaches have been inadequate; subjects do not encode sensory information in the same way that we measure sensory information; subjects encode general rather than specific physiological activity. Each of these issues is discussed.

Fallibility of Self-Reports

Social psychologists have relied heavily on self-reports for several decades. It is common knowledge that self-reported attitudes correlate poorly with behavioral measures. Recently, Nisbett and Wilson (1977) have argued that people do not have direct access to their cognitive processes. Further, Bem (1972) notes that laboratory manipulations in social psychology have found that behavior changes are more easily pro-

duced than attribution or self-report changes (see also Wilson, Hull, & Johnson, 1981). Finally Zajonc (1980) has recently argued that affective information is processed differently—and at times, independently—from cognitive information. These three lines of research have direct bearing on self-reports of physical symptoms.

Most of the time we are actively encoding sensory information and using this information to guide our behavior. The mere fact that we are able to walk indicates that we are using extremely complex kinesthetic, vestibular, and somatic cues. Nevertheless, attempting verbally to explain how to walk is beyond even the most sophisticated "how-to" manual. The ability to walk and to encode the requisite sensory information is completely unrelated to the ability to report or discuss walking behavior. Self-reports, by their very nature, require higher order cognitive processing. Such processing involves inference, guessing, and the weighing of several sources of information. Self-reported physical symptoms do not perfectly mirror afferent sensory signals from the body.

The implication of the above reasoning is that self-regulatory behavior is based on more direct processing of bodily information. When thirsty, we typically will find something to drink. In most cases, we probably do not think to ourselves, "My throat is dry, I must be thirsty, I will go get something to drink." Rather, our hypothalamus encodes the fact that we are dehydrated, which in turn initiates our finding something to drink. If a social psychologist is around, we will then report that we drank something because we were thirsty. In its extreme form, this is a restatement of Bem's (1972) self-perception theory. Note that if the social psychologist is absent, we will proceed through the drinking sequence without ever thinking that we were thirsty (a la Langer's mindlessness concept, 1978).

Even though our self-reports may be poorly related to physiological state, it must be emphasized that they are not randomly reported. In fact, each of the various studies—such as the initial heartbeat-tracking study—found extremely high correlations between external events and the perceptions of heart rate. Hence, the self-reports in this case were cognitively predictable even though they were not related to actual heart rate.

If self-reports of physical symptoms are highly related to nonbodily information, is the same true for the conscious *awareness* of symptoms and sensations? One could argue that it is only the reporting process, as opposed to the awareness process (see Chapter 1), that is biased. My own hunch is that the awareness and reporting of symptoms is a similar process in that both represent relatively higher order cortical processing. In debriefing hundreds of subjects, we have found that subjects honestly believe what they report to us. In other words, subjects are probably reporting what they are "aware" of.

This paradoxical picture of self-reports raises a number of unanswered questions. People visit physicians and therapists based on their aware-

ness of symptoms and sensations. As virtually all physicians know, a large number of physical complaints have no physiological basis. People in the medical and psychological fields should be made aware of many of the sources of bias that can distort a patient's reporting of complaints. Unlike drinking and sleeping, the decision to visit a physician or therapist involves a great deal of cognitive work.

Methodological Issues

The failure to find much evidence for accuracy in symptom reporting may reflect our methodologies rather than the fallibility of self-reports. As discussed earlier, people may only be accurate when their sensations deviate markedly from baseline. We know from experience that our bodies feel different after running up several flights of stairs than if we sit quietly. Mathematically, if we conduct within-subject or between-subjects experiments using only baseline and strenuous exercise, we will find relatively high correlations between perceived and actual physiological state. In other words, we can often "stack the deck" so that accuracy findings are obtained. Unfortunately, this circumvents two critical problems in dealing with accuracy.

The first concerns our normal range of autonomic variability. It is important that we attempt to assess accuracy within an autonomic range that is commonly experienced by the subject. Clearly, the question of accuracy is more interesting when we can relate it to day-to-day experiences.

A more critical and theoretically important issue related to methodologies associated with accuracy concerns the degree to which perceptual processes can bias our reporting of autonomic change. To illustrate the issue, assume that heart rate for a given person can range from 50 beats per minute to 160 beats per minute. At resting levels (e.g., 70 beats per minute), we can perform various experiments that will alter the person's perception of his heart rate by a certain magnitude. At any given actual heart rate, how much can we effectively manipulate the person's perception of heart rate? In other words, would normal perceptual biases alter judgment of heart rate within a certain range or window of, say, ± 5 beats per minute, or is our perceptual window much larger? If we think of perceptual biases as a potential window of change, several questions become apparent. First, are these windows relatively constant from person to person? Second, is the window constant for the same person over all levels of actual heart rate? Could biofeedback or other training experience reduce the person's window?

The window concept has a great deal of intuitive appeal. It indicates that accuracy is a relative construct and that we should define it in probabilistic terms. In addition, such an approach would allow us to determine the relative contributions of stimulus events (in this case, actual heart rate) and cognitive or perceptual biases in mathematical

form. Based on our research thus far, it would be likely that subjects have different windows for different autonomic indices. Using within-subject designs over a large number of settings and differing autonomic states, we could begin to address some of these questions.

Encoding Change Versus Static Information

An intriguing possibility for the generally low levels of accuracy is that people do not encode sensory and/or autonomic information in the same way that we measure it. Recall that in virtually all studies that have dealt with the relationship between perceived and actual internal state, the autonomic measures have been expressed in absolute levels. Heart rate is measured in beats per minute, blood pressure in millimeters of mercury, GSR in ohms, and so on. Several lines of research indicate that the person may actually encode *change* information as opposed to absolute or static autonomic levels. This idea has recently gained a large number of supporters among perceptual psychologists who have been interested in vision perception (e.g., Gibson, 1979; Johansson, von-Hofsten, & Jansson, 1980).

According to this view, a person does not encode static arrays. For example, if a visual image is projected to a constant area on the retina, the person soon fails to "see" the image (Riggs, Ratliff, Cornsweet, & Cornsweet, 1953). Either the eye must be constantly moving or the environmental stimulus changing in some respect for us to perceive external objects. Comparable examples can be seen in the perception of internal sensory events. In research discussed in Chapter 3, it was found that people's self-reports of skin temperature were unrelated to absolute temperature levels. Rather, the subjects were selectively encoding changes in schema-consistent directions. The Mandler et al. (1958) research dealing with the Autonomic Perception Questionnaire indicated that subjects that were most variable along autonomic systems were the ones that reported the most symptoms. It is possible that greater lability provides more change information that is easily encoded by the subject. In fact, Katkin and his colleagues (e.g., Blascovich & Katkin, 1982; Katkin, Blascovich, & Koenigsberg, in press; Katkin, Morell, Goldband, Bernstein, & Wise, 1982) have reported that although there are *not* strong differences between subjects with labile versus stable heart rates in estimating heart rate prior to biofeedback training, subjects with labile heart rates are able to learn to control and subsequently discriminate their heart rate changes much better than those whose heart rate is more stable.

All of these findings indicate that we should view symptom perception in a different light. Rather than simply measuring static levels of given autonomic channels, we should also measure change from previous levels. In other words, we must adapt our physiological output to the ways in which individuals encode this information. Of course, there

are a host of problems in dealing with change information. The most difficult is that we do not know how much change over how much time is required for the person to be able to perceive it. This points to the importance of future parametric studies that can evaluate this issue.

General Versus Specific Physiological Change

Earlier in this chapter it was noted that even though our empirical findings suggest that individuals are not particularly accurate, common sense dictates otherwise. From an adaptive perspective, one could argue that it is far more useful to be aware of gross physiological change than of highly specific physiological activity. After all, the organism can and must regulate food and water intake (which might be related to electrolytic balance or blood glucose levels), fatigue or overexertion (as measured by blood pressure or lactic acid concentration), and other major changes in the body. On the other hand, the value of regulating one's heart rate, finger temperature, or hand perspiration must be secondary. In other words, learning about the perceptual processes underlying highly specific autonomic change may shed very little light on how we perceive and use much grosser biological changes.

As will be discussed in Chapter 6, there is some compelling evidence to suggest that people can perceive large general changes in physiological activity with some accuracy. For example, a recent review by Mihevic (1981) on the physiological bases of perceived exertion indicates that general changes (e.g., oxygen consumption and muscle lactate concentrations) in the body correlate highly with perceived exertion, whereas more specific measures such as heart rate do not. Similarly, some of our own studies have found strikingly high within-subject correlations between perceived symptoms and such things as systolic blood pressure and blood glucose levels. Each of these studies deals with general physiological changes *and* general body labels (e.g., self-reported fatigue or large constellations of fatigue). Nevertheless, such findings may indicate that the natural ability to perceive highly specific symptoms is often an unnecessary skill.

The general versus specific physiological activity issue adds one more complexity to the accuracy problem. The degree to which perceptual processes can distort visceral perception may be inversely related to the specificity of physiological change. As with the external environment, it is easier to report massive changes (e.g., whether it is dark or light outside) than highly specific ones (e.g., whether the North Star is visible or not). This entire issue will be discussed in greater detail in later chapters.

Are We Asking the Right Questions?

Throughout this chapter evidence has been put forward demonstrating that people do not appear to be generally accurate in perceiving physical symptoms and sensations relative to physiological state.

Among the many ironies is that researchers are beginning to be able to predict *perceptions* of physical symptoms with increasing certainty. Psychophysiologists have made remarkable strides in predicting and understanding *physiological* changes. Despite the relative successes of these parallel investigations, our understanding of the links between them is woefully inadequate. Although some potentially fruitful directions have been suggested for future research within this section, we must stand back and evaluate some fundamental assumptions concerning the accuracy question.

First, we must acknowledge that accuracy is highly complex. Factors that may ultimately predict accuracy for one autonomic system will not be the same for predicting other systems. Second, for the accuracy question to have meaning, we must ultimately develop mathematical models that can account for a respectable amount of variance on a within-subject basis (cf. Knowles, 1978). Third, it is imperative that we begin integrating the theoretical findings within the perception and psychophysiological disciplines. A hypothetical blueprint for future research might be as follows.

In dealing with a given autonomic system, such as heart rate, we first must be able to quantify the degree to which various situational, personality, and physiological variables are related to actual heart rate for a given individual. In our mathematical model, then, we may learn that the variables of control, activity level, metabolic rate, accepting or rejecting sensory information, and the like are predictive of actual heart rate in a large number of settings for a given person. A comparable approach must also be taken in learning what psychological and physiological variables influence self-reports of heart rate for the same person. Our final perceptual and physiological models could then be integrated in order to predict the absolute difference between the person's perceived and actual heart rates (i.e., an accuracy score). Because different factors are related to perceptual and autonomic changes, our ultimate accuracy equations or models must reflect the separate contribution of both types of systems.

Finally, we must acknowledge that even the most sophisticated mathematics will not yield perfect accuracy results. To be completely accurate about specific autonomic channels requires more perceptual and/or cognitive effort than is warranted for the individual to survive. As will be discussed in Chapter 8, perfect accuracy—which requires extreme attentiveness to physiological activity—may be maladaptive in that it reduces the degree to which the organism can process external environmental information. That there is not a perfect correspondence between symptom reports and physiological activity may not so much reflect egregious methodological shortcomings but rather a useful biopsychological adaptation. We will return to some of the complexities of the accuracy problem in Chapter 6.

Chapter 5

Cognitive Organization I: Emotions

In the previous chapters the basic perceptual processes related to the awareness and reporting of symptoms have been presented. Clearly, specific sensations can be influenced by setting, expectation, and physiological state. Although briefly mentioned previously, we rarely perceive, report, or act upon highly specific symptoms. Rather, we organize groups of sensations into broader categories. Instead of perceiving feelings of dizziness and stomach contractions, we would more likely be aware of the feeling of hunger. The perception of illness typically is based on a large number of diverse symptoms (see Chapter 3).

What role do specific symptoms or sensations play in broader categories of body state? For example, do symptoms represent basic building blocks or elements in the construction of such states as emotion or illness? If so, are these organizations based on linguistics, learning, perception, physiology, or a combination? These and related questions are the focus of this and the following chapter. In the present chapter, one particular class of possible higher order categorization—emotion—will be discussed. After introducing many of the definitional problems typically associated with emotion, we will discuss three general topics: Is there a one-to-one correspondence between perceived symptoms and perceived emotions? What is the temporal and/or causal link in symptom-emotion relationships? What are the physiological bases to these organizational processes?

Without question, the area of emotion is one of the most confusing and complex in all of psychology. Although there are a number of reasons for this, one of the central problems is the failure of researchers to agree on the definition of emotion (Plutchik, 1980). Some perspectives, for example, focus on its function, whereas others deal with its perception

or physiological, facial, or expressive concomitants. Some define emotion as any stress response or discharge in autonomic activity; others view it as an extreme form of affect; whereas still others claim it to be any affectively toned mood state. Because emotion has cognitive, affective, and behavioral components, many researchers may deal with only one or two factors, whereas others deal with all three. For the present discussion, emotion will be defined as any affectively toned mood state that may or may not be associated with physiological change. Above all, I am concerned with the factors related to its perception by the person.

Historically, one of the greatest problems in our understanding of the factors related to emotion perception concerns the link between any given emotion and its physiological correlates. For example, physiological change has been said to *be* the emotion (James, 1890), to covary with (but not be causally linked to) the emotion (Cannon, 1931), to precede or cause the emotion (Schachter & Singer, 1962), or to be the result of the emotion (Graham, Kabler, & Graham, 1962). Further, the nature of the physiological change itself is disputed. For example, the physiological change has been said to be highly specific to separate emotion states (Alexander, 1950; Malmo, Shagass, & Davis, 1950; Wolf & Wolff, 1943) or to be a general diffuse change that is comparable for all emotions (Schachter & Singer, 1962). To complicate matters even further, some researchers have suggested that actual physiological change is not a necessary component for emotion—that only the perception of such change is required (Kerber & Coles, 1978; Ross et al., 1969; Valins, 1966). These three critical issues surrounding the emotion-physiology link—specificity, temporal/causal link, and actual/perceived change—are especially relevant to our understanding of the relationship between emotions and physical symptoms.

Symptoms and Emotions: Perceptual Specificity

Do we perceive certain unique constellations of sensations for each emotion that we experience? This question lies at the heart of this section. Psychophysiological findings and linguistic analyses suggest that specificity does occur. For example, differential autonomic and central nervous system activity has been found between feelings of anger and fear (Ax, 1953; Wolf & Wolff, 1943), between pleasant and unpleasant mood states (Hess & Polt, 1960), between attitudes of feeling “picked on” and being “on guard against assault” (Graham, 1962), and mood states associated with activity versus passivity (Funkenstein, 1956). Similarly, we know that different emotions are associated with different facial expressions (i.e., Cupchik & Leventhal, 1974; Darwin, 1872;

(Ekman & Friesen, 1975; Lanzetta & Kleck, 1970) and even postures (Waxer, 1974).

Although these research findings have dealt with actual physiological and/or motor changes specific to emotions, *perceived* sensory changes also appear to be specific to separate emotions. This is reflected in our language of emotion. For example, we tremble with fear, burn with anger, become sick to our stomach with revulsion, flush with embarrassment, and so on. All of these sayings, then, indicate that we associate specific sensations with specific emotions.

In addition to linguistic evidence, a limited number of experimental investigations have tried to assess the relationship between perceived sensations and emotions. In two similar studies, Nafe (1924) and Hoisington (1928) presented a variety of stimulus objects to subjects intended to manipulate feelings of pleasantness or unpleasantness. Nafe (1924) found that pleasant feelings were described as "bright" and unpleasant ones as "dull" pressurelike experiences. Although he found individual differences in the localization of the sensations, they were not consistent across subjects. Hoisington (1928) extended Nafe's research by noting that pleasant feelings were typically localized in the upper part of the body in the region of the chest, neck, and shoulders, whereas unpleasant affect was perceived in the general region of the abdomen.

Other investigations, which have not explicitly examined the specificity assumption, have provided support for its existence on a perceptual level. Ironically, one of the more clever studies supporting perceptual specificity was conducted as a test of Schachter and Singer's cognitive labeling theory (which assumes that there is no specificity). In the experiment, Ross et al. (1969) demonstrated that subjects, who believed that a noise caused either fear-relevant or -irrelevant symptoms, differed in the degree to which they subsequently emitted avoidance behavior. In other words, Ross et al. (1969) indirectly supported the idea that individuals cognitively organize symptoms in ways that ultimately alter emotion-related behaviors.

Whereas the Ross et al. research manipulated expectations of symptoms, a more important initial test of the emotion-symptom specificity idea would examine the emotion-symptom relationships in naturalistic settings where no manipulations were involved. Although this type of procedure yields correlational data, it should verify whether or not perceived emotions and symptoms tend to covary with one another in the real world. Our initial research dealing with emotion-symptom specificity involved two studies. The first was a simple between-subjects procedure wherein a large number of students completed a symptom-emotion checklist. The second study used a within-subject paradigm wherein multiple self-reported symptoms and emotions were completed for each subject over several days. As will be shown below, several intriguing patterns emerged.

Between-Subjects Correlational Study

The initial study required 177 students who were enrolled in an introductory psychology course to complete a symptom-emotion checklist on the first day of class. The checklist included 14 symptoms (e.g., headache, racing heart) and seven emotions (e.g., happy, guilty, tense). All items were anchored along 7-point unipolar scales. The symptom items were headed “*Right now, at this moment, I am experiencing,*” whereas the emotion items were headed “*Right now, at this moment, I am feeling.*”

All 14 sensation items were separately correlated with each of the emotion items. Table 5.1 lists the significant Pearson correlations ($p < .01$, two-tailed tests) as well as the multiple correlation (multiple R) derived from regression analyses. Two of the 14 symptom items (itching and sweaty hands) are not included, since they did not correlate significantly with any of the emotions. As can be seen, each emotion category was characterized by a unique constellation of symptoms. It should be emphasized that the statistical problems associated with this research are considerable. Most individuals do not experience “pure” emotions or single sensations. In this sample, the mean intercorrelation was .27 among the emotions and .18 among the sensations.

One way to bypass the intercorrelation issue is to statistically partial extraneous emotions and symptoms when focusing on a particular emotion-symptom cluster. For example, we examined the correlations between self-reported anger and the various symptoms after controlling

Table 5.1 Significant ($p < .01$) Pearson Correlations Between Self-Reported Emotions and Sensations for Between-Subjects Study

Sensation	Happy	Tense	Angry	Jealous	Sad	Guilty	Unhealthy
Headache	—28	24			24	30	34
Watering eyes					19	29	
Racing heart	—29	44			29	46	
Congested nose			25				22
Tense muscles	—19	50	23	31	30	34	
Upset stomach	—24	37	24		28	34	28
Flushed face		27	19	29		26	
Short breath		24				37	
Cold hands						26	
Warm hands		22					
Dizziness							22
Lump in throat						34	
Multiple R	41	61	39	46	42	57	49

Note. These data are based on 177 subjects.

for the other emotions. Although this technique yielded highly similar results to the initial simple correlations (85% of the original correlations were unaffected), this approach ignores the fact that we do experience several emotions at a given time. Similarly, it can be argued that inspecting the unique contribution of each sensation to each emotion by using a multiple regression technique distorts the meaning of the data, since certain symptoms are highly intercorrelated. Consequently, the regression approach ignores the fact that a given emotion may covary with a constellation of sensations that is composed of sensations that are themselves highly correlated. Despite these statistical problems, this study is interesting because it demonstrates that there are differences in the general patterns of symptoms that are associated with each emotion.

Within-Subject Correlational Study

The previous study indicated that, in general, subjects share certain symptom-emotion relationships. As discussed in the previous chapter, such emotion-symptom links may appear more robust when individual cases are looked at. For example, we have found across several within-subject studies that people differ tremendously in the degree to which they report experiencing various emotions. Some feel guilty the majority of the time, whereas others never report feeling the emotion. Similar differences have been found for reports of anger, fear, anxiety, and embarrassment. Just as there are large differences for the degree to which emotions and symptoms are reported, our studies have also indicated that there may be differences in the way that symptoms and emotions are related.

The work of Lacey (1956), Malmo and Shagass (1949), and several others points to the fact that there are individual differences in the physiological responses to different situations or emotions. According to this idea, called individual response stereotypy (IRS), one person may respond to a noxious event with changes in blood pressure and skin conductance, and another may respond to the same event with changes in heart rate and stomach contractility. Further, each subject may respond in physiologically similar yet unique ways to other types of stressors. The concept of IRS is interesting because it may also occur on the perceptual level (cf. Shields & Stern, 1979). The study to be presented here indicates that people differ markedly in the perceived links between emotions and symptoms.

The within-subject study reported here was a reanalysis of study 2 of Pennebaker et al. (1982) wherein nine subjects completed a symptom-emotion checklist 8–15 times per day for 5 consecutive days. Because this research was conducted in order to learn the relationships between sensations and/or emotions and blood pressure readings, different sensations and emotions were used than were included in the previous

between-subjects study (the blood pressure research will be discussed in Chapter 6).

The nine subjects (five males and four females) who participated in the study ranged in age from 20 to 45. The symptom-emotion checklist comprised 18 symptoms and 11 emotions, each of which was represented on a 7-point unipolar scale. Because subjects were required to complete the questionnaire approximately once per hour, the self-reports reflected the subject's being in a wide array of settings over time.

For each subject, correlations were computed between each emotion and the 18 symptom items. Tables 5.2 and 5.3 include some of the correlational data for subjects. A number of points should be raised about the results of this study. As can be seen in Table 5.2, there was some agreement among subjects, indicating that certain emotions tended to correlate with clusters of symptoms. Even more startling, however, is that only perceived tension yielded any symptoms wherein the majority of subjects evidenced significant correlations with specific symptoms (tense muscles and trembling). In other words, there were large individual differences.

The magnitude of these differences is highlighted in Table 5.3, where only the first four subjects' data are presented. As can be seen, there is considerable variability in the number of, and degree to which, symp-

Table 5.2 Sensation-Emotion Correlations That Were Statistically Significant for Three or More Subjects in Within-Subject Study

Sensation	Happy	Angry	Sad	Guilty	Afraid	Tense	Healthy
Headache	***					***	****
Watering eyes			***				
Racing heart						*****	
Congested nose				***			****
Tense muscles	***	****				*****	
Upset stomach	***			***			****
Sweaty hands						***	
Warm hands							***
Dizziness			*****		***		****
Lump in throat							***
Light-headedness	****			***			***
Trembling				***	***	*****	***
Tight stomach						***	***

Note. Each asterisk denotes a significant correlation for one person. Correlations for not healthy-healthy were all negative; for not happy-happy all were negative except light-headedness. All other correlations were positive. Not included in the list, since less than three correlations attained significance for the 9 subjects, were the sensations flushed face, shortness of breath, itching, cold hands, and hard of hearing

toms are related to the various emotions, and even in the direction of the relationships. At this point, it is difficult to assess the reasons for these differences. Likely candidates include different physiological activity from subject to subject, differences in early learning or general expectations about the links between emotions and symptoms, or differences in inference strategies. Each of these issues will be discussed at the end of the chapter.

One particularly intriguing event occurred for one of the subjects 6 weeks after participating in this study. Subject 3 (whose identity is somewhat masked) had been seriously and steadily dating a member of the opposite sex for several years. During a period of time, Subject 3's partner was called out of town. While the partner was gone, Subject 3 began secretly seeing another person, called X. After the first date with X, Subject 3 became extremely sick with the symptoms of stomach pains, dizziness, and trembling. The stomach pains were sufficiently intense that Subject 3 was taken to the hospital. No organic cause was found. On returning home, Subject 3 called X. While talking with X, the stomach pains again returned until the phone call was over. After not talking with X for 2 days, Subject 3 decided to call X one last time and terminate the relationship. Again, as soon as the telephone conversation began, Subject 3's stomach pains returned and continued until the discussion was over. Ever since the final phone call, the subject has not experienced these symptoms.

As might be expected, Subject 3 admitted having experienced a great deal of guilt and tension concerning the secret affair. Interestingly, this one subject evidenced the highest correlations for guilt and tension with the sensations of upset stomach, tense stomach, racing heart, dizziness, and trembling. Neither Subject 3 nor I had examined the emotion-symptom correlations until after the illness was disclosed. It must be added that the subject had never before experienced this "disease" nor had ever had a secret relationship.

Subject 3's case is particularly dramatic and probably would not have caught anyone's attention except for the close covariation between the symptoms and the phone conversations with X. This case is also interesting in that it does not appear to be a simple problem of inference or misattribution. Whether the underlying explanation best fits a Freudian, Pavlovian, or other theoretical framework may be beyond the bounds of this book.¹ Nevertheless, the case does point to an interesting use of the within-subject paradigm: One can cross-reference one's symptoms to their presumed underlying or overt emotions.

¹ Various psychodynamic models have indicated that symptom formation and reporting is the result of the dissociation between an unpleasant and/or repressed emotion and its sensory components. Whether this process reflects a transfer of psychic energy (e.g., Gray, 1978) or other process has been discussed elsewhere (see Kenyon, 1964; Mayou, 1976).

Table 5.3 Statistically Significant Pearson Correlations for Emotions and Sensations for Subjects 1, 2, 3, and 4

Sensation	Subject 1						Subject 2							
	Hp	Ag	Sd	Gt	Af	Ts	Hl	Hp	Ag	Sd	Gt	Af	Ts	Hl
Headache											31			
Wat eye								-30		54	46			
Rac hrt						29								
Con nse												-40	50	
Tnse mus				31	36			-39	43		36		50	
Ups stom							-28	-48			45			
Flsh fce							-29	43						
Swty hnd	-27	26												
Shrt br								40						
Itch												31		
Cold hnd	-32		34			25								
Warm hnd	32	25				-33		46				-30	39	
Dizzy		26				-35						29		
Lmp thrt														
Light hd	26	26				-34							-29	
Tremble			25	51				32						
Tight stom					-41			-29				41	-31	

^aNote. Subject 3 developed the symptoms that are underlined (see text for explanation). By chance alone, six correlations for each subject should be statistically significant. Only those correlations that were significant ($p < .05$, two-tailed) are listed. Emotion abbreviations are as follows: Hp = happy, Ag = angry, Sd = sad, Gt = guilty, Af = afraid, Ts = tense, and Hl = healthy.

^bSubject 4 never reported experiencing the emotion "afraid".

Summary

Taken together, both the between-subjects and within-subject studies support the idea that people perceive specific constellations of symptoms as covarying with specific emotions. This perceptual specificity notion appears to be shared between groups of individuals (analogous to an implicit stimulus-response stereotypy) even though there is a certain degree of individual variation (similar to an implicit individual response stereotypy).

Could these specificity findings merely reflect linguistic conventions and/or schemas? That is, does a person who feels angry assume that anger-related symptoms are present? Debriefing subjects in both of the above studies suggests not. In the between-subjects (as in the within-subject) study, it was clear that people do not report pure emotions. A

Table 5.3 (continued)

	Subject 3 ^a						Subject 4 ^b								
	Hp	Ag	Sd	Gt	Af	Ts	Hl		Hp	Ag	Sd	Gt	Af	Ts	Hl
Headche				32			-35								-39
Wat eye			42				-39								
Rac hrt						28									39
Con nse				49			-37							30	
Tns mus	36	37		39	43										66
Ups stom			34		29										
Flsh fce				31											
Sweaty hnds							29								
Shrt brth							31								
Itch														39	
Cold hands															
Warm hands															
Dizzy			40			-43									
Lump thrt			29												
Light hd			30												
Tremble			28	40	54										39 -29
Tight stom	28		38		47	29									38

person who reported that he felt somewhat angry was also likely to report that he also felt somewhat happy. It is unlikely that the average subject was able to consciously or unconsciously compute the degree to which the various emotions should be related to the specific symptoms. This was most apparent in the within-subject experiment. After completing 40-80 symptom-emotion checklists, I asked the majority of subjects which symptoms they thought covaried with what emotions. All subjects reported that they had little or no idea, and further, that it was an impossible task to figure out, given the large number of symptoms and emotions on the checklist. Even the infamous Subject 3 had no idea which symptoms statistically covaried with guilt or tension even after the affair with X. These findings, then, indicate that perceptual specificity exists and is not entirely due to experimental demands or expectations.

Causal and Temporal Relationships Between Symptoms and Emotions

The above studies indicate that there is a clear covariation between perceptions of specific symptoms and specific emotions. From a theoretical perspective, it is interesting to ask if there is a causal connection between symptoms and emotions. Recall that some theorists believe that sensations of arousal are later labeled an emotion (Schachter & Singer, 1962), whereas others believe that a perceived emotion precedes the physiological activity and/or sensations (e.g., Graham, 1962). Other researchers, of course, posit that emotions and symptoms and/or physiological change occur at the same time and are identical (e.g., James, 1890) or relatively independent—in a causal sense (Cannon, 1931).

Most of these theories, of course, are more concerned with actual physiological change than with perception of that change. Nevertheless, it is interesting to know the temporal course in the perceptual cycle of the occurrence of symptoms and emotions. In this section, two relatively similar experiments were conducted with independent samples. In the first study, subjects were asked to try to make themselves feel one of several common emotions. Once the subjects had conjured up the emotion, they were asked to complete a symptom checklist. From the study, we were able to learn which symptoms tended to covary with each of the emotions. The second experiment required a separate group of subjects to try to make themselves feel one of several constellations of sensations (which had been derived from the previous study). After they had been given time to do this, they completed an emotion checklist. Each of these studies is discussed in detail below.

Emotion-to-Symptom Experiment

In the first of the two laboratory studies, 98 introductory psychology students were tested individually. On arrival at the laboratory, subjects were told to use whatever techniques they wanted in order to induce an emotion dictated by the experimenter. Subjects were randomly assigned to make themselves feel either fearful, sad, angry, guilty, joyous, embarrassed, or proud. Each subject was left alone for 2 minutes in order to conjure up the instructed emotion.

Two minutes later, the experimenter returned and asked the subject to try to maintain his or her present emotional state while completing a short questionnaire. All subjects were given a checklist consisting of 17 symptoms and the seven emotion items, all anchored along 7-point unipolar scales. All the items were headed with the statement “Right now, at this moment, I am experiencing:” Subjects were then debriefed in order to assess how they had accomplished feeling the emotion.

One-way analyses of variance were computed on the emotion manipulation checks. All came out as predicted except pride—which was indistinguishable from joy. In fact, during debriefing sessions most pride subjects reported that they could not separate pride from joy. Because all pride condition results were essentially identical to joy findings, the pride condition will not be discussed further.

Each sensation item was subjected to a one-way analysis of variance, using manipulated mood as the independent variable. Significant effects were found for all sensations except shortness of breath, cold hands, sweaty hands, trembling, and goose bumps. Table 5.4 presents the means of the sensations for the various emotions which are unique. If

Table 5.4 Unique Means for Each Sensation and Items for Which a Significant Correlation Emerged Between Self-Reports of Emotions and Sensations for Emotion-to-Symptom Study

Sensation	Manipulated emotion					
	Joy	Anger	Sadness	Guilt	Embarrassment	Fear
Queasy stomach	2.1		2.9	4.0		4.0
Tense stomach	2.6					4.8
Tight chest	2.5					4.1
Pressure or tension in head	1.9	4.1				
Watering eyes			3.8	2.1		3.6
Racing heart			3.3		5.4	
Tightness in jaw	2.2	4.1				4.5
Lump in throat	2.2			4.3		4.7
Flushed face	2.7					4.5
Warm all over	4.7		3.0			4.6
Light-headedness	3.9	2.0				
Tense muscles	3.2	4.8				

Note. A unique mean is one that is statistically different from the sum of the other means for that particular sensation. Boxed means indicate that the sensation item correlated with the emotion self-report in addition to there being a unique mean.

See text for explanation.

contrasts (using the mean-square error term) for the given condition indicated that the symptom for the specific emotion differed significantly ($p < .01$, two-tailed) from the other emotion cells, it was deemed unique. In addition to the analyses of variance, simple Pearson correlations were computed between the self-reported emotions and each of the sensation items. The boxed means in Table 5.4 indicate that there was a statistically significant correlation ($p < .01$) between the self-reported emotion and the symptom *in addition to* its being a unique mean. These cumbersome statistics were used in order to find the best match between perceived symptoms and emotions. Ideally, if a symptom truly covaried with a given emotion, the manipulation of the emotion should influence the symptom and, even when collapsing across all cells, a strong correlation between the symptom and emotion should obtain.

The summary sensation items which have unique means and significant correlations relative to the manipulated emotions are depicted in Table 5.5. As in previous studies, unique constellations of sensations appeared for each of the emotions. Although this study is not comparable to the previous ones in that different emotions and sensations were used, for those items that were included in the correlational studies, the results are, by and large, consistent.

One final result from this experiment deserves mention. Each subject was individually debriefed and asked how he or she went about conjuring up the appropriate emotion. Recall that we asked a large number of people to introspect to create an emotion in only 2 minutes. First, virtually no one reported having any trouble creating the manipulated emotion to at least some degree. Some were clearly more successful than others (e.g., a female in the sad condition who was wiping tears from her eyes; an initially pleasant male in the angry condition who was transformed into a red-faced, fist-clenching, and abrupt misanthrope by the time the experimenter returned). More interesting, however, was the way by which the majority of subjects made themselves experience their assigned emotion. About 60–70% of the subjects noted that they first had to think of a previous time when they were in a situation that evoked the mandated emotion. Only by reliving the prior scenario were they able to recreate the mood. No subject spontaneously said that he or she first felt the sensations and then the emotion. In fact, when asked about the temporal sequence of emotion and symptoms, most reported not thinking about symptoms at all until the experimenter had handed them the questionnaire at the end of the concentration period. The implications of the debrief information will be discussed at the end of the chapter. At this point, however, we can tentatively conclude that in the subjects' minds, the appearance of the emotion preceded the awareness of the sensations. In most cases, however, the perception of an emotion-provoking setting preceded everything.

The strength of this experiment is in showing that when mood is

Table 5.5 List of Sensations Derived from Emotion-to-Symptom Experiment
That Were Manipulated in Symptom-to-Emotion Experiment

Joy	Anger	Sadness	Guilt	Embarrassment	Fear
Light-headedness	Pressure in head	Watering eyes	Lump in throat	Flushed face	Tightness in chest
No queasy stomach	Tightness in jaw	No racing heart	Queasy stomach	Queasy stomach	Watering eyes
No pressure in head	Tense muscles	No queasy stomach	Racing heart	Racing heart	Tense stomach
No tense stomach			Tense jaws	Tense jaws	
No tightness in jaw			Lump in throat	Lump in throat	
			Warm all over	Warm all over	

artificially manipulated, subjects continue to demonstrate perceptual specificity. Unique constellations of perceived physical symptoms are associated with specific emotion. Clearly, a study such as this implies a causal/temporal relationship: Manipulated emotions cause self-reported symptoms. Before defending or debunking this idea, another experiment is presented that seeks to learn if the opposite temporal pattern can exist; that is, can perceived symptom clusters result in perceived emotions?

Symptom-to-Emotion Experiment

The basic idea of the next study was to learn if an induction of the sensation constellations corresponding to those found in the last study would result in specific reports of emotion. The paradigm used in this experiment was virtually identical. A total of 44 introductory psychology students were tested individually. None had participated in the previous experiment.

On arriving at the lab, a male experimenter escorted the subject to a cubicle and explained that he or she would receive a list of sensations. The subject was told that he or she should attempt to actually feel or experience the sensations. "We don't care how you do it. Simply try to make yourself feel the sensations that are on the list." As in the previous study, each subject was given 2 minutes. The symptoms that subjects were expected to feel were typed on an index card. Subjects were randomly assigned to one of six symptom constellation conditions (see Table 5.5).

The experimenter left for 2 minutes to allow the subject time to feel the appropriate symptoms. On returning, the experimenter instructed the subject to attempt to maintain the sensations he or she was currently feeling while completing an emotion checklist, which he gave to the subject. The checklist was composed of six emotions (fear, anger, guilt, sadness, joy, embarrassment), each of which was represented along a 7-point unipolar scale and was headed, "Right now, at this moment, I am feeling:" On completing the questionnaire, subjects were debriefed concerning how effective they were at inducing the specific symptoms and how they went about linking the sensations to any emotions.

The self-reported emotion items were subjected to one-way analyses of variance using the manipulated symptom constellation as the independent variable. As can be seen in Table 5.6, four of the six manipulations successfully increased the emotion self-report corresponding to the imagined sensation constellation. With the exception of the fear and embarrassment symptom manipulations, all analyses of variance were highly significant. Although not perfect, these data are impressive given the small sample size.

The debriefing data from the experiment also produced some in-

Table 5.6 Self-Reports of Emotion Items for Symptom-to-Emotion Experiment

		Manipulated sensations							
Perceived emotion	(Joy)	(Anger)	(Sadness)	(Guilt)	(Embarrassment)	(Fear)			
Lt hd	Tns hd	Wat eye	Lump thr	Flush fc	Tns chst				
No qs st	Tns jaw	No rac ht	Qs stom	Qs stom	Wat eye				
No tns hd	Tns mus	No qs st	Rac ht	Rac ht	Tns stom				
No tns st			Tns jaw						
No tns jaw			Lump thr						
			Warm						
Joy	<u>4.4^a</u>	1.3	3.0	2.6	2.1	1.7			
Anger	<u>2.0</u>	<u>5.3^a</u>	4.7	3.5	4.1	4.8			
Sadness	2.3	<u>2.4</u>	<u>4.6^a</u>	4.1	2.3	2.5			
Guilt	2.3	4.3	<u>1.9</u>	<u>5.1^a</u>	2.7	2.5			
Embarrassment	2.7	4.0	3.3	5.8	<u>3.7</u>	3.3			
Fear	1.7	3.6	2.0	4.7	<u>4.1</u>	4.2			
<i>n</i>	7	9	7	8	6	6			

^aMean is significantly greater than other means for that particular self-reported emotion (orthogonal contrasts using mean square error term, $p < .05$). The higher the mean, the greater the intensity of the self-reported emotion along the 7-point scale. The underlined means in the diagonal represent the self-report of the emotion from which the manipulated sensations were derived.

triguing information. First, most people did not have great difficulty in imagining their assigned sensations. The one problem for many subjects was that they were often not familiar with one or another of the symptoms in their assigned cluster. For example, two subjects in the anger condition noted that they did not know what "tense muscles" were! This difference in definition, interpretation, and perception of highly specific symptoms was discussed in Chapter 3. Another intriguing finding that surfaced during the debriefing sessions concerned how subjects completed the emotion checklist at the end of the experiment. Although the majority of subjects offered no information, about 18% of the subjects spontaneously mentioned that the way they decided on their emotion was *first* to think of the sensations, then to think of a situation in which they had felt the sensations before, and *then* to decide on the emotion. Other subjects (less than 10%) reported that they tried to feel the symptoms as though they were sick. However, when handed the emotion questionnaire, they found that their grouped symptoms were closely linked to one particular emotion (this was especially true for guilt). Both of these strategies indicate that the mere awareness of emotion-relevant sensations may not be sufficient information for the perception of emotion in all or even most cases. Interestingly, the first strategy mentioned by subjects wherein subjects first thought of the sensations, then the setting, and then the emotion is the same sequence posited by Schachter and Singer (1962). The second strategy, albeit more vague, indicates that subjects first adopted any type of schema in order to induce the symptoms and then searched for the most likely experimenter-presented schema that would explain the symptoms. In other words, the second strategy indicates that the presence of a group of symptoms or sensations readies the perceiver for a certain type of feeling, attribution, or schema—not unlike the preparedness concept of Seligman and Hager (1972).

Summary

The results of the symptom-to-emotion experiment complement those of the emotion-to-symptom study. Just as the perception of an emotion can result in the specific reporting of unique constellations of sensations, subjects who are given symptom clusters can identify them with their corresponding emotions. It could be argued, then, that either type of perception—emotion or symptom cluster—can precede the other. Further, the results imply that either state can be causally related to the other. To consider emotions and symptoms in cause and effect terms, however, may well be misleading.

A basic premise of this portion of the book is that emotion represents a way of categorizing or organizing symptoms or sensations. In all probability, the potential awareness of symptoms and emotions can

occur at the same time. One reason that it may not on occasions is that the individual does not or cannot attend to or analyze both classes of psychological states at the same time. This harkens back to a previous discussion of Gestalt principles. When I drink a cup of coffee, I often do not think about the water, coffee crystals, and nondairy creamer consisting of corn syrup solids, partially hydrogenated vegetable oils, and so on (thank God). Nevertheless, when thinking of the "elements," I am able to think of the higher order construct of coffee and vice versa. To say that one precedes the other in time is misleading in that the perception of the coffee and the constellation of coffee elements are, in a sense, the same thing.

The temporal/causal issue raised at the beginning of this section has evolved into something of a nonissue—at least for the time being. As will be discussed in the final pages of the chapter, the two experiments presented here have uncovered a host of complex but intriguing questions. Admittedly, both studies suffer from methodological weaknesses. Only a limited domain of symptoms and emotions was used. Having subjects imagine emotions or symptoms is not comparable to setting up situations or administering drugs that could manipulate feeling states. Although subjects reported that they were, by and large, successful at inducing the appropriate feeling states, we cannot be certain how they did it. A particularly important criticism and/or question raised by these studies is that we have merely demonstrated people's "implicit psychophysiology." That is, people *can* match sensations and emotions, but in everyday life they usually do not. Before addressing this issue directly, we must take one more empirical side road. What evidence do we have about the link between the perceived emotion and symptom reports and the underlying physiological activity? Obviously, if this is an implicit cognitive process, we should first check to see if there may be a true physiological basis.

Physiological Search for the Symptom-Emotion Link

One problem of the previous studies is that we have not measured any type of physiological activity. That perceptions of emotions and symptoms are closely intertwined suggests that there may be a physiological link. Additional credence must be given to this idea based on the large number of theories and findings indicating a link between emotion and measurable physiological activity (e.g., Ax, 1953; Libby, Lacey, & Lacey, 1973; Schachter, 1957; Wolf & Wolff, 1943). In an attempt to explore the possible physiological correlates of perceptual specificity, a series of clever experiments was conducted by J. A. Skelton (1981) as part of his dissertation.

In his research, Skelton conducted three experiments wherein he focused on two dissimilar mood states: revulsion and sexual arousal. In his first study, Skelton required a large sample (212 undergraduate males and females) to read a series of short vignettes depicting scenes that involved a gruesome car accident or a couple's engaging in sexual activity. Subjects were asked to rate the degree to which they would experience each of several physical symptoms if they had truly witnessed such a scene. In line with our previous research, Skelton found relatively independent symptom clusters associated with revulsion and sexual arousal. In a second laboratory study, Skelton was able to manipulate reactions to pictures of revolting or sexually arousing pictures by using false feedback of either sexually relevant symptoms (e.g., warm hands) or revulsion-relevant symptoms (e.g., tense stomach).

Most relevant to the present issues, however, was the third experiment, wherein subjects viewed a series of gruesome, sexually arousing, and neutral slides as part of a within-subject design. Throughout the study, subjects held a small box which consisted of two buttons. Subjects were told that they were to push one button whenever they felt any sensations indicating that their stomach was contracting, whereas they were to push the other button if they noticed any increase in the skin temperature of their hands. Previous studies had indicated that subjects associated stomach contractility with perceptions of revulsion and increased skin temperature with sexual arousal. Prior to and during the slide presentations, stomach motility (using an electrogastrogram—see Stern, Ray, & Davis, 1980) and skin temperature were continuously monitored and recorded from apparatus in an adjacent control room. Following each slide, subjects rated the degree to which they found each slide revolting or sexually arousing.

As predicted, subjects pressed the stomach and temperature buttons at different rates as a function of the types of slide they were viewing. In general, sexually arousing slides caused subjects to press the skin temperature button at a higher rate. Revulsion slides produced an opposite pattern. Interestingly, the neutral slides resulted in subjects' not pressing either button. These data, then, again support the perceptual specificity idea. Unlike the previous studies, however, the responses were overt behaviors that were thought (by the subjects) to be objectively monitored. In addition, the responses were made to external stimuli which had previously been rated as extremely arousing, shocking, and depressing (for revolting slides) or titillating (for sexually arousing slides).

The physiological data were not statistically related to the button presses, self-reports, nature of slides, or any other parameters that were measured. Whether analyzed in a between- or within-subjects manner, there was no evidence that the button presses that purportedly represented perceptions of stomach contraction or skin temperature were in fact related to these objective measures.

The physiological findings from the Skelton data tend to corroborate the general patterns of results reported in Chapter 4. That is, people were by and large not accurate in estimating changes in either skin temperature or stomach motility. Nevertheless, the *perceptions* of temperature and motility were directly related to ratings of the slides. In other words, perceptual specificity between emotions and symptoms can occur independently of underlying physiological processes. As has been discussed in earlier chapters, data such as these leave the researcher in a quandary. Where *do* these perceived emotion-symptom links come from? Do they merely reflect inference, linguistic convention, or other "cold" cognitive process?

Toward an Understanding of the Emotion-Symptom Link

In this chapter, a number of issues have been introduced that are relevant to the *perceptual specificity hypothesis*, that is, the idea that perceptions of emotion covary with perceptions of unique patterns of physical symptoms. Although the various studies that have been presented indicate that specificity does exist, we have not adequately explained why it occurs and its prevalence in the real world. Finally, there has been no mention of the theoretical or practical applications of these findings. Each of these topics will be discussed in this final section.

That clusters of symptoms appear to covary with specific emotions confirms the general cognitive organization concept discussed at the beginning of the chapter. The failure to find any physiological bases to these links was, on one level, perfectly consistent with the general pattern of results in Chapter 4 and, on another level, disturbing. We have shown that both between-and within-subject designs indicate this specificity. Does it merely reflect linguistic convention and/or early learning? Similarly, do reports of symptoms and emotions, as they relate to each other, represent an inference as opposed to a direct perceptual process? Several bits of evidence can help us answer these questions.

In all probability, the results reported here do not simply reflect linguistic convention. Perhaps the strongest evidence for this can be seen in the within-subject study wherein different subjects evidenced unique symptom-emotion clusters. Interestingly, when subjects in that study were debriefed, they typically were unable to verbalize what symptoms statistically covaried with each of their emotions. Similarly, the large between-subjects correlational study required all subjects to complete the questionnaire only once. Because any one person's moods or emotions are typically not pure, it would be difficult to complete the emotion-symptom checklist in line with linguistic convention. (A good example of this problem would be for the reader to complete the symptom checklist in Appendix A. Although it would probably be sim-

ple to complete the questionnaire so as to reflect linguistic conventions when in extreme and pure emotion states, it would be extremely difficult to do so otherwise.) It should be noted that the results of the emotion-to-symptom and symptom-to-emotion between-subjects experiments probably do tap underlying belief structures or linguistic convention to a far greater extent.

Even if our understanding of the relationship between perceived emotion and symptoms is to some degree learned, how has it evolved? Clearly, there must be some physiological basis. As pointed out earlier in the chapter, a number of researchers *have* found physiological differences that distinguish certain basic emotions—such as fear and anger (see Plutchik, 1980, for review). It is also self-evident that people do in fact blush when embarrassed, clench fists when angry, and even vomit when confronted with especially upsetting scenes. Most of these occurrences, however, require the arousal of the particular emotion to an extreme degree. In relatively benign and nonthreatening laboratory settings, the person may perceive a given emotion to a limited degree and infer that he or she is responding physiologically in a corresponding manner, when in fact such is not the case. It should also be noted that a person may not need to experience any one of these emotions to an extreme degree in order to be able to associate certain symptoms with certain emotions. Merely observing others flush, clench, vomit, shake, rattle, or roll may be sufficient grounds for inferring emotion-symptom links for one's self. To summarize the physiological issue, then, subjects *may* be inferring emotion-symptom links based on learning or linguistic convention much, if not most, of the time. Nevertheless, it is extremely likely that these inferences have had at some time a true physiological base. (Chapter 6 discusses this issue in detail.)

A related issue concerns the prevalence of occurrence of the perceptual specificity of emotion. As the various studies have indicated, people *can* report which symptoms are associated with which emotions. Nevertheless, *do* people use symptom information in deciding upon their emotion, and vice versa? Research findings suggest that they do. For example, Ross et al. (1969) found that manipulations of different types of perceived symptoms resulted in perceptions of different emotions, which in turn caused different types of behaviors. In fact, one could argue that the bulk of the misattribution of emotion research that has evolved from Schachter and Singer (1962) supports the idea that people use symptom information—at least to some degree—in defining emotion state. Less empirical work has examined when perceptions of emotion result in perceptions of specific symptoms.

Ironically, a central problem pointed out at the beginning of the chapter is one that has persisted—even thrived—in reviewing the research presented thus far: the problem of definition of emotion. To say that an emotion is merely a constellation of sensations is naive and incom-

plete. Environmental and situational factors are often prerequisites for the perception of either emotions or symptoms. Recall that most of the subjects in the emotion-to-symptom study conjured up an emotion by first thinking of a specific situation. Conversely, in the symptom-to-emotion experiment *at least 18%* of the subjects traced their sensations to a situation before defining the self-reported emotion. Does this mean that all emotion states require the perception of a situation? Both human and animal research indicates that the answer is no.

Certain feeling states, for example, can be perceived without situational appraisal. We can feel tense, anxious, sick, thirsty, and so on without ferreting out a specific situational cause. These feeling states, then, are highly dependent on the perception of clusters of elemental symptom information. Other more complex emotional states, however, are probably far more dependent on situational information. It may be useful to think of emotion states along a continuum which requires increasing situational information from specific sensations, to broader feeling states composed of symptom constellations (e.g., tension), to emotions composed of symptom constellations and environmental information (e.g., guilt, jealousy). The more complex the emotion, then, the more situational information may be necessary in order to perceive it. Interestingly, a comparable argument has been made concerning the perception of emotion in others based on facial expression. That is, we can usually ascertain another person's general mood (e.g., positive or negative) by looking at facial expression alone. However, if we see their expression within the context of their environment, we can deduce subtler shades of their emotional state (cf. Ekman & Friesen, 1975).

A final issue raised by the data in this chapter deals with potential applications of our being able to assess emotion-symptom links. In recent years, remarkable strides have been made in the field of psychopharmacology in the development of drugs that appear to effectively control both emotion perception and expression. By and large, their effectiveness is attributable to their central nervous system effects. The present research indicates that drugs that induce peripheral autonomic changes may also effectively affect mood perception. In other words, with increasing technology, we may be able to perfect a drug that selectively causes the perception of such things as a lump in the throat and a queasy stomach—thereby making the patient feel guilty!

More intriguing (and perhaps more likely) is the possible application of the within-subject technique to psychotherapy. That many people cannot or do not accurately read or understand their physical symptoms and emotions is one of the few points of agreement among most psychotherapists. Often physical symptoms are presented without the patient's ability to assess what emotions—if any—they may represent (e.g., anxiety neuroses, hysterias). Presumably the person cannot or is unable or unwilling to attribute the symptoms to the appropriate cause.

Both the therapist and patient would benefit if they knew which symptoms tended to covary with which emotions. Unfortunately, each subject or patient appears to evince unique symptom-emotion relationships, thus ruling out a grand cross-reference chart. By completing symptom-emotion checklists for a few days, one could learn when the offending symptoms were aroused as a function of both emotion and setting. It is interesting to note that the assumptions of this approach are consistent with psychodynamic, behavioral, and even humanistic perspectives.

Summary

This chapter has discussed one way by which simple physical symptoms and sensations can be organized into broader constructs such as emotions. Several studies indicated that separate emotions tend to covary with unique constellations of physical symptoms. This relationship between symptoms and emotions—referred to as perceptual specificity—is correlational and, to at least some degree, causal. That is, manipulations of symptom clusters result in self-reported emotions and vice versa. Although perception of emotion is closely linked to symptom perception, it is also partially dependent on situational information—particularly when more complex emotions are considered. Finally, the one study that explicitly measured physiological activity while monitoring perceived symptom-emotion relationships found no evidence that perceptual specificity is dependent on autonomic activity. Although this may typically be the case for mild moods or emotions, the evidence that specific emotions are related to specific physiological change is overwhelming. We must ultimately examine extreme emotions in learning the etiology or basis for inference of the perceptual specificity phenomenon. The following chapter will address this issue in far greater detail.

Chapter 6

Cognitive Organization II: Blood Pressure and Blood Glucose

The research in the preceding chapter indicated that physical symptoms can be organized into higher order categories such as emotions. The symptoms, then, can work as elements or building blocks in the construction of bodily state. A perplexing finding that hinders our understanding of the cognitive organization idea is that—to this point—we have not found strong physiological correlates of specific symptoms or symptom constellations. Although it was hypothesized that the original organization of symptoms into emotional categories was based on physiological and motoric activity during times of extreme emotions, the day-to-day perception of moods or symptoms reflected an inference process.

Are symptoms *ever* cognitively organized based on underlying physiological parameters? Some recent findings suggest that the answer is yes. In this chapter, a series of studies will be presented that indicate that people report constellations of symptoms that reliably covary with such physiological measures as systolic blood pressure and blood glucose. Using within-subject designs in both the laboratory and field, we are learning that these physiologically based symptom clusters are unique from subject to subject and are often unrelated to subjects' beliefs about their body's behavior. In presenting the various findings, theories, and implications, it is necessary first to introduce the basic paradigm and results associated with our blood pressure experiments and related blood glucose studies. Data related to subjects' actual and perceived cognitive organization of symptoms—relative to physiological state—will follow. Finally, a number of theoretical and applied implications of this research will conclude the chapter.

Blood Pressure and Blood Glucose Research Projects

In previous chapters, specific symptoms have not correlated highly with specific autonomic indices. Nevertheless, it may be reasonable to assume that clusters of symptoms may covary with *gross* physiological measures that affect a number of sensory systems (as opposed to specific physiological activity that would influence only one system). As noted above, we typically perceive higher order body states as opposed to highly discrete symptoms. Given this, it is possible that certain physiological parameters that influence several parts or systems of the body may affect constellations of symptoms (and hence higher order body states). In recent years, there have been occasional within-subject findings to support this view. For example, Borg (1962) was particularly interested in perceived fatigue and exertion relative to objective physiological measures among athletes. Starting with Borg, a number of researchers have begun finding that certain gross physiological parameters were highly correlated with perceived exertion but that highly specific measures (e.g., heart rate, skin conductance) were not related. In an excellent review of the literature, Mihevic (1981) summarizes a large number of experiments that link oxygen consumption and blood lactate levels, but not more specific autonomic measures, to Borg's exertion-fatigue measure.

The idea that symptom clusters may be related to gross physiological activity has a certain intuitive appeal. Further, it suggests that physiology-symptom relationships may be especially strong when within-subject analyses are used. In contemplating the gross physiological change idea, my students and I began to consider the various types of physiological changes that acted on a large part of the body, that could easily be measured outside of the lab, and if possible that were related to a major health risk. As the title of this chapter indicates, we quickly agreed that blood pressure may be an interesting, important, and potentially useful anatomical system that might be related to symptom clusters. Our choice of measures was indeed profitable.

Historically, fluctuations in blood pressure have been considered to be asymptomatic. Most physicians are careful to warn their hypertensive patients always to take their medication, since they cannot rely on physical symptoms to signal changes in their blood pressure. These cautions, on one level, are well founded and accurate. Across several studies, researchers have not found consistent relationships between perceived symptoms and blood pressure (BP). For example, some researchers report that elevated BP is associated with increased symptom reporting (Wood, Elias, Schultz, & Pentz, 1978); others report the opposite pattern (Tibblin, Lindstrom, & Ander, 1972). One researcher notes that among the various symptoms that he has examined, only perceptions of breathlessness are consistently related to elevated BP among

hypertensives (Robinson, 1969). Others (e.g., Adelman, 1978; Filenius & Kocher, 1979) report that hypertensives do report various symptoms when submitting to treatment and that once medication has been initiated the symptoms diminish. Taken together, then, these and many other similar studies indicate that there are not any consistent or reliable symptom-BP relationships.

This conclusion is based on a fascinating logical fallacy. Researchers, physicians, and even patients typically assume that the symptoms of a given disease will be common to all victims of the disease. Methodologically speaking, we are trained to view symptom-physiology relationships in a between-subjects manner. Although this approach is usually sufficient for disorders such as influenza, ulcers, or broken bones, it may not be useful in dealing with diseases that have more subtle, progressive, and nonlocalized physiological effects. More ambiguous physiological systems—such as blood pressure or blood glucose—may be highly influential in the development of symptom reporting and organization. As discussed in earlier chapters, subjects differ considerably in the ways that they attend to, organize, and define most physical symptoms. These between-subject differences, then, could mask true covariations between blood pressure and symptom reports. The best way to learn if there are unique, individually specific patterns between BP and symptoms was to conduct a series of within-subject experiments.

In this section of the chapter, several studies will be briefly presented that trace our thinking about the within-subject relationships between symptom reports and physiological measures. The first studies examined symptom-BP relationships in both field and laboratory settings (from Pennebaker et al., 1982). Our success with blood pressure prompted us to examine another “asymptomatic” disorder—blood glucose variations in diabetics (from Pennebaker, Cox, Gonder-Frederick, Wunsch, Evans, & Pohl, 1981). These two research programs have now spawned a whole new generation of research issues and problems.

Blood Pressure Project

Blood pressure field study. The first experiment that was conducted using a within-subject design by us employed nine subjects, ranging in age from 20 to 45. In the study, subjects were required to complete a symptom-emotion checklist consisting of 18 symptoms and 11 emotions 8-15 times per day for 4-5 days. The checklist required subjects to rate the degree to which they were currently experiencing each item along a 7-point unipolar scale. After completing each checklist, subjects took their own BP using a portable Lumi-Tronic III sphygmomanometer. All subjects were instructed not to look at their checklist responses or BP readings following each recording period. It should be noted that

Table 6.1 Summary of Data for Naturalistic BP Study

Subject no.	Sex	Age	Mean BP	Symptom-SBP			Emotion-SBP		
				#	Highest	Item	#	Highest	Item
1	M	29	120/61	9	+.62	Racing hrt	0	—	—
2	M	29	118/65	6	+.68	Sweaty hnd	1	+.56	Energetic
3	F	20	106/64	7	+.60	Short brth	2	-.37	Guilty
4	F	21	123/61	3	+.55	Racing hrt	1	+.32	Tense
5	M	21	115/59	1	+.61	Cold hands	2	+.30	Tense
6	F	22	121/73	3	+.46	Warm hands	2	+.58	Afraid
7	M	33	127/85	5	+.62	Tense musc	4	+.62	Angry
8	M	29	121/65	4	-.42	Tight stom	2	+.40	Sadness
9	F	45	103/63	4	+.50	Racing hrt	4	+.51	Energetic

Note. # indicates the total number of statistically significant simple Pearson correlations for the particular subject. There were a total of 18 symptom-SBP and symptom-DBP correlations and 11 emotion-SBP and emotion-DBP correlations for each subject. From Pennebaker et al. (1982, study 2).

the subjects included four faculty members (including me), two graduate students, and three undergraduate research assistants.

Each subject's data were analyzed separately. For each subject, the 18 symptom and 11 emotion self-reports were correlated with systolic blood pressure (SBP) and with diastolic blood pressure (DBP), thus yielding a total of 18 symptom-SBP, 11 emotion-SBP, 18 symptom-DBP, and 11 emotion-DBP Pearson correlations.¹

A summary of the highest correlations for each subject is presented in Table 6.1. Several interesting points are raised by these data. First, the symptom-SBP correlations were by and large high for most subjects. In addition, the symptoms that were the highest differed from subject to subject. Second, the symptom-SBP correlations were higher than emotion-SBP, symptom-DBP, and emotion-DBP relationships. Finally, the sheer number of significant relationships varied considerably from person to person.

¹ Systolic and diastolic blood pressure reflect two related measures of cardiovascular activity: SBP represents the force with which blood is pumped in the body with each stroke of the heart; DBP is best thought of as the general level of pressure in the arterial system before each heartbeat. Both SBP and DBP vary as a function of peripheral resistance (e.g., the degree to which arteries are dilated or constricted), blood volume, and stroke volume of the heart. In general, SBP is more sensitive to immediate changes in sympathetic and parasympathetic activity, postural changes, and so on. DBP, on the other hand, changes more slowly over a longer period of time. Although both SBP and DBP have been shown to be related to heart disease, current thinking suggests that DBP is a slightly better predictor of heart attacks (e.g., Guyton, 1976).

Table 6.1 (continued)

Subject no.	Sex	Age	Mean BP	Symptom-DBP			Emotion-DBP		
				#	Highest	Item	#	Highest	Item
1	M	29	120/61	2	-.34	Flush face	3	-.34	Sadness
2	M	29	118/65	1	-.35	Headache	0	—	—
3	F	20	106/64	4	-.39	Lump in thrt	2	+.34	Sadness
4	F	21	123/61	6	+.52	Racing hrt	3	+.55	Tense
5	M	21	115/59	1	-.34	Cold hands	2	-.34	Happy
6	F	22	121/73	1	+.39	Light-headness	0	—	—
7	M	33	127/85	4	+.47	Trembling	0	—	—
8	M	29	121/65	4	+.39	Sweaty hands	2	+.44	Energetic
9	F	45	103/63	3	+.47	Upset stom	6	+.68	Energetic

Not only were the magnitudes of specific correlations quite variable across subjects, but the patterns of SBP correlations differed to a marked degree. These differential patterns are illustrated in Figure 6.1 for 9 of

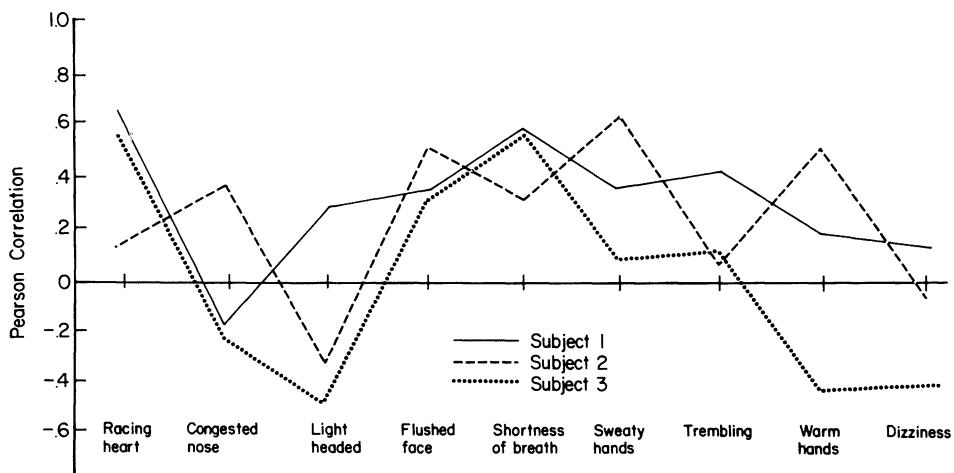


Figure 6.1 Simple correlations between selected physical symptoms and systolic blood pressure for three subjects. From J.W. Pennebaker, L.A. Gonder-Frederick, H. Stewart, L. Elfman, & J.A. Skelton, Physical symptoms associated with blood pressure. *Psychophysiology*, 1981, 19, 201-210. Copyright 1982 by the Society for Psychophysiological Research. Reprinted with permission of the publisher and authors.

the 18 symptom-SBP correlations for the first three subjects. This trend holds true for all nine subjects. In fact, among all symptom-SBP correlations, not one correlation was in the same direction for all subjects. If the data are collapsed across subjects, the highest mean symptom-SBP correlation was a +.23 for "shortness of breath"—which is comparable to Robinson's (1969) finding that between-subject analyses indicated that only self-reported breathlessness was related to high blood pressure.

A number of other analyses were conducted on these data. For example, each subject's symptom data were subjected to principal components oblique rotation factor analyses. Each of the nine data sets yielded between three and six factors. For seven of the nine subjects, one of the factors perfectly mirrored the two or three symptoms most highly correlated with SBP for that subject. This indicates that SBP uniquely covaries with a perceptible constellation of symptoms. The importance of this finding as it pertains to the issue of cognitive organization will be discussed in detail later in the chapter.

Another type of analysis that was conducted with these data involved correlating subjects' behaviors (e.g., exercising, drinking alcohol or caffeine, smoking) with BP as well as with other self-reports. These kinds of analyses allowed us to evaluate immediate physiological and psychological effects of behaviors and settings. For example, at the time the study was conducted Subject 1 smoked 10–15 cigarettes a day, whereas Subject 7 smoked about two packs per day. Smoking correlated +.50 with SBP for Subject 1 and was unrelated to BP for Subject 7. These data were influential in ultimately motivating Subject 1 to stop smoking. Comparable analyses have been computed in order to examine coffee drinking, exercising, and other habits. The interested reader is referred to the excellent work of Csikszentmihalyi, Larson, and Prescott (1977) for a number of creative applications of a similar paradigm.

One question that we originally had about the within-subject data concerned its reliability over time. Exactly 1 year after the initial BP study, two of the subjects (Subjects 1 and 2) participated in the experiment again. Subject 1 was aware of the symptoms that had correlated with SBP, whereas Subject 2 was not aware. In addition, each subject's life-style had changed in several ways from the previous year (e.g., Subject 1 had stopped smoking; Subject 2 had started). Both subjects were asked to estimate their BP prior to each measurement. In order to assess the reliabilities of the symptom-BP and emotion-BP correlations, the correlation matrices from the first year were correlated with the matrices of the second year. The symptom-SBP correlation matrices were highly reliable for both subjects (Subject 1, $r = .72$; Subject 2, $r = .71$). The emotion-SBP, symptom-DBP, and emotion-DBP correlations were not significantly related for the 2 years. These data indicate that the general symptom-SBP patterns are relatively stable over 1 year.

Finally, each subject's estimated BPs were correlated with his actual

BPs for the follow-up study. Subject 1—who knew which symptoms covaried—was highly accurate in his estimations of SBP ($r = .83$, $p < .001$) but not of DBP ($r = .33$, $p = .06$). Subject 2—who did not know what symptoms correlated with BP—could not reliably estimate either SBP ($r = .32$, $p = .09$) or DBP ($r = .06$, ns). Although these data are based on only two subjects, they suggest that the patterns of correlations with SBP are consistent over time and may help subjects estimate their SBP levels.

In sum, the first symptom-SBP within-subject field study was extremely encouraging. One problem, however, was that we were not able to know why there were such high within-subject correlations that varied so much from subject to subject. One possibility, analogous to the individual response stereotypy concept presented in Chapter 5, is that individuals respond uniquely to stress. Whereas one person may respond to stress by increased SBP, reduced heart rate, and lowered stomach activity, a second person could respond to the same stressor with increased SBP, no change in heart rate, increased stomach activity, and increases in skin conductance. In other words, people may differ in the degree to which they emit unique and specific patterns of autonomic responding that are correlated with SBP (e.g., Lacey, 1959). This explanation assumes that different symptoms correlate with specific physiological indices that, in turn, correlate highly with SBP. Consequently, one person whose self-reported racing heart correlates with SBP is a person whose actual heart rate covaries with SBP. The following laboratory study was conducted in order to test this idea.

Blood pressure laboratory study. In order to test the individual response stereotypy idea as an explanation for the unique symptom-SBP relationships, the laboratory experiment required subjects to participate in a large number of tasks while we measured SBP, DBP, skin resistance (GSR), heart rate (HR), and skin temperature (which was indirectly measured by finger pulse volume, or FPV). At each of 40 points in the study, each of these physiological measures was collected at about the same time that we collected self-reports of various symptoms including sweaty hands (a concomitant of GSR), fast pulse (HR), and warm hands (FPV).² If individual response stereotypy underlies the individual differences pertaining to the symptom-SBP relationships, then for any

²Note that GSR and FPV are not direct measures of sweaty hands and warm hands, respectively. For example, electrodermal activity can be sensitive to changes in potassium levels rather than to absolute amount of perspiration on the hands of resting subjects (Christie & Venables, 1971). Although within-subject correlations between GSR and palmar sweat are highly correlated (Wilcott, 1962), GSR can only be considered an indirect measure of hand perspiration. A similar argument can be made about the relationship between FPV and perceived warm hands. Consequently, these measures should be viewed as rough correlates of perceived sensations.

symptom that covaries with SBP, its autonomic referent should also correlate with SBP. Of course, the experiment was designed to test additional issues related to the symptom-SBP phenomenon, such as the role of individual differences or of attentional factors as possible mediators.

In the study, 30 normotensive undergraduates (15 male and 15 female) participated in 20 tasks and 20 baseline sessions. Following each task and baseline session, self-reports of seven physical symptoms were called out by the subject. Four of the 9-point scales were unipolar: no sweaty hands-sweaty hands, no pounding heart-pounding heart, no heavy breathing-heavy breathing, and no tense stomach-tense stomach. The remaining three were bipolar: slow pulse-fast pulse, cold hands-warm hands, and muscles relaxed-muscles tense. Immediately after the self-reports had been called out orally, the various physiological measures were obtained by the experimenters in the adjacent control room. Skin resistance and FPV were measured by sensors placed on the subject's left hand and recorded on separate channels of a Grass polygraph.³ Heart rate and BP were obtained from the subject's right arm by using a Gulf-Western SD-600 Blood Pressure Monitor. The cuff microphone

³ Both GSR and FPV were recorded by means of a Grass Model 7 polygraph. GSR was recorded from the second phalanges of the first and third fingers of the subject's left hand using Beckman Ag/AgCl electrodes. A 10-mA constant current was used for all GSR recordings. Pulse volume was recorded from a Grass PTTL photoelectric plethysmograph placed on the tip of the middle finger of the left hand. The plethysmograph was connected to a Grass 7P5 preamplifier. Signals were integrated by a Grass 7P10 integrator set on a 10-sec reset mode with slow AC coupling.

GSR is expressed in ohms. Hence, the higher the number, the greater the resistance (i.e., the less eccrine gland activity). FPV was assessed by the total pen deflection (in centimeters) that occurred during the 10 sec after the subject had called out the self-reports. Because pen deflection is influenced by the amount of blood in the fingertip as well as by heart rate, the total deflection was divided by actual heart rate during the 10-sec interval. Note that this measure cannot be standardized between subjects. It can only be used to assess relative changes over time for each subject individually. This problem is corrected for by the fact that within-subject analyses are used. Finally, the FPV scores were also analyzed without dividing by heart rate, on the assumption that perceptions of warm hands may be based on the total amount of blood circulating in the finger. These analyses produced almost identical patterns of correlations as the standard FPV measure.

It should be noted that GSR and FPV were continuously recorded and coded at three times for each self-report. The first measurements were taken immediately prior to the request for the symptom report. A second measurement was taken as soon as the subject had called out the first rating response (sweaty hands). Immediately following completion of the symptom reports, the blood pressure/pulse cuff was inflated. When a tone signaled that the BP and HR measures were accurate (deflation of the cuff took 20-30 sec), a third measure of GSR and FPV was obtained. Since the intercorrelations among the three separate measurements of GSR and FPV were high (mean intercorrelation for each measure averaged +.95), only the third recordings were used in the data analyses, since this period was temporally closest to the BP and HR readings.

was placed directly on the subject's brachial artery and was inflated from the adjacent control room.

The subjects, who were tested individually, participated in 20 tasks, each lasting from 1 to 2 minutes. The tasks were presented in the same order for all subjects. The tasks varied considerably in their content and effectiveness in manipulating actual and perceived physiological activity. The tasks included viewing slides (depressing, gory, sexually arousing, boring, peaceful), listening to sounds over headphones (loud aversive noise bursts; "ultrasonic noise," described in Chapter 3; interesting street sounds, described in Chapter 2), participating in various tasks (manual dexterity, word memory, mental arithmetic), and undergoing an assortment of physical "exercises" (relaxation training, hyperventilation, holding breath, running in place for 2 minutes, immersing foot in ice water for 1 minute). Between each task was a 2-minute baseline period wherein the subject was told to sit quietly. Although the experiment lasted slightly over 2 hours for each subject, most found it to be interesting. (Only one subject fell asleep during the relaxation exercise.)

The data were analyzed in two general ways. The first approach was the standard between-subjects analysis wherein each subject's mean self-reported symptoms and BP were correlated. As can be seen in Table 6.2, this approach yielded no significant relationships between symptoms and blood pressure—thus corroborating the traditional view that blood pressure fluctuations are asymptomatic. The second approach involved analyzing each subject's data separately. As in the previous study, the within-subject analyses involved correlating the self-reported symptoms with SBP for each subject across the 40 observations. The results from the within-subject analyses corroborate the findings of the previous study. Of the 30 subjects, 23 had at least one statistically significant simple correlation (corrected for experimentwise error rate). Further,

Table 6.2 Between-Subjects Correlations in
Laboratory Blood Pressure Study

Self-reports	Physiological measures				
	SBP	DBP	HR	GSR	FPV
Sweaty hands	.01	.01	.14	-.26	.10
Pounding heart	.12	.15	.08	.04	.11
Heavy breathing	.13	.24	.04	.07	.16
Tense stomach	-.01	.13	.07	-.09	.16
Fast pulse	-.12	.07	.21	-.24	-.01
Warm hands	-.19	-.26	-.14	-.34	.40*
Tense muscles	-.11	.17	.11	-.09	-.02

Note. The asterisk means that r (28 df) is significant at $p < .05$.

From Pennebaker et al. (1982).

almost half of the subjects (13 of the 30) had at least one correlation that was greater than or equal to +.70.

In addition to the simple correlations, multiple regression analyses were performed for each subject using SBP as the criterion variable and the seven symptom items as the predictors. These analyses were intended to determine the total variance accounted for (multiple R^2) by the symptom items rather than to reflect the relative contributions of the separate symptoms themselves. As can be seen in Table 6.3, the multiple R^2 's were extremely high for most subjects (the R^2 statistic must attain a level of .32 or higher in order to be significant).

As in the previous study, the general patterns of correlations differed from subject to subject. For example, Subject 1 had six significant correlations, whereas Subject 2 had only one. The specific items that were correlated with SBP also varied considerably. Interestingly, of the seven symptom items, three—heavy breathing, pounding heart, and fast pulse—tended to be high for the majority of subjects. It is noteworthy that the symptom of heavy breathing, which was significant for 18 of the 30 subjects, was also related to SBP in the previous study as well.

Three other findings should be briefly mentioned. First, internal analyses of the symptom-SBP correlations indicated that they were highly reliable.⁴ Second, although the table indicates that males evidenced higher symptom-SBP correlations than females, this finding is probably due to the greater variability of SBP among males (cf. Manuck & Garland, 1979). When a partial correlation is computed between sex and the R^2 statistic partialling out the effect of SBP variability, the sex- R^2 relationship disappears. These results, then, suggest that greater SBP lability may facilitate perception of related physical symptoms (see Chapter 4 for a discussion of autonomic lability and perception). It is interesting to note that hypertension in its early stages is characterized by increasing variability in blood pressure (Engel & Bickford, 1961). Other than SBP variability and sex, no other individual difference measures (e.g., Type A-B, self-consciousness, general symptom reporting) were related to the symptom-SBP relationships. The third finding was that symptoms were more highly correlated with SBP than any of the other physiological measures. In fact, multiple R^2 data were computed between the seven symptoms and each of the physiological measures for each subject (i.e., five sets of multiple regression analyses were computed for each subject, corresponding to each of the physio-

⁴The technique for testing reliability is a variation on the split half procedure. The data for the 40 observation periods were randomly divided into two groups of 20 for each subject. For each of the halves, the seven symptom-SBP simple correlations were computed. These two sets of seven correlations were then correlated with each other for each subject, thus yielding one reliability correlation coefficient for each subject. The mean reliability correlation across all subjects between the two sets of seven correlations was +.35, which is significantly greater than 0, $t(28) = 4.49, p < .001$.

logical measures). Averaging the R^2 statistic across all 30 subjects indicated that the mean total variances accounted for by the seven symptoms were as follows: SBP = .51, DBP = .29, HR = .35, GSR = .39, and FPV = .37.

The observant reader will quickly note that three of the columns (GSR-SH, HR-FP, FPV-WH) in Table 6.3 were also presented in Chapter 4 in the discussion of the accuracy issue. Inspection of these columns relative to the simple symptom-SBP correlations discloses that the individual response stereotypy explanation cannot account for the high within-subject symptom-SBP relationships. This is true for at least two reasons. First, the individual response stereotypy explanation assumes that people are accurate in reporting autonomic activity. The data do not support this assumption. Second, if this explanation were true, the magnitudes of the correlation coefficients between the various autonomic measures of HR, FPV, and GSR with SBP should be as high as or higher than the self-report-SBP correlations. Again, this was not the case. Mean within-subject correlations with SBP were .02 with GSR, .28 with HR, and .03 with FPV. Taken together, these data indicate that an individual response stereotypy explanation is at best incomplete. Alternative explanations will be discussed in the final section of the chapter.

Summary of blood pressure studies. Both experiments indicate that physical symptoms covary with SBP on a within-subject basis. There are large individual differences in the specific symptoms that are related to SBP. The laboratory experiment indicated that symptoms are more highly related to SBP than to DBP, HR, GSR, or FPV. At this point, we do not have any evidence to suggest that the reason that different symptoms are highly correlated with SBP is that people accurately perceive other autonomic indices that are themselves covarying with SBP. Before discussing the implications of these data, we will present another line of within-subject research related to another physiological index.

Blood Glucose and Diabetes Project

The success of the within-subject BP studies encouraged us to examine another disorder that has been considered to be partially asymptomatic—diabetes.⁵ As in the case of hypertension, the patient with

⁵ Although there are different types of diabetes, our patients suffer from diabetes mellitus. This type of diabetes can have an onset in either childhood or adulthood. Diabetes is considered to be a disease characterized by a failure of the regulation and metabolism of glucose in the cells—which is the primary source of nutrient and energy. In most cases, diabetics do not secrete insulin properly, perhaps as a result of functional pancreatic problems. Insulin is a hormone which allows the glucose to pass from the bloodstream into cell bodies. Without insulin, glucose builds up in and is confined to the blood supply, while the cells are starving for it. An injection of insulin enables the glucose to enter the cells. (See American Diabetes Association, 1981).

Table 6.3 Summary of Within-Subject Simple Correlations for Laboratory Blood Pressure Experiment

Subject	Sex	Mean BP ^a	SBP correlations with ^b							Multiple R^2			
			SH	PH	HB	TS	FP	WH	TM				
1	M	117/70	49	72	75	77	60	00	63	37	58	48	76
2	M	124/93	45	07	-06	11	11	18	22	82	-17	-40	57
3	M	149/84	26	64	68	71	58	13	45	-29	-21	63	72
4	M	125/86	03	67	74	45	66	-05	-16	21	67	21	78
5	M	132/86	08	40	64	22	40	-01	52	12	34	68	46
6	M	126/78	-03	05	24	28	50	-02	34	00	35	23	38
7	M	113/79	61	69	72	46	71	69	51	-02	-07	46	64
8	M	104/75	44	66	70	72	29	33	36	33	-11	22	64
9	M	116/78	09	29	43	02	32	16	22	-36	42	18	28
10	M	116/87	29	58	64	27	71	06	79	46	59	-02	74
11	M	130/84	-04	47	63	29	51	00	58	70	41	13	58
12	M	117/88	84	47	81	58	55	79	63	-31	01	40	80
13	M	131/93	02	32	25	34	27	-14	04	-17	41	66	48
14	M	134/67	01	76	73	66	70	13	78	-16	16	07	67
15	M	105/78	15	-07	-06	-28	-17	-24	-19	20	57	-49	20
16	F	114/88	21	68	48	13	58	00	37	-04	16	14	66
17	F	100/79	06	69	71	48	57	31	46	-44	52	-45	69
18	F	103/71	16	44	46	36	50	37	25	-40	-11	-12	38
19	F	108/77	05	04	13	54	39	12	23	28	07	-14	34
20	F	117/81	24	29	-30	35	36	25	44	22	45	-02	25
21	F	106/71	00	38	37	-12	33	-11	-01	00	-11	02	32
22	F	110/76	48	26	23	28	08	42	35	66	02	-24	34
23	F	99/71	14	-03	-01	00	30	07	00	-08	00	17	13

24	F	110/82	-20	26	12	01	27	-12	32	16	14	51	27
25	F	122/90	31	34	48	25	27	23	36	-07	05	07	32
26	F	122/80	50	67	71	48	46	09	39	-22	34	65	56
27	F	99/73	-18	74	79	04	69	-02	35	-17	45	19	64
28	F	133/85	-12	52	55	-20	47	05	61	-12	07	11	57
29	F	135/107	01	-15	17	09	36	04	37	-28	-14	38	39
30	F	111/74	17	21	05	02	15	-06	20	13	06	25	42

Note. For any of the seven SBP-symptom correlations to attain significance ($p < .05$, two tailed), r must exceed $\pm .42$. For any of the three correlations GSR-SH, HR-FP, or FPV-WH to attain significance ($p < .05$, one tailed), r must be less than $-.31$ for GSR-SH or greater than $+.31$ for HR-FP and FPV-WH. For multiple R^2 to be statistically significant ($p < .05$, $7/22 df$), R^2 must be equal to or greater than $.32$. From Pennebaker et al. (1982)

aThe mean BPs are averaged over all 40 trials.

bSH = sweaty hands, PH = pounding heart, HB = heavy breathing, TS = tense stomach, FP = fast pulse, WH = warm hands, TM = tense muscles.

diabetes is not able to pinpoint which symptoms are indicative of need for medication and hence must rely on monitoring systems external to the body (e.g., urine or blood glucose tests). Although in the most extreme cases blood glucose (BG) levels are associated with salient physical effects (coma, severe hunger), in less extreme instances the potentially dangerous physiological effects of BG are far more difficult to perceive.

One problem that has plagued both the patient and researcher is that until recently, the diabetic had to rely on urine measures in order to assess glucose or insulin levels in the body. This technique has a number of shortcomings, the most notable being that it is not a completely reliable indicator of the patient's present level of glucose in the blood (e.g., Evans & Pohl, 1980; Ikeda, Tajima, Mimami, Ido, Yokoyanna, & Abe, 1978). Fortunately, a new technique is now commercially available that directly measures BG. This procedure requires the subject to lance his or her finger for a small blood sample, which is placed on a stick and inserted into a portable device which displays the BG level on a digital light-emitting diode (LED) meter. Because diabetes is such an insidious disease, patients are often required to measure their BG levels several times per day in order to maintain their glucose and insulin levels within an acceptable range.

The research that we conducted used a group of 30 insulin-dependent diabetics (11 males and 19 females) who were hospitalized while undergoing a 2-week training program intended to teach them how to monitor BG levels accurately by means of a portable Ames Dextrometer. After learning how to use the Dextrometer, the patients sampled their glucose levels seven times a day for 5-10 days. Prior to measuring BG, patients completed a symptom checklist consisting of items thought to be relevant to BG for the majority of subjects (see Table 6.3 for list of items). In addition to the 19 standard items, each subject added up to four symptoms that he or she thought might be related to BG levels. It should be noted that the patients completed the questionnaires in the hospital in the diabetic unit. Consequently, these results do not reflect a standardized lab setting or the subject's own day-to-day experience.

The results of the experiment were analyzed in much the same way as for the other within-subject projects. As in the blood pressure studies, most subjects evinced several statistically significant symptom-BG correlations. Over half of the subjects had at least one simple correlation that exceeded $\pm .50$. From a statistical standpoint, the BG data are difficult to interpret because very high and very low levels of glucose can be associated with reported symptoms. Interestingly, within-subject analyses indicated that symptoms were, by and large, only linearly related to BG. That is, a given symptom would typically be associated either with high BG or with low BG, but not with both high and low. As can be seen in Table 6.4, the various symptoms were related to either high or low BG, depending on the subject. For example, some symptoms were correlated with low BG for a large number of subjects (e.g., per-

Table 6.4 Summary of Symptom Responses for Blood Glucose Study

Symptom	Mean	SD	% associating symptom ^a		Total
			LBG	HBG	
Trembling (tr)	1.6	.84	33.3	0	33.3
Pounding heart (ph)	1.3	1.07	16.7	0	16.7
Flushed face (ff)	1.3	.84	10.0	3.3	13.3
Light-headedness (lh)	1.5	1.17	20.0	0	20.0
Sweating (sw)	1.5	1.31	13.3	0	13.3
Fast pulse (fp)	1.3	1.02	16.7	0	16.7
Dry nose, eyes, or mouth (dm)	1.7	1.21	0	23.3	23.3
Fatigue (fa)	2.0	1.61	6.7	6.7	13.3
Queasy stomach (qs)	1.3	.96	3.3	6.7	10.0
Hungry (hu)	2.3	1.8	53.3	0	53.3
Heavy breathing (hb)	1.2	.84	3.3	3.3	6.7
Tense (tn)	1.7	1.38	10.0	6.7	16.7
Alert (al)	5.0	2.14	3.3	0	3.3
Sleepy (sl)	2.6	1.97	10.0	0	10.0
Sweet taste (se)	1.2	.72	6.7	13.3	20.0
Weakness (wk)	2.0	1.70	26.7	6.7	33.3
Salivation (sa)	2.3	1.93	3.3	6.7	10.0
Anxious or nervous (ax)	2.0	1.64	3.3	3.3	6.7
Hopeful or optimistic about treatment or training (hp)	5.5	2.0	10.0	0	10.0

Note. Mean and standard deviation (SD) for each symptom are based on all subjects' data. All self-reported symptoms were checked along 7-point unipolar scales where, for example, 1 = no trembling and 7 = trembling. The last column presents the total percentage of subjects with correlations of less than $-.40$ or greater than $+.40$. From Pennebaker, Cox, Gonder-Frederick, Wunsch, Evans, and Pohl (1981).

^aThese columns refer to the percentage of subjects who had a correlation of $-.40$ or lower with the symptom and BG (LBG column), or evidenced a correlation of $+.40$ or higher with the symptom and BG (HBG column).

ceived hunger was related to low BG for 53.3% of the subjects). One symptom, dry nose or mouth, was significantly correlated with high BG for 23.3%. Finally, 9 of the 19 symptoms were related to both high and low BG for at least some of the subjects.

It should be emphasized that the particular symptoms that were correlated with BG varied considerably from subject to subject in both direction and magnitude (see Table 6.5). In addition to the simple correlations, stepwise multiple regression analyses were computed for each subject using BG as the criterion and only five of the symptoms as predictors. (The best five symptoms were selected, based on the assumption that more than five would not have much practical utility in training

Table 6.5 Summary of Symptom and BG Data Analyzed by Subject

Subject no.	Sex	Age	N	BG level		Highest symptom-BG <i>r</i> 's				
				Mean	SD	1	2	3	R ²	
1	F	27	39	157	81	-34ph	-34fp	-30hu	.29	.04
4	F	33	33	151	90	88dm	67se	-27sl	.80	.00
10	M	24	36	129	63	-46hu	-43tr	-38wk	.32	.03
11	F	27	36	161	78	-74hu	62dm	59qs	.75	.00
12	F	26	37	116	67	-65hu	57tn	41fa	.65	.00
13	M	39	38	141	58	-77tr	-74ph	-71fp	.76	.00
14	F	21	36	156	71	-51tr	-50fp	-50sl	.48	.00
20	F	15	35	150	90	-53tr	-46sl	42sa	.63	.00
22	F	56	78	159	99	-47tr	-44ph	-44sw	.27	.00
24	F	32	47	99	57	-42sl	-38sw	-15sa	.33	.00
25	F	65	51	150	103	-48sw	-47wk	-43lh	.50	.00
26	F	34	72	185	101	66dm	31ax	-24al	.53	.00
30	M	55	46	145	82	-57hu	-49se	-27ff	.57	.00
31	F	23	61	150	74	-55tr	-42wk	-40hp	.43	.00
32	M	43	65	249	120	74ff	66fa	66dm	.77	.00
33	M	31	38	99	56	50wk	46dm	-46hu	.53	.00
40	F	30	53	155	77	-30hu	-23qs	-17se	.20	.06
41	F	27	67	181	110	65dm	-62hu	60qs	.74	.00
42	F	23	54	132	78	32qs	-31hu	23al	.24	.02
43	F	31	67	93	46	-36wk	-31hu	-30fa	.24	.00
50	F	24	53	179	99	-72lh	-66hu	-64wk	.66	.00
52	M	39	53	142	77	36se	34dm	-33hu	.46	.00
53	M	57	60	138	71	-48lh	-46hu	-45tr	.46	.00
54	F	27	35	272	52	50se	-47fa	43dm	.54	.00
60	F	30	58	168	82	-44wk	-42hu	-37tr	.37	.00
61	M	16	55	100	59	-70hu	-60tr	-49wk	.60	.00
62	M	21	52	168	79	47ax	-42fp	-40hu	.55	.00
63	M	21	56	122	69	-44hu	39al	-37wk	.41	.00
65	F	32	43	154	73	-33fa	-32wk	31ax	.33	.01
66	M	31	52	126	67	-58ax	-42hu	-37hp	.65	.00

Note. N denotes the number of times that the subject properly completed the symptom checklist and measured BG. Letters after the symptom-BG *r*'s are abbreviations for specific symptoms. See Table 6.4 for symptom name. The *p* column refers to the significance level of the R² statistic. A *p* listed as .00 is significant at *p* < .01. From Pennebaker, Cox, Gonder-Frederick, Wunsch, Evans, and Pohl (1981).

subjects to use symptoms in evaluating their BG levels.) With one exception, all subjects evinced significant R² statistics. The reader should be somewhat wary of the high R² values. Recall that we have selected the best 5 symptoms from a total of 19 in attempting to optimize the multiple correlation with BG. In order to assess the role of chance, 30 additional multiple regressions were computed by using random numbers and controlling for number of observations. Again these regressions

were computed by a stepwise procedure selecting 5 of 19 sets of random numbers. Whereas the mean R^2 for the subjects' true data was .50, the approach with random numbers yielded a mean R^2 of .26. Hence, the reader should be cautious in assuming that we are accounting for 50% of the variance, since comparable analyses with random numbers account for 26% of the variance.

The results from this initial project with diabetics have prompted Daniel J. Cox, Linda Gonder-Frederick, Stephen Pohl, and me to pursue further studies with these and other diabetic subjects. Since the initial project, we have asked 24 of the original subjects to monitor BG and complete symptom checklists at home on two occasions 6 months apart. Because we are interested in the reliability of the technique, we have not told the subjects which symptoms were in fact correlated with BG. Since the first in-hospital test of the symptom-BG relationships, we have found that the correlations have remained remarkably stable. Overall, the mean correlation between symptom and BG patterns has been +.51 from hospital to the first home assessment (6 months later). These data are particularly encouraging based on the fact that the reliability of the technique is only weakly related to subjects' beliefs or expectations about which symptoms they think are related to BG. As will be discussed in the following section, our expectation data suggest that it is highly unlikely that our subjects are "faking good" for us.

One can readily deduce the direction that can be taken from research such as this. Ideally, one can learn which physical symptoms are associated with which physiological changes and ultimately use these symptoms to regulate behavior. There are a number of potential dangers, however. The first is that people will rely exclusively on symptoms in order to determine when medication should be taken and how much to take. This could lead to serious health consequences, since physical symptoms can be misperceived, depending on a large number of situational factors. Another potential problem is that telling patients which symptoms are related to blood pressure or blood glucose will cause them to become overattentive to the symptoms, which will in turn cause them to worry excessively, which in turn could elevate blood pressure or blood glucose (for a discussion of comparable types of exacerbation cycles see Storms & McCaul, 1976). We are currently testing these potential problems.

Bases of Cognitive Organization: Through the Looking Glass

The results of the blood pressure and blood glucose research add another perspective to the cognitive organization issue. Previous chapters have indicated that people's reports of symptoms correlate poorly with the physiological bases of the symptoms. In this chapter, however, we have indicated that clusters of symptoms correlate quite highly with

presumed “imperceptible” physiological measures. Lewis Carroll would undoubtedly agree that things are getting curiouser and curiouser.

In this section we will pursue the nature of symptom organization in light of the BP and BG findings. Three general issues are discussed. The first concerns the relative independence of BP and BG symptoms on a within-subject basis. That is, we must first know if these two general physiological changes produce unique or common symptom clusters. Second, it is imperative to learn if clusters of symptoms associated with a given physiological measure constitute a stable and coherent mathematical factor. Finally, we will discuss the relationship between people’s empirical symptom organization and their beliefs about symptom organization. As will be seen, the “naive theories” or implicit beliefs about symptoms associated with BP or BG may be partially valid—depending on your perspective.

Blood Pressure Versus Blood Glucose Symptoms

Before we can make any statements about symptoms being organized—at least in part—along physiological lines, we must review the data that have been presented thus far. Recall that we have found that symptoms tend to covary with BP and BG among separate groups of subjects. Perhaps people tend to report the same types of symptoms in response to *any* physiological change. Hence, if there is any marked change in BP, BG, or any other general system, the person will report one general cluster of symptoms. If this were true, it would suggest that perception of physiological state tends to activate one general symptom-related schema.

In an effort to test this idea, Linda Gonder-Frederick (1981) conducted a within-subject experiment wherein 18 insulin-dependent diabetics completed a symptom checklist prior to having both BP and BG measured. Although the subjects measured their own BG, a trained experimenter (who was blind to both checklist and BG responses) measured BP. This procedure was repeated approximately seven times per day for 5 consecutive days. On completion of the study, each subject’s 19 self-reported symptoms were correlated with both BP and BG readings. If symptom reporting reflected a tendency of subjects to report a common constellation of symptoms in response to any given physiological change, then it would be predicted that the symptoms that covaried with glucose would be the same as those covarying with systolic blood pressure.

The results of the Gonder-Frederick study indicated that, for the majority of subjects, fluctuations in BP and BG produced independent symptom clusters. This was tested by correlating each subject’s symptom-BG and symptom-SBP correlation matrices with each other. (For no subject was the BG and SBP simple correlation statistically signifi-

cant.) For 12 of the 18 subjects, correlations between the symptom-BG and symptom-SBP matrices did not approach significance (r 's ranging from $-.36$ to $+.37$). The remaining six subjects, however, evinced correlations that were significant and of high magnitude (the six subjects' r 's = $.85, .64, .60, .58, -.59, -.64$). Note that four of the six subjects' symptom-SBP correlations were positively associated with high BG-related symptoms, whereas the remaining two subjects evinced an opposite pattern.

It should be noted that there were some interesting methodological issues in this research. Of particular importance was that the study was conducted in the hospital where the staff was actively attempting to control BG during treatment. In addition, subjects' activity and stress levels should have not been as variable as in the real world, thus resulting in a restricted range of SBP lability. Nevertheless, comparison of BG and SBP standard deviations of this sample with our other studies indicated that they were comparable. Despite these problems, the research with a sample such as this is valuable in that diabetics are more prone to cardiovascular problems than normals (e.g., Guyton, 1976). As will be discussed later in this chapter, it may be possible to train diabetics to discriminate BG from SBP symptoms after undergoing a within-subject training procedure at home (as opposed to the hospital).

To summarize, the Gonder-Frederick study suggests that for the majority of subjects, separate constellations of symptoms covary with BG and SBP. Symptom reporting then is not a unidimensional process prompted by any gross physiological change. Note that all of these within-subject studies have demonstrated an empirical link between a physiological measure with self-reported symptoms. Our next question concerns the empirical symptom-physiology relationship.

Factor Structure of Symptoms

In this and the previous chapter, we have been focusing on how self-reported physical symptoms can be organized. The statistically oriented reader may wonder why no factor analyses have been presented, since in theory such analyses would indicate how symptoms statistically cluster together. As might be expected, between-subjects factor analyses of symptom checklists have never yielded coherent or stable factors (e.g., Pennebaker & Skelton, 1978). This holds true for different types of symptom checklists and different settings in which the checklists are completed. In other words, between-subjects factor analyses do *not* yield symptom clusters that mirror emotion-relevant symptoms, nor even symptoms that one might expect would cluster based on underlying anatomy or physiology (e.g., cardiovascular vs. gastrointestinal symptom clusters).

Within-subject factor analyses, however, have yielded stable, unique,

and often interpretable symptom clusters. For example, in the naturalistic BP study discussed earlier that involved nine subjects, principal components oblique rotation factor analyses yielded a BP factor for seven of the nine subjects. That is, factor analyses on each subject's symptom data yielded from three to six factors (with each factor consisting of an average of 2.5 symptoms), one of which consisted of the symptom items that were most highly correlated with SBP. Interviews with each of the subjects disclosed that the remaining factors appeared to reflect a combination of emotions, settings, and/or physiological imbalance. Whereas one of the subject's factors (made up of the flushed face, warm hands, dizziness, and sweating hands) mirrored her condition when she returned to her non-air-conditioned apartment each night during the summer, another's factor (which included watering eyes, racing heart, and upset stomach) reflected feelings of depression that he was periodically experiencing at the time. In other words, the factor structure of each person's reported symptoms was highly idiosyncratic. Although most had one symptom cluster that covaried with SBP, the remaining clusters *may* have mirrored either another physiological state or setting or mood.

Factor analyses were also computed on the symptom data of each of the subjects who participated in Gonder-Frederick's (1981) BG/BP study. Of the 18 subjects in the study, 7 had separate symptom clusters that mirrored both BG and BP symptom relationships. Another 5 subjects had at least one factor that reflected the simple correlations with one of the two physiological measures. The remaining 6 subjects' factor analysis data could only be politely labeled as uninterpretable.

It should be noted that the various factor analyses are exploratory and not the final word. In all cases, we have analyzed too few subjects' data. Further, each subject's data set has comprised too few observations with too many symptom variables. Nevertheless, the preliminary findings are encouraging. On a within-subject basis, the majority of subjects demonstrate statistically coherent symptom clusters. In addition to mirroring probable physiological indices (e.g., SBP and BG changes), the symptom clusters appear to reflect different settings and moods for different individuals. Note that these are *statistical* clusters and not necessarily *perceived* clusters. As the following section indicates, they too may be relatively independent.

Naiveté of Naive Theories

All of us hold certain beliefs about various aspects of our bodies. Some of these beliefs, or naive theories, concern anatomy; others are related to symptoms and pathological condition. Often a naive theory can lead to objectively harmful behavior. For example, if you believe that insanity or headaches are caused by evil spirits trapped in the skull,

it would make good sense to drill a hole in one's head in order to let them out. In fact, the early Romans held such theories, which undoubtedly resulted in some rather unpleasant skull operations. Excellent compendia of modern-day naive theories of anatomy held by patients have been discussed by Kaplan (1981) and Cohen (1981).

Of particular relevance to the present chapter has been recent research indicating that individuals hold various theories about the symptoms they believe are characteristic of specific diseases. Without question, some of the most important work in this vein has been conducted by Howard Leventhal and his colleagues (e.g., Leventhal, Nerenz, & Straus, 1980; Leventhal & Nerenz, 1981; Leventhal, Meyer, & Gutmann, 1980). Much of their work deals with the beliefs that hypertensives hold concerning perceptions of symptoms that they think covary with BP. In the research, hypertensives are individually interviewed about any symptoms that they personally think are related to hypertension. Although most hypertensive patients initially say that, of course, hypertension is an asymptomatic disease—at least according to their physician—further prodding by the interviewers indicates that the vast majority hold one of three different theories of hypertension. One group assumes that hypertension is a form of heart disease, and thus they are highly attentive to heart-related sensations, such as pulse rate. A second group views hypertension as a general arterial disorder, which prompts them to monitor fluctuations in numbness or coldness in the limbs. The final group holds that hypertension is the result of uncontrolled emotions. As such, these patients are especially attentive to their emotions and emotion-related symptoms. These intriguing differences in beliefs have also been shown to be related to medication use. That is, the hypertensive patients will take BP medication when the symptoms underlying their naive theories are present (Leventhal & Nerenz, 1981).

The obvious question from these findings is: Are the hypertensives' naive theories accurate? The within-subject experiments indicate that people do exhibit unique constellations of symptoms that covary with SBP. Consequently, the naive theories may not be so naive after all. Unfortunately, the data are not yet in concerning the possible truth of naive theories among hypertensives. However, Linda Gonder-Frederick, Dan Cox, and I have begun examining the accuracy of similar naive theories concerning fluctuations in blood glucose among diabetics. Preliminary findings suggest that there is a kernel of truth to naive theories—but treatment tends to invalidate them.

In order to test the validity of naive theories, a sample of 18 diabetics who had participated in the hospital study were asked to complete abbreviated symptom checklists (with 10 symptom items, of which 6 were standard for all subjects and 4 others were selected for their statistical relation to the particular subject's BG) prior to taking BG levels at home at least 40 times over a 2-week period. In addition—as part of the

reliability study discussed earlier in this chapter—subjects participated in this phase of the research on two occasions that were, on the average, 6 months apart. In other words, each of the 18 subjects completed symptom-BG records at three different times: once in the hospital and twice at home. Subjects were never told which symptoms were statistically related to their BG readings.

One month after subjects had completed the final phase of the symptom-BG recordings, they were contacted again by the experimenters and asked to rate the degree to which they thought each of the 10 symptoms that had been on their symptom checklist was related to both hypoglycemia (low BG) and to hyperglycemia (high BG) along separate 7-point scales. Each subject's rating of each symptom (hereafter referred to as the belief scale) was then correlated with that subject's three symptom-BG correlation matrices, reflecting the three separate occasions on which the subject had undergone the within-subject procedure. Fortunately, the belief scale can be reduced from two separate scales (high vs. low BG) to one by subtracting the low-BG responses from the high-BG ones. When all analyses were computed, then, each subject had three simple correlation coefficients with the belief scale that reflected the correspondence of the naive theory of glucose-relevant symptoms with the empirical symptoms collected 1 year earlier (in the hospital), over 6 months earlier (collected at home), and 1 month earlier (also collected at home).

The results of these analyses indicated that subjects' naive theories were surprisingly accurate relative to their *first* being hospitalized. Their accuracy, however, diminished substantially over time. The mean correlations, collapsed across the 18 subjects, with the belief scale were .62 with the initial hospital recordings; .49 with the first home recordings; .21 with the second—and most recent—home recordings. If we analyze these on a case-by-case basis, we find that 13 of the 18 subjects had statistically significant (using a liberal criterion of $p < .05$, one-tailed test) correlations between the belief scale and initial hospital correlation matrices, whereas only 5 of the 18 were significant for the second home recording period. These data indicate that naive theories become less valid with treatment and/or with experience with symptom-BG rating procedures.

In-depth analyses of these findings have yielded an intriguing explanation for this rather peculiar pattern of results. The patients in our research entered treatment because of their uncontrolled BG. Even though all had used urine testing in order to get an idea of BG levels in the past, the patients had not been successful in moderating their glucose with self-administered insulin injections. As a result of extreme variations in BG levels, most of the patients apparently learned which symptoms tended to covary with BG. Since beginning to use the BG apparatus regularly, the majority of patients' glucose levels have moderated. In addition, the symptoms that covary with their BG have changed

(as evidenced by the reduction in reliability of symptom-BG patterns over time). Note that for virtually all subjects, even though BG and symptom reports are less variable, different symptom-BG simple correlations obtain significance. *Nevertheless, the patients' beliefs have not altered!* In other words, the initially accurate naive theories have transformed themselves into truly naive theories.

Our findings, then, complement those of Leventhal and colleagues. Although beliefs about symptoms may be based on true underlying physiological processes, they are also dependent on enduring, and perhaps inflexible, cognitive structures. Once a naive theory has been adopted by a patient, it may be extremely unlikely that the patient will independently form a new theory as his or her symptom-BG relationships alter. The results of this study with 18 subjects, then, offer an explanation of how symptoms can become cognitively organized and why, under certain conditions, their organization does not map underlying physiological processes. Further implications of these findings will be discussed in the final section of the chapter.

Summary

In this section, a great deal of hard and soft data has been presented. In general, symptoms that covary with one type of general physiological change (blood glucose) are not the same symptoms that covary with other physiological indices (blood pressure). Factor analyses of symptoms appear to be related to physiological, situational, and even emotional variables on a within-subject basis. The considerable individual variation in the nature of these clusters explains why no stable symptom factors emerge when responses to symptom checklists are examined in a between-subjects manner. Finally, empirical organization of symptoms does not necessarily reflect the perceived organization of symptoms. As the naive theory results indicate, subjects' beliefs or theories about the organization of symptoms *can* be used on physiological processes. This organization, however, can persist even as the physiological bases disappear. In other words, presumed symptom organization can be independent of empirical organization. These various findings have several implications.

Conclusions and Implications

Symptom reporting is clearly not a random process. Further, symptoms are usually not perceived and reported in isolation. Rather, they are cognitively and empirically organized in meaningful ways. In this section, some of the basic rules of symptom organization will be reviewed. Following the discussion of the cognitive organization of symptoms,

various implications of the blood pressure and blood glucose studies will be presented. I will conclude the chapter with one final “curtain call” for the within-subject paradigm.

Cognitive Organization Revisited

What are the rules for the organization of symptoms? The answer to this question has evolved into a complex series of issues, which include cognitive versus empirical organization; hierarchical structure; and developmental-personality-physiological bases. Each of these interdependent facets will be discussed separately.

In considering symptom organization, it must not be forgotten that how we think symptoms are organized does not always fit the way they are empirically organized. As will be recalled from Chapter 5, between-subjects experiments indicated that people hold common schemas about the organization of symptoms as they relate to emotions. These commonly held beliefs about symptom organization, however, do not typically obtain when within-subject emotion-symptom correlations are computed. Perhaps the most striking example pointing to the disparity of cognitive versus empirical organization was seen with the blood glucose studies wherein beliefs about glucose-relevant symptoms had in fact been relatively accurate a year prior to the study. However, as subjects had changed physiologically and/or their empirical symptom-physiology links had changed, their initial beliefs remained intact. Finally, Leventhal's data indicate that the ways by which we cognitively organize symptoms may be more dependent on our knowledge of cardiovascular anatomy (or preconceptions of such anatomy) than on the “true” way by which symptoms are organized. Note that perceived and actual organizations of symptoms undoubtedly overlap much of the time.

If we briefly ignore the cognitive versus empirical distinction, we can begin to see some general hierarchical rules of symptom organization. First, symptoms cluster together in the formation of higher order body states. Anxiety, for example, could be the sum of a number of symptoms, such as tense muscles and trembling. As noted earlier, we may actually experience anxiety and, only after introspection, note the component sensations. Second, there are tremendous individual differences in the ways by which people organize symptoms. For example, when we have shown our subjects their symptom clusters (derived from within-subject factor analyses), they will often say, “Oh yes, now that you mention it, I get that symptom cluster whenever I'm in such-and-such a situation.” When we grill our subjects in greater detail, we find that the symptom cluster in question does not have a name (i.e., it is not a labeled emotion) and it may not occur in just one setting. Rather, it is a common feeling for that particular person. Perhaps further research will discover that such symptom clusters only occur for “generic”

settings, for example, whenever the person feels threatened, content, or hostile (a la Graham, 1972). Third, symptom organization probably reflects both an inference and a direct perceptual process. That a person reports symptoms A, B, and Q as a stable symptom cluster does not necessarily mean that all three symptoms were directly perceived. Given the results of the laboratory blood pressure study, it may make more sense to say that perhaps one of the symptoms was directly perceived and the remaining two were inferred from the first. Although this is an empirical question, it would simply not be efficient for the organism to perceive or reconstruct higher order feelings from component symptoms every time it confronted another situation.

The fourth general issue concerning symptom organization is that we need to refine our methodological and mathematical tools substantially before we can advance our understanding. For example, we have proposed that symptom organization may be additive (i.e., symptoms $A + M + Q = \text{experience } X$). Clearly, none of our mathematical models fit such an assumption. We have also tried to consider symptom organization as a Gestalt process—that is, the sum of symptoms is not equal to the higher order experience. As intuitively plausible as this assumption may be, it suffers from a mystical, non-testable image. Perhaps other ways of thinking are in order. For example, if we borrow the atom-molecule distinction from chemistry, we may be able to view higher order experience as a three- or multidimensional structuring of symptoms. Alternatively, we may need to expand our within-subject procedures in order to get hundreds or thousands of self-reports over a shorter period of time. In so doing, we may learn that higher order experience may not have common labels. Recall the example of the symptom clusters as being familiar to subjects (i.e., the “feeling I get when I come home from work and there is no air conditioner” experience) but having no name. Continued research along these lines, then, may indicate that our true units of study are not things such as emotion or hunger. Rather, perceived and empirical body experience consists of clusters of symptom, situational, and other types of information (see Plutchik, 1980, for examples). At this point, then, our general hierarchical rules of symptom organization can be expanded in a number of directions before the rules themselves can be deemed hierarchical.

The final issue concerning the organization of symptoms deals with the underlying bases and evolution of symptom organization. The blood glucose research indicated that the cognitive organization of symptoms can have a physiological base. The same data also demonstrated that once the schema or organization is adopted by the individual it tends to endure. As discussed in Chapter 3, other factors undoubtedly influence how we structure symptoms (e.g., reading, seeing, hearing about body experiences). We are not yet in a position to know when we will use our own physiological information in the construction of symp-

tom clusters. In all probability, extreme physiological reactions (as have probably occurred with most insulin-dependent diabetics in our sample) can establish enduring symptom schemas. A good example of this was told to me by a medical psychologist. This person, who was site visiting a hospital, began to experience extreme chest pains. Fearing a heart attack, the person rushed to the cardiovascular unit where his EKG (electrocardiogram) was taken. The physicians deduced that the problem was merely a muscle spasm unrelated to the heart. Since that time, the person has told me, he has become hypochondriacal about heart and numbness sensations. That one physiologically based experience, then, indelibly established a way by which to organize his symptoms.

It must, of course, be emphasized that any type of symptom organization is unique to each person. Because we all function differently physiologically and have different developmental and perceptual experiences, it is not surprising to learn that we have never found two people whose symptoms have clustered together in the same ways. It is possible that certain individual difference measures may predict this organization to some degree, but at this point we have not found this to be the case.

Implications of the Blood Pressure and Glucose Research

The discussion of the cognitive organization issues should not obscure some of the theoretical and applied issues that have been generated by the blood pressure and glucose studies. In this section, three questions will be addressed: Why do symptoms covary with BP and BG? Why do a large number of symptoms covary more highly with SBP than with any other physiological measures that we have used? What are the practical applications of this research?

In many respects, it is peculiar that so many symptoms covary with fluctuations in SBP and, to a lesser degree, BG levels. We do not have a common language for SBP and its symptoms. Systolic blood pressure, unlike flushing or trembling, cannot be immediately recognized by others. Perhaps more significant is that it cannot be localized, as with a headache or even tense muscles. Finally, we must acknowledge that for the majority of individuals SBP per se is not being perceived; rather, its accompanying symptoms are the percepts. That statistically both SBP and BG appear to be responsible for a coherent cluster of symptoms indicates that changes in these physiological indices represent common bodily experiences for most people.

As discussed earlier, the fact that symptoms covary with SBP and BG may be due, in part, to both direct perceptual and inference processes. The perception-based individual response stereotypy argument (which was based on the premise that subjects are accurate in perceiving other autonomic channels) did not receive strong support. Logically, some of the SBP symptoms are directly perceived given that SBP reflects the fact that blood is circulating throughout the body with varying amounts

of force. Increased force, then, may cause receptors in the chest, neck, head, or eyes to fire. This receptor activity would then be represented in perception. This explanation is particularly relevant to the high correlations between self-reported racing heart and/or fast pulse with SBP level (see Chapter 4). Other self-reported symptoms such as heavy breathing could also reflect changes in actual breathing rate or volume, since changes in oxygen consumption are directly linked to BP regulation (Guyton, 1976).

Although the direct perception argument may explain many of the symptom-SBP and even symptom-BG simple correlations, this type of explanation is limited in that a number of cardiovascularly-irrelevant symptoms (e.g., tense stomach) were also highly correlated with SBP. Undoubtedly, subjects were also inferring many of the symptoms that they were reporting. The inference process was working in at least two ways. The first assumes that subjects were attentive to the situations that they were in and concluded that they must be feeling certain symptoms. These conclusions or inferences may have truly covaried with changes in physiological state. A good example can be seen in the glucose study. If subjects had not eaten breakfast and then noticed that it was noon, most could have inferred that they were hungry (*a la* Schachter & Rodin, 1974) without directly perceiving hunger at all. At the same time, it would not be at all surprising that the subject's BG level would be lower than normal. Note that these inferences could be coincidental or based on past experience with extreme physiological state. The second way that inference processes could explain why symptoms covary so highly with these physiological states is that people infer the presence of some symptoms from the direct perception of others. As noted earlier in this and previous chapters, a person who might directly perceive a symptom such as a pounding heart may then infer that his or her face is flushed. In all probability, of course, the covariance of symptoms with SBP and BG is the result of a combination of perception and inference processes.

One of the most curious and intriguing aspects of the BP research was the magnitude of the correlations between symptoms and SBP. Ironically, far from being asymptomatic, SBP fluctuations were statistically more related to all symptoms than any other measure that we have ever used. A clear implication of this finding is that SBP (and to a lesser extent BG level) is a central determinant of physical symptoms. Of course, SBP affects the entire body to a greater extent than most other single autonomic measures. Both SBP and its regulatory concomitants (e.g., breathing rate, vasodilation, water retention) directly and indirectly affect a large number of sensory systems. Perhaps we have stumbled across a mythical holy grail within psychology: a physiological measure of the construct of arousal or drive state. Only future studies that employ SBP as a dependent measure can verify such an idea.

Beyond the theoretical issues raised by these research projects, a

clear implication is that individuals do have symptoms that appear to covary with SBP, BG, and perhaps other heretofore "asymptomatic" physiological processes. Among the major problems with all diseases that do not have common symptoms are that they are difficult to diagnose, and once they are diagnosed, it is difficult to convince the patient to comply with medical regimens. A particularly graphic example concerns the person who learns that he is hypertensive and then submits to medication. Typically, the first phase of treatment will be to prescribe drugs that will give the patient unpleasant symptoms (e.g., increased need to urinate, dizziness). In other words, the formerly undiagnosed healthy-feeling hypertensive has now been given drugs that make him feel worse than ever with no offsetting benefits of symptom reduction. If the prospective patient can learn to "read" his or her body symptoms, compliance with possibly unpleasant medication may increase merely because the individual is receiving feedback concerning the efficacy of the drug. Similarly, if the person can learn to detect which settings influence SBP, BG, or other physiological systems, he or she can attempt to avoid or alter the situations, or at the very least take additional medication.

The ultimate practical value of this general approach is currently being tested. The major drawback at this point is that a simple, standardized procedure must be developed that can reliably evaluate which symptoms are related to which physiological systems. Researchers or practitioners who may be interested in this approach must take great care in training subjects how and when to complete the questionnaires as well as monitor the critical physiological variables. Because of the time-consuming and intrusive nature of the procedure, many patients need constant encouragement and feedback as to their progress. Finally, as the BG study may suggest, patients will ultimately have to undergo the within-subject procedure periodically in order to learn if the same symptoms are still covarying with the same physiological indices. These and other problems suggest that several more years of development and research must be undertaken.

Comments on the Within-Subject Design

The research projects discussed in this and the preceding chapters have relied to a great extent on within-subject as opposed to between-subjects designs. The primary advantage of the within-subject approach has been that we have picked up important symptom relationships that do not appear when standard between-subjects analyses are used.

Although the within-subject laboratory design has been used for several decades in psychology (e.g., Skinner, 1938; Campbell & Stanley, 1963), only recently have researchers begun to collect multiple measures from groups of subjects at several points in time in naturalistic

settings. Two researchers—Seymore Epstein (e.g., 1979) and Mihalyi Csikszentmihalyi (e.g., 1981)—have successfully employed this approach in order to study a number of social and psychological phenomena. Their work, together with our own, points to a number of issues that the within-subject researcher should consider. First, by varying the time frame for observations (e.g., once every minute, hour, 3 hours, day), the nature of the self-report relationships will vary. The closer in time that the observations are collected, the closer one approximates normal perceptual processes. The further apart the observations, the more likely that the researcher will gain an understanding of the subject's broader orientations and behavioral dispositions. One problem shared by all within-subject researchers is that we have not been able to collect enough data points from enough subjects in order to glimpse both short- and long-term behaviors. Ideally, of course, we would like to have subjects complete checklists every minute for several weeks or months. Naturally, it would be imperative that completing the checklist not influence the subjects' thoughts or behaviors. Before we are deluged with subject volunteers, it will be necessary to manipulate observation intervals for the same subjects (i.e., once per minute for an hour at one time, once per day for 2 months at another, etc.) in order to compare perceived and actual relationships among variables involved.

Another important issue concerns the "prompt" for completing the questionnaire. Whether the observation is prompted by the experimenter at random times (e.g., by use of a beeper) or standard times (the beginning of each class session over the school year), or if the subject selects his or her own times within the time frame needed by the experimenter (e.g., try to fill out the scale once per hour), poses different problems. Self-initiated observation periods that we have used may produce biased results since we do not know those psychological points that cause the person to remember to fill out the checklist (e.g., the subject may be reminded about the checklist when he or she feels a certain symptom). The beeper approach is intrusive and could artificially arouse the subject whenever he or she is paged. Simply filling out a checklist in a certain setting each day may not accurately reflect the subject's general state of mind, since the setting itself may be a cue to infer or perceive certain symptoms or moods.

Finally, we must ultimately link our observation times with the subjects' frame of perception. Whereas the experimenter may think that important behaviors will be picked up by monitoring subjects' behavior every 30 minutes, subjects will vary considerably in their own views of what defines the nature and time of an important behavior. For an excellent discussion of the ways by which subjects define and segment their own behaviors, see Vallacher and Wegner (in press). To learn how individuals segment others' behaviors, see Newson (1976).

Despite all of these problems, the within-subject methodology prom-

ises to be a valuable tool in our understanding of psychological states. With it, we are beginning to see and appreciate the individual variations in perception and behavior. Above all, we are learning how symptom, physiology, setting, and other variables covary in ways that we would not otherwise have seen.

Chapter 7

Personality and Developmental Correlates

What kind of person is a symptom reporter and how did he or she get to be that way? The previous chapters clearly point to the fact that there are large individual differences in the ways that people perceive and report symptom clusters. By the same token, there are also large variations between people in the raw number and magnitude of symptoms they report. In this chapter, we will examine symptom reporting as a personality disposition. In order to dissect the symptom reporter, we must first introduce some common measurement instruments and construct validation studies. The second section presents data that demonstrate the relationship between symptom reporting and a large number of other dispositional measures. Once the relative independence of the symptom-reporting construct has been established, we will delve into possible proximal and distal correlates of symptom reporting. That is, in the third section, data will be presented that examine the relationships between symptom reporting and a number of common behaviors such as smoking, drug taking, diet, and exercise. One could argue without these data that symptom reporters are the way they are because they live profligate, degenerate lives. The final, and most detailed, section will discuss a number of developmental theories and findings concerning the evolution of the symptom reporter from birth to sitting at a desk in an introductory psychology class—pen in hand—completing a symptom checklist.

Measurement and Construct Validity of Symptom Reporting

Symptom reporting can be measured in dozens of ways. For example, one can simply ask the subject to what degree he or she is currently experiencing such symptoms as a racing heart or headache. Although such a symptom checklist is more apposite as a state measure, it can also be used to tap the trait of symptom reporting. This is because summing the items on such a scale yields a total symptom scale that is internally consistent. Appendix A discusses the scalar properties of the standard symptom checklist in detail. In addition to checklists that seek to learn how the subject is feeling at that point in time, a number of symptom inventories have been devised that tap the frequency of occurrence of a number of physical and psychological symptoms. Although some of these scales specify a time frame (e.g., within the last year, month), many do not. Scales of this nature include the Cornell Medical Index (Abramson, Terespolsky, Brook, & Kark, 1965), the Hopkins Symptom Checklist (Derogatis, Lipman, Rickels, Uhlenhute, & Covi, 1974), the MMPI hypochondriasis scale (Hathaway & McKinley, 1942), the Somatic Perception Questionnaire (Shields & Stern, 1979), Langner's (1962) 22-item symptom checklist, the body consciousness scale (Miller, Murphy, & Buss, 1981), the Autonomic Perception Questionnaire (Mandler et al., 1958), and the Pennebaker Inventory of Limbic Languidness, or the PILL (Pennebaker et al., 1977).

A particularly interesting quality of each of these scales is that each is internally consistent, meaning that a person who reports any one particular symptom is likely to report others. The tendency to report symptoms, then, can be viewed as a stable unidimensional construct. This is true even though the symptom inventories have been devised and used for very different purposes. For example, some have attempted to assess the accuracy with which subjects perceive autonomic change (e.g., the Autonomic Perception Questionnaire, the body consciousness scale). As a rule, these attempts have produced mixed results (see Chapter 4). Other symptom scales have been said to measure psychological distress (e.g., Langner questionnaire), hypochondriasis, or even generalized anxiety (see Spielberger, 1972).

The scale that we have used in most of our individual difference studies—the PILL—is a 54-item symptom inventory that requires subjects to rate the frequency of occurrence of physical symptoms along a 5-point scale ranging from 1 = have never or almost never experienced the symptom to 5 = more than once every week. A copy of the inventory along with many of its psychometric properties is included in Appendix B. Briefly, the scale is internally consistent ($\alpha = .91$), has an acceptable test-retest reliability over time (2-month reliability = .83), and no stable factor structure.

A number of construct validation studies indicate that high PILL scorers report and are aware of more symptoms across a number of set-

tings relative to low PILL scorers. For example, internal analyses of the heart rate estimation experiment (Pennebaker, 1981—discussed in Chapter 4) and the BP laboratory experiment (from Pennebaker et al., 1982—discussed in Chapter 6) indicated that high PILLs thought their heart rate was faster in the former study, and that all perceived symptoms were more intense in the latter than low PILLs. Logically, one would expect high symptom reporters to engage in more health-related behaviors than people who did not report many symptoms. In fact, this is the case. Averaging results from a number of experiments, subjects' PILL scores (wherein the higher the PILL score, the more symptoms reported) are positively correlated with self-reported physician visits within the past year +.22 ($N = 505$), number of days that the person's activities were restricted as a result of health problems +.19 ($N = 505$), and aspirin use within the last month +.30 ($N = 231$).¹

Finally, cross-validation analyses with other symptom inventories indicate that the PILL correlates moderately with the Hopkins Symptom Checklist .48 ($N = 231$), the Autonomic Perception Questionnaire .50 ($N = 75$), the Cornell Medical Index composite score .57 ($N = 100$), and our standard symptom checklists .45 ($N = 1248$). It should be noted that it was necessary to develop the PILL—rather than to use one of the other available inventories—because the others contained either too many or too few items, had an inappropriate time frame, required only a binary yes-no response, and/or emphasized primarily severe, infrequent symptoms as opposed to more common ones. These differences may explain why the PILL does not actually correlate higher with other symptom inventories.

Symptom reporting, then, can be viewed as a stable, unidimensional construct. Although there are a number of situational factors that can influence the perception of symptoms, some individuals are simply more prone to report them than others. The following section begins our attempts to understand the nature of the symptom reporter.

Personality Correlates of Symptom Reporting

Although a large number of individual difference measures correlate with symptom-reporting questionnaires, two general constructs—attentiveness to body and measures of competence or control—have consistently been related to reports of symptoms. As noted in Chapters 1 and 2, people who chronically attend to internal state tend to report

¹ Unless listed otherwise, all simple correlations presented in this chapter are statistically significant at $p < .01$, two-tailed tests. The N in parentheses denotes the total number of subjects that the correlation was based on. There are substantial differences in N because different studies involved anywhere from 53 to 412 subjects. The correlation coefficients that are presented in the text and tables are mean correlations, weighted by sample size.

a large number of symptoms, visit physicians, and take more over-the-counter drugs than people who are not attentive to their bodies. For example, Greenley and Mechanic (1976) reported that symptom reporters claim to identify with introspective others to a greater degree than those who report few symptoms. Measures of repression-sensitization correlate with frequency and severity of reported illness and health center utilization (e.g., Byrne et al., 1968). Sensitizers process more internal sensory information and more readily perceive the onset of illness.

Other direct and indirect measures of attentiveness to body that have been shown to be related to symptom reporting as measured by the PILL can be seen in Table 7.1. Of particular relevance is that the dispositional measures of private and public self-consciousness (Fenigstein et al., 1975) consistently correlate with measures of symptom reporting. Individuals rated as high in private self-consciousness are attentive to their thoughts and moods (e.g., "I'm generally attentive to my inner feelings"). Less immediately apparent is that public self-consciousness correlates almost as highly with the PILL as private self-consciousness. Representative public self-consciousness items include: "I'm concerned about the way I present myself" and "I'm concerned about what other people think of me." One can only speculate that both privately and publicly self-conscious individuals are attentive to bodily state in general; however, the publicly self-conscious have more things to worry about (i.e., self-presentation) and hence are more likely to find symptoms in social settings such as the mass testing in the case of the PILL. We will return to this issue in later sections.

As indicated in Table 7.1, the high symptom reporter is also rated as more anxious than the low PILL responder. Measures tapping social anxiety (subscale of Self-Consciousness Scale) and somatic and cognitive anxiety (Schwartz et al., 1978), as well as general anxiety as measured by the Manifest Anxiety Scale (Taylor, 1953), correlate positively with symptom reporting (cf. Lipman et al., 1969). In fact, many of these anxiety-related results are perfectly predictable given that many consist of several symptom items (e.g., "I often have butterflies in my stomach"). Measures of anxiety, then, can be viewed as indicants of attentiveness to symptoms. Interestingly, in a discussion of test anxiety, Wine (1971) has observed that highly test-anxious students perform poorly on exams because they are processing a disproportionate amount of internal sensory information relative to the tests they are taking. In other words, symptom reporters may be at a disadvantage in a number of settings that demand constant processing of external information.

Scales tapping control or competence have also been found to be inversely related to symptom reporting. For example, measures of self-esteem correlate negatively with symptom reporting (e.g., Rosenberg, 1965; Rosa & Mazur, 1974). Helmreich (1972) notes that the concept of self-esteem implies the ability to control or be competent in dealing

Table 7.1 Simple Correlations Between PILL and Selected Variables

Variable (<i>N</i>)	PILL	Health center use	Aspirin use	Sick days
Self-consciousness scale (<i>N</i> = 1431)				
Private	.235***	.091	.037	.001
Public	.225***	.040	.066	.064
Social anxiety	.110***	-.113*	.104	-.035
Type A (JAS) (<i>N</i> = 715)				
Type A	.140***			
H (hard driving)	.130***			
S (speed/impatience)	.160***			
Rotter IE (<i>N</i> = 284)	.095*	-.004	-.048	.030
Snyder Self-monitoring (<i>N</i> = 178)	.200***			
Schwartz repression scales (<i>N</i> = 231)				
Cognitive anxiety	.396***	.034	.132*	.089
Somatic anxiety	.403***	.080	.121*	.102
Miller monitoring-blunting (<i>N</i> = 231)				
Total scale	-.144**	.037	-.030	.051
Monitoring	-.020	.142**	.041	.086
Blunting	.175***	.057	.052	.003
Krantz Health Opinion Survey (<i>N</i> = 231)				
Information seeking	-.002	.135**	.030	-.067
Behavioral	.047	-.097	-.024	-.145**
Schedule of Recent Experience (<i>N</i> = 231)				
Total score	.284***	.154**	-.026	.066
Hopkins Symptom Checklist (<i>N</i> = 231)				
Total score	.479***	.071	.194***	.081
PILL	—	.202***	.298***	.220***
Health center use (<i>N</i> = 231)	—	—	.576***	.217***
Aspirin use	—	—	—	.315***

Note. *N* in parentheses refers to the total number of cases that the simple correlation with PILL represents, averaging across samples. All correlations with health center use, aspirin use, and sick days are based on one sample of 231 subjects. All tests of significance are two tailed.

**p* < .10.

***p* < .05.

****p* < .01.

with the environment. Manipulated perceived control over the environment also tends to reduce the degree to which subjects report symptoms (e.g., Matthews, Scheier, Brunson, & Carducci, 1980; Pennebaker et al., 1977; Weidner & Matthews, 1978). In each of these examples, then, individuals who do not perceive themselves as being in control of their environments report more symptoms than those who feel more in control. As can be seen in Table 7.1, some measures related to control are correlated with PILL scores. For example, Rotter's (1966) internal-

external locus of control scale correlates weakly with PILL, such that externals report more symptoms than internals. This relationship has also been corroborated by others (Kilpatrick, Dubin, & Marcotte, 1974).

Consistent with the above studies, measures of life change and major loss-of-control events are related to a large number of health-related problems. For example, people who have reported experiencing major life changes on the Schedule of Recent Experience (Holmes & Rahe, 1967) report more symptoms on the PILL and claim to have more health problems in general in college (e.g., Marx, Garrity, & Bowers, 1975) and in the military (Rahe, Mahan, & Arthur, 1970). Other measures of life change (e.g., Jacobs, Spilken, & Norman, 1969) yield comparable results.

Oddly, measures of Type A and related subscales of H (hard driving) and S (speed and impatience) have consistently correlated *positively* with PILL scores (for a discussion of the Type A measurement and subscales, see Glass, 1977; Friedman & Rosenman, 1974; Krantz, Glass, & Snyder, 1974). This relationship is unexpected in that Glass (1977) has viewed the Type A construct as being related to reactivity to loss-of-control experiences. In a sense, then, the coronary-prone Type A seeks—and perhaps usually has—more control than the Type B counterpart. Measures of Type A correlate .30 with self-esteem (Glass, 1977). An interesting twist on the Type A-symptom report relationship has recently been reported by Matthews (1979). In her research, Matthews found that when actively engaged in a task, the Type A does not report symptoms. However, prior to and following task activities, the Type A's report more symptoms than Type B's. Taken together, the Type A findings suggest that hard-driving Type A's—when they have nothing to do (except complete symptom questionnaires)—report symptoms. Only when they are actively involved in work or experimental tasks are they no longer likely to report symptoms.

Competence and control measures may be related to symptom reporting most of the time for a variety of reasons. One argument is that failure to control the external environment is highly stressful, thus resulting in major physiological upheavals (e.g., Seligman, 1975; Selye, 1976). Another factor may be that loss-of-control experiences influence subjects' attention and/or cognitive strategies (e.g., Matthews, Scheier, Brunson, & Carducci, 1980). The "psychic cost" of the increased attentional effort is then expressed physiologically. (If this is the case, the results in Chapter 6 indicate that it would most likely be expressed by changes in SBP.) Finally, loss-of-control experiences may cause a person to adopt symptom-relevant hypotheses and thus selectively search their bodies in greater detail.

Finally, Table 7.1 reports a number of other correlations that may interest the reader. PILL scores are only weakly related to Miller's (1979) monitoring-blunting scale—with symptom reporters less likely to monitor stressful settings. No consistent relationships have been

found between the two subscales of the Health Opinion Survey (Krantz, Baum, & Wideman, 1980) which measure information-seeking and behavior intervention in dealing with one's own health. Finally, Snyder's (1979) Self-monitoring scale is positively related to PILL responses, whereas intelligence measures (Scholastic Aptitude Test scores) and grade point averages are unrelated to symptom reporting.

It should be noted that a number of demographic variables that were discussed in Chapter 1 as being related to symptom reports are also related to PILL responses. For example, mean correlations with PILL over a number of studies include each of the following: $-.17$ ($N = 1048$) with age; $-.17$ ($N = 274$) with population of home town; $-.22$ ($N = 617$) with socioeconomic status of parents (defined by education and income of both parents); $.16$ ($N = 1048$) with sex, where 1 = male and 2 = female. Our results, then corroborate the general patterns found for indicants of symptom reporting (e.g., aspirin use, days of restricted activity due to illness) in national samples.

To summarize, the symptom reporter is self-conscious and anxious, has low self-esteem, and aspires (but may not succeed in being able) to control aspects of his or her environment. In addition, he or she (more often she) tends to be young, from a small town, and from a lower socioeconomic background. Finally, not only does our symptom reporter report symptoms, but she or he also tends to visit medical personnel and take aspirin with greater frequency than the person who is not a symptom reporter. This sketch of the symptom reporter omits some critical information. First, the correlations between the various individual difference and demographic measures with the PILL are low. Second, it is impossible to assess the nature of these correlational relationships. For example, it is just as plausible to argue that reporting symptoms causes the person feel self-conscious, anxious, and even out of control, as it is to make the opposite argument for each variable. Third, there are a number of intervening variables that may account for these relationships. For example, the hard-driving, anxious person may get less sleep and abuse his or her body to a greater extent than the easygoing, high-self-esteem individual. These other factors, then, may explain the underlying persona of the symptom reporter.

Habits and Daily Behaviors of the Symptom Reporter

In this section, a number of dietary, social, sexual, exercise, and related behaviors will be discussed as they relate to symptom reporting. The data to be presented were collected from 412 undergraduates (150 males and 262 females) enrolled in a number of psychology courses. Because subjects were not offered credit for completing the 10-page ques-

tionnaire, the return rate was only 68%. Nevertheless, a random sample of the nonrespondents was contacted, and it yielded data suggesting that nonrespondents did not differ significantly from respondents on any demographic variable or health-related behavior. This research represents another project being conducted by Billy Barrios, Claudia Hoover, and me. In the questionnaire, a number of symptom questions (e.g., headache, upset stomach, racing heart) were included that asked respondents to rate the degree to which they normally experience each on the average day. These items were then summed and divided into three groups: high, moderate, and low symptom reporters. This division, then, was used as a basis for computing a number of one-way analyses of variance related to the habits and daily behaviors of our subjects. In addition to family background information (which will be discussed in the following section), the general categories of interest include health-related behavior, eating patterns, social behaviors, and self-image concerns. Each of these categories will be discussed separately. A summary of the means and significance levels for each variable is presented in Table 7.2. It should be noted that for several variables, a significant sex effect obtained. Nevertheless, with only one exception (number of male vs. female friends), no sex \times symptom report interactions attained significance.

Health-related behaviors. As can be seen in Table 7.2, high symptom reporters (SRs) visited the campus health center more frequently for illness and for other reasons (such as allergy shots) than other groups. There were no differences for visits related to checkups. Interestingly, although high SRs reported taking more aspirin, they did not differ significantly in taking vitamins. These sets of findings indicate that symptom reporters react to adverse changes in their bodies but do not seek to prevent problems by undergoing checkups or taking vitamins. These data are consistent with the fact that high SRs report exercising and sleeping less and, when under stress, using more drugs and caffeine than either moderate or low SRs. It should be emphasized that these data do *not* indicate that symptom reporters are hypochondriacs who are constantly trying to avoid illness. If anything, their life-styles may promote health problems.

Eating habits. Recently, there has been a trend to examine the relationship between food preference and health variables (e.g., Schwerin, Stanton, Riley, Schaefer, Leveille, Elliott, Warwick, & Brett, 1981). Schwerin et al. and other nutritional researchers argue that eating patterns may either cause health problems or merely reflect unhealthy life-styles. As Table 7.2 indicates, there are a number of significant differences between the SR groups in terms of eating patterns and, to a lesser degree, food preferences. Basically, high SR subjects tend to skip

meals (particularly breakfast) and to exhibit patterns of fasting and binge eating relative to the other groups. Despite their reporting that they have an unbalanced diet, high SRs have food preferences that are remarkably similar to those of the other groups except for tendencies to prefer green vegetables and to dislike soup and water. In terms of eating habits, it is important to point out that all three groups are comparable as regards their reported weight (relative to standards published by the Metropolitan Life Insurance company). In general, then, high SR subjects' eating patterns deviate from those of moderates and lows, even though *what* they eat appears to be similar to the other groups.

Table 7.2 Self-Reported Behaviors and Habits of High, Moderate, and Low Symptom Reporters

Self-report item	Symptom reporter			Significance
	High	Moderate	Low	
<i>Health-Related Behavior</i>				
Number of health center visits				
in previous 7 months for illness	1.31	0.89	0.78	.009
Health center visits for checkups	0.56	0.50	0.50	ns
Health center visits other	0.88	0.56	0.39	.05
Aspirin use (mean times/month)	3.77	2.55	2.10	.001
Vitamin use (0 = never, 2 = always)	1.06	0.88	0.92	.130
Exercise compared to peers				
(1 = much less time, 7 = much more)	3.80	4.34	4.25	.019
Liking for cigarettes (7 = very much)	2.28	1.38	1.52	.001
Liking for diet pills	1.64	1.27	1.18	.003
Liking for alcoholic beverages (mean of beer, wine, and mixed drinks)	4.52	4.47	4.27	.061
When under stress, the following behaviors change (1 = decrease in frequency, 7 = increase in frequency):				
coffee consumption	5.48	4.79	4.65	.001
drug use	4.37	3.93	3.92	.002
sleep	2.32	2.92	3.05	.002
<i>Eating Habits</i>				
Meals eaten per day	2.41	2.57	2.65	.018
Eat breakfast (0 = no, 2 = always)	1.11	1.26	1.36	.015
Presently dieting (0 = no, 1 = yes)	.37	.29	.32	ns
How balanced is your diet (7 = balanced)?	4.34	4.73	4.61	.049
How often have you gone for 24 hours without solid food, excluding illness in the last year (1 = never, 5 = weekly+)?	2.37	2.01	1.86	.002
Frequency of binge eating (5 = weekly)	3.63	3.28	3.03	.002
Weight deviation (%) from normal (using Metropolitan Life tables)	+ 0.73	+ 1.29	+ 0.62	ns

Table 7.2 (continued)

Self-report item	Symptom reporter			Significance
	High	Moderate	Low	
Liking for each of the following foods/food groups (1 = not at all, 7 = very much):				
green vegetables (green beans, celery, salad)	4.84	4.72	4.48	.055
carbohydrates (french fries, noodles, bread)	4.86	4.86	4.91	ns
cheese (cheddar, cottage)	4.48	4.18	4.23	.144
sweets (brownies, soft drinks)	4.87	5.03	5.00	ns
soup (chicken broth)	3.50	3.90	3.73	.113
water	4.32	4.79	4.63	.075
Social Behaviors				
No. of very close male friends				
male respondents	4.19	3.92	4.06	ns
female respondents	3.49	3.00	2.62	.014
No. of very close female friends				
male respondents	3.62	3.22	3.06	.085
female respondents	4.25	4.34	4.12	ns
Percentage dating 1 person steadily	55	49	39	.077
Prior to the age of 17, did you ever have a particularly traumatic sexual experience (e.g., rape, being molested)? ^a	14.4	3.7	2.5	.001
Self-Image Concerns				
Degree perceive self as overweight	4.91	4.42	4.47	.002
Degree others view you as overweight	4.06	3.98	4.08	ns
Importance of attaining ideal weight	5.33	4.67	4.61	.001
Degree perceive self as attractive	4.65	4.65	4.84	ns
Degree others view you as attractive	5.02	4.80	4.80	ns
Importance of attractiveness	5.53	5.15	5.24	.028
Developmental Issues				
Birth order				
only child (%)	5.2	6.1	5.9	ns
firstborn (%)	34.0	32.1	33.6	ns
later born (%)	60.8	61.8	60.5	ns
Marital status of parents				
married (%)	75.2	82.1	85.7	.138
divorced (%)	19.6	10.2	5.9	.005
widowed (%)	5.2	7.7	8.4	ns
How well do you get along with your parents (mean of mother and father, where 1 = not at all, 7 = very well)?	5.76	5.90	5.85	ns
How well do parents get along with each other?	4.87	5.56	5.54	.004

Table 7.2 (continued)

Self-report item	Symptom reporter			Signifi- cance
	High	Moderate	Low	
To what degree do you consider your mother as (1 = not at all, 7 = great deal):				
warm	5.88	5.96	5.92	ns
flexible	4.82	4.58	4.83	ns
abusive	1.99	1.99	1.79	ns
possessive	4.17	3.99	3.66	.050
To what degree do you consider your father as:				
warm	4.99	4.88	4.85	ns
flexible	4.24	4.13	4.13	ns
abusive	2.43	2.28	2.33	ns
possessive	4.27	3.87	3.62	.045
<i>Demographic Information</i>				
Sex				
number of males in sample	21	79	50	.002
number of females in sample	75	117	69	
Age				
	19.5	19.4	19.9	.052
Years education of				
father	15.9	16.0	16.3	ns
mother	14.8	14.5	14.6	ns
Hollingshead occupational rating averaged for both parents (1 = highest socio-economic ranking, 7 = lowest)				
	2.97	2.92	2.90	ns

^aEntries reflect the percentage of respondents answering in the affirmative.

Social behaviors. One of the most striking differences among the symptom reporter groups involved social and/or sexual behaviors. High SRs consistently oriented toward members of the opposite sex to a greater degree than low or moderate SRs. Not only did the high SRs report having more opposite-sex friends, but they also tended to be dating someone steadily. Most shocking of all of these statistics was one item that asked subjects if they had ever had a traumatic sexual experience prior to the age of 17. Whereas over 14% of the high SR subjects answered yes, less than 4% of either of the other groups responded affirmatively (although this pattern was more pronounced for females, the direction of results was the same for males).

Self-image. Finally, a number of questions concerning body image—as it pertains to both weight and physical attractiveness—were included to examine self-perception, perceived others' view of self, and importance of the goals of ideal weight and/or attractiveness. Although high SRs

thought they were overweight relative to the other subjects, they admitted that others did not perceive them as being overweight. Most important, high SRs reported that attaining their ideal weight and being physically attractive were extremely important goals relative to their moderate and low SR counterparts. In other words, symptom reporters place a very high premium on self-presentational concerns. This finding is consistent with the fact that high SRs also tend to be high on the trait of public self-consciousness.

In sum, the daily behavioral data paint a more complex picture of the SR. Although apparently socially adept (judging by dating frequency and number of opposite-sex friends), the symptom reporter is clearly concerned with appearing attractive to others. Many of the SR's habits may promote poor health (i.e., poor eating habits, drug and alcohol use). Finally, the surprisingly high incidence of "traumatic sexual experience" responses among the high SR subjects is perplexing. Although we do not know the nature of these experiences, these data do suggest that many of the SRs come from a different background from most non-SRs.

Developmental Issues in Symptom Reporting

The personality and daily habit data discussed above suggest that the socialization of the child could influence the ways in which he or she attends to, organizes, and interprets bodily sensations. Within the developmental literature, four recurring themes have been studied empirically. The first assumes that the degree to which the parents are attentive to the child's health will ultimately influence the child's symptom reporting and/or health-seeking responses (e.g., physician visits, school absenteeism). A second theme is directly related to the socialization of body-related schemas or hypotheses. This approach seeks to learn if the child tends to report the same types of symptoms as the parents. The third perspective considers that much of the child's symptom reporting and health problems serve as secondary gains—either to reduce family conflict or to avoid or to be removed from aversive situations. The final approach—which overlaps considerably with each of the above—is psychodynamically based. According to this view, symptom reporting is an outgrowth of the lack of warmth between child and parents. The child in this setting may adopt a dependency relationship with one parent that ultimately results in the development of hypochondriasis or hysterical symptom acquisition. Research findings within each of these categories are discussed separately.

Attentiveness of parents. An intuitively appealing idea is that if the parents are overly attentive to the child's health, the child will learn to

be overly attentive to his or her own health, and thus report symptoms to a higher degree. Although there have been a number of tests of this hypothesis, one of the most common has been to examine birth order. Presumably, because the firstborn receives more attention from the parents than later borns, he or she should be more attentive to bodily changes. Results from several studies have not provided consistent answers. Of recent studies examining the relationship between birth order and reported illness (usually reported by the parents), two have found that firstborns are more prone to illness (Franklin, 1973; Sheldrake, Cormack, & McGuire, 1976) and two have not found this pattern of results (Gonda, 1962; Friedman, 1975). Among our own research studies, one has found a marginally significant trend ($p < .10$), suggesting that firstborn nursery school children are absent because of illness to a greater degree than later borns (Pennebaker, Hendler, Durrett, & Richards, 1981). Correlational data with college students relating PILL responses with birth order have found no significant relationships (see Table 7.2).

Without question, the strongest test of the attentiveness hypothesis has been conducted by David Mechanic (1964, 1979). In his first study, Mechanic interviewed 350 fourth- and eighth-grade children and their mothers concerning perceptions of symptoms by the children and by the mother for both herself and her child. Correlations were computed between measures of the child's attentiveness to symptoms and the degree of interest in symptoms shown by the mother for both her child and herself. Although the correlations were statistically significant, they accounted for only about 2% of the variance. In a 16-year follow-up with the same subjects, Mechanic (1979) reported that attentiveness and overconcern of parents apparently have a long-lasting effect—forcing the "child's attention on internal states and teaching a pattern of internal monitoring" which contributes to a distress syndrome later in life. In addition to being caused by the mother's attentiveness, the child's attentiveness to internal state may be the result of chronic disease or hospitalization, family distress, or other factors. Whatever the causes may be, this attentiveness to symptoms persists over an extended period of time. In sum, the parental attentiveness hypothesis has received weak support. Although it is a contributing factor to the child's perception of his or her symptoms, other variables are involved.

Parental interpretation of sensations. As noted above, the way in which the child organizes and perceives symptoms and sensations may be similar to the parent's. The way that the parent interprets ambiguous sensations could be adopted by the child. Note that this argument is different from the attentiveness issue. A parent, for example, could be oblivious to the child's health but still convey ways by which to define, interpret, and organize sensory experiences.

The research findings to support this hypothesis are again weak. Campbell (1975) found low but positive correlations between the mother's symptom reports and her child's. Mechanic (1964), using a different approach, found that mothers who are under stress report more physical symptoms both for themselves and for their children. As Mechanic notes, this is an important finding in the sense that it usually is the mother's decision (as opposed to the child's) to take the child to a physician, administer medication, and define the child's sick role.

One reason why these results may be so weak is that the respective samples were fairly homogeneous. Recall from Chapters 1 and 3 that the symptoms that are reported *within* any given culture tend to be similar. Hence, American parents and their children may report any of 10 or 12 symptoms (e.g., headache, upset stomach), whereas a different culture may be attentive to a completely different set of symptoms. Statistically, then, analyses on a homogeneous sample will deflate correlations between parent and child symptom patterns.

Secondary gain in symptom reporting. Examination of Table 7.2 indicates that high SRs are more likely to come from families where the parents are divorced and, when the respondent was growing up, the parents did not get along with each other compared with the moderate and low SRs' parents. On a surface level, these findings are not consistent with either the attentiveness or the interpretation hypothesis. That is, one would predict greater attentiveness and transmission of knowledge concerning body in a united family than in one fraught with discord. As it turns out, the findings concerning family conflict and symptom reporting are not unique to our questionnaire study.

Perhaps the most consistent developmental pattern is that children in aversive home or school environments report more health problems than those who are not in such settings. One of the most exciting research efforts in this vein has examined the relationship between family dynamics and the child's health. Minuchin and his colleagues (1975) have indicated that family conflict is related to childhood asthma, anorexia nervosa, and other disorders. Further, when psychotherapeutic interventions are instituted to reduce family conflict, dramatic improvements in the health of the children are found. This systems approach assumes that the child's health serves as a homeostatic mechanism in the household. When family conflict increases, the child becomes sick, which in turn reduces the conflict. Other studies have indicated that family conflict is related directly to a child's postoperative problems (Jessner, Blom, & Waldfogel, 1952), school absenteeism (Boardman, 1975), and poor health in general (Mutter & Schleifer, 1966).

Interestingly, these health problems are not limited to family conflict. Two recent studies have found that if the parent or teacher or both view the child as antisocial (e.g., aggressive or shy), increased health

problems occur. In one archival study with over 200 nursery school children, the child was more likely to be absent from school as a result of reported illness if the mother had rated the child as antisocial at the beginning of the school year. This pattern was obtained after controlling for various demographic variables, the child's early health, and measures of family conflict (Pennebaker, Hendler, Durrett, & Richards, 1981). Teacher ratings were similarly related to absenteeism. Finally, in a massive survey of over 1400 parents of children between the ages of 5 and 13, Eisen, Ware, Donald, & Brook (1979) found that parent's perceptions of the child's health and social relations were positively correlated. These data can be interpreted as reflecting the child's or parents' use of illness and/or symptom reporting as an excuse to avoid school. Physical symptoms, from this perspective, represent a means to an end.

Stress responses and symptoms. That symptom reporters often come from conflict-ridden families or schools may not reflect secondary gains exclusively. It is well known that stress results in massive hormonal and autonomic changes (e.g., Guyton, 1976; Selye, 1976), which in turn could make the child more susceptible to disease. Similarly, massive stress responses may be of sufficient intensity to be perceived by the child. As noted in Chapter 6, extreme physiological responses may be sufficient in and of themselves to set up long-term attentional processes that cause the individual to monitor internal state to a higher degree than he or she would otherwise do.

At this point, it is impossible to disentangle stress response from the secondary gain hypotheses. Functionally, the child's getting sick serves as a way of reducing family conflict or avoiding school. Of course, a functional explanation is not necessarily a causal one.

Psychodynamic explanations. As noted in Chapter 1, a number of related psychological disorders characterized by symptom reporting in the absence of measurable physiological activity have been discussed by psychodynamic theorists since the time of Freud (e.g., 1935/1959; Breuer & Freud, 1925/1955). Two syndromes that have received a great deal of attention are conversion reactions and hypochondriases. Whereas conversion reactions are manifested by the loss of functioning in some part of the body, hypochondria is usually defined as obsession or unusual preoccupation with one's body and/or bodily sensations. Despite these differences in definition, there are some interesting similarities in their presumed etiologies and to some of our own findings concerning symptom reporting.

According to Freud, conversion reaction is the result of dissociated anxiety related to sexual drives. The presence of symptoms gives affected patients something to worry about. In this way, symptoms serve the dual function of reducing anxiety and attracting attention from others

(Jones, 1980). It is noteworthy that conversion hysteria is more likely to occur among young women who have had some disturbance in their psychosexual development. In fact, a number of psychoanalytic writers (e.g., Fenichel, 1945; Marmor, 1953) have emphasized the importance of both oral and phallic stages in the development of conversion.

The limited empirical research by psychoanalytically oriented scientists has produced some fascinating results that parallel some of our own findings. For example, Cleghorn (1967) cites a study of 90 female hysteria patients wherein self-reports tapping sexual provocativeness were especially high. Sexual maladjustment appears to underlie virtually all empirical studies on female conversion disorders (e.g., Merskey & Trimble, 1979; Perley & Guze, 1962; Purtell, Robins, & Cohen, 1951). Finally, Jones (1980) noted that of 10 female conversion reaction patients that she studied, 5 had been seduced by male relatives in childhood. These findings are in line with Freud's own observations concerning seduction experiences of conversion cases (Jones, 1980).

Unlike conversion reaction, psychodynamic interpretations of hypochondriasis present a far more vague picture (Freud, 1914/1957; Gray, 1978; Kenyon, 1964, 1976; Nemiah, 1975). Although some individuals claim that males are more prone to hypochondriasis than females (e.g., Mechanic, 1978; Meister, 1980), others report no differences in rate (Nemiah, 1975). The major problem in understanding hypochondriasis is that most writers do not agree on its definition. Ironically, Freud (1914/1957) viewed hypochondria as a physical process outside the domain of psychoanalytic study. Others have viewed hypochondria as a disorder wherein sexual orientation toward others is withdrawn in preference for one's own body (cf. Gray, 1978). Kutash (1965) notes that the dynamic view of hypochondria claims it to be a psychological defense used by the patient unconsciously to avoid responsibilities. Finally, based on his own research with over 500 hypochondriacs, Kenyon (1964, 1976) concludes that the concept or diagnosis of hypochondriasis should be dropped altogether, since it refers to a heterogeneous group of individuals that can be classified more accurately into more conventional categories (e.g., psychoses, neuroses).

It should be noted that very few empirical studies have been conducted on hypochondriacs. Interestingly, along with overconcern with bodily sensations, pain, and smells, researchers have found that hypochondriacs are more likely to report sexual anxiety and concern with bodily appearance than those not so diagnosed (e.g., Bancroft, 1974; Kenyon, 1976; Meister, 1980; Olley, 1974). These findings are consistent with the general pattern of results wherein incidence of hypochondriasis is highest during periods when one's sexuality is most threatened—for example, menopause (see Kenyon, 1976).

Despite the many problems in definition, underlying psychodynamic explanation, and lack of methodological rigor associated with studies on conversion reaction and hypochondriasis, the overlap of empirical

findings in our own research with SRs is startling. In the self-report study discussed earlier in the chapter, we found that high SRs were far more likely to report having experienced a traumatic sexual experience prior to age 17, were more likely to have close friends of the opposite sex, were more concerned about maintaining an ideal weight and being physically attractive, and were more likely to report their parents as being possessive than were low SRs. At this point, we can only say that there does appear to be an interesting link among these variables and symptom reporting. To claim that these relationships support a psychodynamic interpretation may, of course, be misleading. Nevertheless, rigorous research designs that allow causal inference will certainly help in establishing the viability of such a link.

Summary of Developmental Research

As this section of the chapter has indicated, there have been surprisingly few well-controlled and or longitudinal developmental studies dealing with the development of symptom-reporting patterns in children. At this point we must conclude that parental attentiveness to the child's health and socialization of the child's body schemas are at the worst weak and, in the best of all possible worlds, not yet adequately tested. The only consistent finding across the vast majority of studies is that family or social conflict is correlated with symptom-reporting and illness-related behaviors. How to interpret this general correlation has yet to be agreed upon. There is little doubt that symptom reporting *can* serve as a secondary gain for the child in a conflict-ridden household. Whether this is learned or whether it is a natural outgrowth of physiological stress responses is open to debate. Finally, the general approach of the psychodynamic theorists should not be discounted. Empirically, we have found that the parents are viewed as possessive—but otherwise "normal." In addition, the high SRs are oriented to members of the opposite sex—as measured by the number of opposite-sex friends and the high percentage of SRs who date someone steadily. Most curious is the high number of SRs who claim to have had traumatic sexual experiences earlier in life. These parental, social and sexual data, then, are potential grist for the psychodynamic mill.

Composite Picture of the Symptom Reporter

Before tying all of our findings into a general explanatory hypothesis concerning the development of the symptom reporter, we must first review what is true about the symptom reporter from an empirical perspective. The modal high SR is a female from a conflict-ridden home who is anxious and self-conscious and has low self-esteem. This person

is particularly concerned with her appearance, which is probably used in attracting members of the opposite sex. In addition, the high SR engages in a number of behaviors that may contribute to poor health—smoking, drug and alcohol use, little exercise, and unhealthy eating patterns (e.g., fasting and binging, skipping meals). A final group of characteristics that should not be forgotten includes having overly attentive parents, being younger than others in her comparison group, having had a traumatic sexual experience, and having a Type A personality.

In attempting to integrate the various findings concerning the development of the SR, we must include in any theory the following tenets:

1. *Family conflict* will dramatically increase symptom awareness and reporting for each of the following reasons.

a. Parental conflict will bring about physiological changes which make the child more prone to a number of major diseases. The contracting of any major disease will affect how the person organizes and attends to symptom information.

b. Parental conflict will undermine the child's self-confidence. Feelings of lessened control or competence will force the child to become more self-attentive in general, thus increasing symptom reporting.

c. Parental conflict will increase the child's social insecurities (which is related to public self-consciousness). In compensating for this, the child seeks the approval and love of parents, and later, of peers.

2. *Social insecurity* is ultimately related to symptom reporting for a number of reasons, including the following.

a. The socially insecure individual seeks the approval of others (especially members of the opposite sex). As such, the person will be more attentive to weight, physical appearance, and other superficial factors that may attract members of the opposite sex. In order to attain these goals, the person adopts "unhealthy" eating patterns and dieting techniques (including smoking, diet pills, skipping meals, fasting, and binging) which in and of themselves can result in symptom awareness—due to increased susceptibility to disease and/or gross physiological imbalance.

b. The socially insecure individual will be involved in more superficial relationships (particularly with members of the opposite sex) which will increase the probabilities of any such relationships not succeeding, which will further increase feelings of social insecurity.

c. Socially insecure individuals who are forced into a social world, whether nursery school or college, will be under more physiological stress than socially secure persons. The stress itself is related to symptom reporting.

3. *Reinforcement for symptom reporting* will occur during all phases of development of the symptom-reporting pattern. Reinforcement can take the following forms.

a. Conflict reduction (a la Minuchin et al., 1975)—the reporting of

physical symptoms causes parents, roommates, spouse, and the like to stop bickering.

b. Symptom reporting can change the power relationship among the participants by drawing attention to the symptom reporter and allowing the "symptom reportee" to adopt a nurturing role.

c. Symptom reporting can be used as an excuse for failure, or for wanting or not wanting to do something.

d. Reporting symptoms can be reinforced by having another person reduce the intensity of the symptoms (i.e., aspirin for a headache, a massage for a sore back, etc.). Ironically, this is the adaptive purpose for symptom reporting in the first place—as will be discussed in the following chapter.

Note that each of these reinforcement techniques is effective in orienting the person to his or her body and not just to the *reporting* of symptoms.

4. *Extreme physiological activity* is probably required at some point(s) in the symptom reporter's life. Although not a necessary cause, it is sufficient in that:

a. Extreme physiological activity causes the person to be more attentive to and organize sensory experience in comparable ways in the future.

b. Extreme physiological activity may make the person more attentive to any bodily signs (cf. Wegner & Giuliano, 1980), which in turn can increase feelings of self-consciousness, low self-esteem, anxiety, and the like.

Each of these four variables—family conflict, social insecurity, reinforcement for symptom reporting, and extreme physiological activity—can contribute to the development of the high symptom reporter. As would be expected, each of the variables is dependent on the others. The reader will note that virtually every empirical truth is accounted for (except, perhaps, why the symptom reporter likes celery—sounds Freudian). One factor has been omitted. Undoubtedly, there is a genetic basis to symptom reporting. But then Lykken (1981) has indicated that virtually every behavior, cognitive style, physiological activity, and so on has been shown to be genetically based.

Chapter 8

Summary and Conclusions

Attempting to understand the body's signals is similar to trying to interpret the noises and sensations of the automobile that we drive. We do not have a computer printout of either the current physiological status of our body or the condition of the various systems of our car. Given this, we are in the position of attempting to understand a large array of ambiguous sensations about which we have at best a modicum of knowledge. Whether we are dealing with human bodies or inanimate cars, the awareness and reporting of symptoms are dependent on psychological or perceptual processes. Throughout this book, a large number of studies have outlined some of the parameters that determine when and why symptoms are reported. Before discussing some of the implications of symptom research, we present the following brief review of our current knowledge about the perception of physical symptoms.

Physical symptoms are percepts subject to the same perceptual and cognitive rules that govern the perception of external events. Given that we have a limited capacity to process information, external and internal sensory data often compete for processing. As such, the probability of noticing and reporting symptoms is inversely related to the quantity and/or quality of external information that must be processed at any given time. The competition-of-cues findings, then, indicate that the perception of any internal state—whether specific symptoms or broader categories of body state, such as fatigue or emotion—is dependent on the external environment and vice versa. A second important set of findings is that symptoms are organized and interpreted within the schemas or hypotheses that we have available to us. Further, if we adopt a given hypothesis that is relevant to our body, we will be likely to selectively monitor ourselves for the presence of confirming sensory

information. An excellent example of this process can be seen with placebos: A person takes a pill that is supposed to have a specific effect; the person closely monitors his or her body for signs of the effect and, given the ambiguous nature of most sensations, is able to find sensory confirmation of the pill's effectiveness.

One issue that has not been entirely resolved has been the relationship between physical symptoms and their presumed physiological bases. As discussed in Chapter 4, people do *not* appear to be able to perceive highly specific physiological states with great accuracy. That is, both between-subjects and within-subject designs suggest that the correlations between specific symptoms and their autonomic concomitants are typically low. Of particular importance is the fact that accuracy should *not* be viewed as a unitary construct. That is, a person who may be accurate about one bodily system (e.g., heart rate) is no more likely than another to be accurate about another system. One problem with visceral perception research is that people may not encode sensory information in the same ways that we measure it. For example, people may perceive only *changes* in physiological state rather than the absolute levels that we typically measure. A number of hypotheses to explain these curious facts have been offered. Based on cognitive organization research dealing with diabetics (Chapter 6), accuracy of certain symptoms may be most likely to occur during extreme physiological conditions. Not only may individuals be accurate during these times, but their beliefs about their physiology are likely established. Despite poor accuracy during relatively normal times, it should be emphasized that symptom reporting is far from random. Rather than basing beliefs about symptoms and sensations on actual physiological state, individuals often infer their symptoms, emotions, and other internal states from their immediate environment.

In Chapters 5 and 6, a number of issues concerning the ways symptoms can be organized were introduced. A particularly interesting example can be seen with perceptions of emotions. Basically, individuals believe and apparently perceive specific constellations of symptoms as covarying with separate and unique emotions. Although no evidence was found to indicate a physiological base to the perceptual specificity hypothesis, such a base may have been established during extreme emotional responses earlier in the person's life. Particularly intriguing is the fact that each person evinces unique symptom-emotion correlations (on a within-subject basis). Symptoms, then, can be viewed as elements of broader sensory experience. The organization of symptoms is efficient and adaptive for the individual in attempting to make sense of a wide array of potential sensory signals.

An unexpected twist on the cognitive organization research has been found among constellations of symptoms that clearly covary with fluctuations in blood pressure and blood glucose levels using within-subject

paradigms. Ironically, blood pressure and blood glucose changes have traditionally been thought to be asymptomatic. In the blood pressure studies (conducted with normotensive college students and adults) and the blood glucose project (conducted with insulin-dependent diabetics) we found that unique but stable clusters of symptoms reliably covaried with changes in blood pressure and glucose, and that when tested with the same subjects, the physiologically based symptom clusters were independent of each other. Two particularly important findings obtained that are relevant to the formation of schemas: First, people's *beliefs* about the symptoms that they think are related to glucose changes are only moderately accurate. Nevertheless, their beliefs appear to have a physiological basis. In the glucose experiment it was found that *beliefs* about symptoms and glucose were related to *actual* symptom-glucose relationships prior to but not following treatment. Once treatment had changed the empirical relationships, subjects continued to think that their initial symptom-glucose relationships had not changed. In other words, once a belief system concerning physiological processes has been established, it is difficult for the subject to modify this system. Second, this research finding indicates that belief systems can be established when specific physiological systems (e.g., blood glucose) are not in control and subject to tremendous fluctuations.

Finally, a number of findings and speculative hypotheses were introduced concerning the personality makeup and development of the symptom reporter. Symptom reporting can be viewed as a stable disposition as well as a response to situational changes. Among other things, the high symptom reporter tends to be female, from a conflict-ridden home, anxious, socially insecure, oriented toward and/or seeking to please members of the opposite sex, with an unhealthy life-style in relation to that of the low symptom reporter. This pattern is viewed as an extension of early family training that fostered social insecurity and reinforced symptom reporting. Each of these factors may have further produced higher physiological stress responses, making the person more prone to illness and ultimately more attentive to health.

The results of each of the experiments that have been presented have answered a number of questions, but at the same time have raised a number of issues. For example, we have not been able to resolve such questions as: Is most sensory information processed nonverbally or nonconsciously? Do we encode change or static information, or both? Does the perception of physical symptoms depend on at least some actual physiological information or can it be "invented" as in hallucinations? Some other things that we have not figured out include: What is the link between symptom awareness, symptom reporting, and health-seeking behavior? What are the necessary versus sufficient developmental causes of symptom reporting? What are those variables that are related to the organization of symptoms? As can be seen, the longer we

study a phenomenon, the easier it is to generate questions about it. One global question that has not been asked concerns the adaptive value of symptom awareness and reporting. Where do symptoms fit into the grand scheme of things?

Adaptive and Functional Bases of Symptoms

As far as we know, individuals in all cultures perceive and report physical symptoms. Even members of the current generation of English-signing primates apparently report symptoms (Patterson & Linden, 1981). Obviously, the ability to perceive symptoms is highly adaptive. The organism that can use symptoms as a source of feedback in order to self-regulate will have a far higher survival rate than the organism that does not perceive and/or use symptom information. Symptoms, then, are signals indicating the current state of the body and/or environment. The self-regulatory nature of symptoms need not be belabored. What must be emphasized instead is that this symptom self-regulatory system is error prone. Individuals can fail to perceive or report symptoms, misperceive symptoms, or even overperceive symptoms. Each of these perceptual or reporting errors has different advantages and disadvantages for the organism.

The person who does not actively perceive physical symptoms would, of course, increase the chances that his body would be damaged in one way or another. A classic example of this problem occurs in people with congenital insensitivity to pain, a disorder that prevents them from experiencing pain (Melzack, 1973). Individuals born with this disorder have a greatly curtailed life expectancy, since they often cut, burn, or otherwise harm themselves without their knowledge. Less extreme examples can be seen with individuals who often die of diseases with subtle onsets (e.g., breast cancer, heart disease). In many cases, individuals who are not attentive to their symptoms and/or are unable or unwilling to report symptoms allow the underlying pathological condition to advance too far. It will be recalled from Chapters 1 and 7 that females report far more symptoms than males and visit physicians to a greater extent. Rather than being overattentive to symptom information, mortality data would suggest that females' symptom perception and reporting are at appropriate levels relative to the males' lack of attentiveness to body state. Finally, the individual who perceives but does not report symptoms will be in a far better position than the nonperceiver. Although the nonreporter will tend to suffer by not receiving medical or other help from others, such a person will be able to regulate their behaviors based on symptom information (for a discussion of help seeking, see DePaulo, 1982).

Individuals who misperceive and/or misreport symptoms confront completely different types of problems than those who are not attentive to body state. Errors in perception of the causes of symptoms—or misattribution of symptoms—can result in the person's thinking his heart attack is merely indigestion (Hackett & Cassem, 1969), or that his Dristan-induced rapid heart rate is due to his irritating dog. These errors in attributing the cause of the symptoms may be fatal to the person (or his dog), but at least the person feels better at being able to pinpoint some type of explanation for his symptoms. In addition to misperceiving the cause, the person can also misperceive the symptom itself. As discussed in earlier chapters, an individual holding a given body-relevant schema may tend to overlook certain symptoms and to exaggerate the magnitudes of others, thereby concluding that he or she is suffering from a disorder that is not objectively occurring. Perhaps one of the most common assumptions that is made in the perception and reporting of symptoms is that the person to whom the symptoms are reported organizes his or her bodily sensations in the same way as the person who experiences the symptoms. Cross-cultural research indicates that this is not always the case. Recall an example introduced in Chapter 1 wherein researchers from England assumed that African tribesmen never suffered from ulcers, since no one in the tribe ever noted ulcer-relevant symptoms (Raper, 1958). Undoubtedly, the tribesmen organized and perceived symptoms associated with the gastrointestinal tract in different ways from the British. From an adaptive perspective, then, to perceive and report internal states in ways that are radically different from those used by one's peers, physicians, or therapists may result in misdiagnosis of a problem, ineffective treatment methods, or simply misunderstanding and lack of trust between the parties involved.

Finally, the individual who is overattentive to body state and who tends to report symptoms to a much higher degree than others may stand to lose the most from a social point of view. Although such a person may accurately detect subtle physiological changes, others who cannot verify such changes may tend to derogate the reporter as a hypochondriac or crock (e.g., Bender, 1964). Interestingly, the overattentive symptom reporter may be at the greatest disadvantage in dealing with certain aspects of the external environment. Recall that the competition-of-cues research has indicated that the processing of external versus internal information is reciprocal—all things being equal. From this, we would predict that the symptom reporter would be less attentive to a large number of sources and types of external information.

In explaining any behavior such as symptom reporting from an adaptive or functional view, it must be remembered that if an organism is behaving in a “maladaptive” way (i.e., over- or underreporting symptoms), the organism must be doing it for a reason. Just as the overattentive person who is aware of all sensations may be at an advantage from

a health (but not social or task-related) viewpoint, the underattentive individual may be more efficient in accomplishing certain types of tasks that require the utilization of peripheral cues. Note that these extremes are virtually identical of those raised in discussions concerning the internal-external dimensions associated with obesity (e.g., Rodin, 1981). Just as the over- and underattentive persons attain certain short- or long-term goals, the individual who misperceives or inaccurately reports symptoms has the ever-so-slight advantage of thinking that he or she has correctly reported symptoms or their cause (which is better than not knowing the cause). In sum, whatever the threshold for perceiving or reporting symptoms, the individual must maintain a balance between assessing internal signals in order to regulate the body and monitoring and mastering various facets of the external environment.

Applications of Symptom Research

Throughout this book, a number of specific applications of symptom findings have been discussed. For example, the blood pressure and blood glucose studies may help people to read bodily cues, which in turn may increase medical compliance rates. Other studies, such as jogging or coughing, may be useful in specific settings for certain individuals. At this point, however, it is useful to stand back and consider some payoffs of symptom research from three perspectives: those of the symptom reporter, of the paid professional symptom decoder such as the physician, and of the unpaid professional—the parent. Each of these individuals has a different set of problems in monitoring, interpreting, and organizing symptom information.

The Symptom Reporter

If on occasion you become aware of a number of symptoms, many of the findings reported in this book may help you in interpreting them. For example, the symptoms may signal that something is wrong with your environment (e.g., that you are under- or overworked, or are in social isolation) as well as your body. More than anything, the symptom reporter should be attentive to those situational and emotional factors that covary with the awareness of symptoms. We selectively monitor our bodies based on information that we may have heard or read about. Similarly, we may have had an extreme physiological response (broken bone, chest pains) that has made us particularly attentive to that area of the body. In other words, a number of factors can cause us to monitor certain symptoms to a much greater degree than we would normally.

A major difficulty that most of us must contend with is that symptoms—by their very nature—are ambiguous and subjective, open to a variety of interpretations. In addition, we usually are not trained to link sensory signals to external or psychological causes. If we feel nauseated, we usually cannot tell if the symptoms are due to something that occurred 1 or 30 minutes, or even several hours or days, earlier. Finally, we tend to assume that “physical” symptoms are the results of physical—not emotional or perceptual—causes. Each of these problems may force the person to adopt inaccurate hypotheses about the meaning of his or her symptoms.

The presence of physical symptoms will often result in the person's not reporting them for two major reasons. The first is the fear that the symptoms represent a life-threatening disorder such as cancer. The other is that the individual may worry that there is no physiological basis to the problem, which will result in a loss of pride—as well as of money, if a visit to medical personnel is considered. The first fear has been discussed by Mechanic (1978) and may actually increase the number of symptoms due to general stress reactions, closer scrutiny of other bodily sensations, and the like. The second fear may be especially well founded given that it is not easy to get physiological measures of self-reports. The person should not doubt his perceptions, however. As discussed in Chapters 3 and 4, measurement procedures often do not mirror percepts. And by the same token, perception of physiological processes can be unrelated to the physiological processes. Of course, this is hardly consolation for the person who notices subtle physical symptoms and is reluctant to report them to others. At this point, it would be wise for the individual to seek medical attention. If the person is then derided as a hypochondriac, he or she can reread this book and understand why.

The Professional Symptom Decoder

The physician and, to a similar degree, the therapist have an interesting series of problems in attempting to translate what a person reports his or her symptoms to be into a problem that can be treated effectively. Although the majority of cases that are presented to physicians represent common problems that can be objectively verified, oftentimes the physician is unable to substantiate a diagnosis. Many of the findings reported in this book may be directly relevant to understanding the patient's complaints.

First, is the patient reporting all of his or her symptoms? Is the presentation of symptoms organized in a way that is misleading? Recall that we all organize sensory experience in very different ways. As such, we will ignore some sensory information and accentuate the importance of others. Naive anatomical or causal theories held by the patient will

often grossly distort the presentation of symptoms and symptom-relevant behavior. Second, in what settings does the person experience the symptoms? Is there a covariation between being in an isolated or overly hectic setting and the onset of symptoms? As discussed in Chapter 2, symptom reporting is likely to occur when there is a lack of external information. Could the reported symptom or symptom cluster be an unlabeled emotion? Recall from Chapter 5 that a unique pattern of symptoms tends to covary with discrete emotions. A person who might not be able to express or acknowledge a given emotion may be particularly distressed when the emotion-related symptoms appear, since from the reporter's perspective, the emotion could not possibly be occurring. A brief interview may be necessary in order to learn how a person typically feels in a hypothetical setting where different emotions are aroused. A third important variable to consider is the developmental and background information of the patient. As the data in Chapter 7 indicated, family background, sex, social variables, eating habits, and a number of other variables are highly correlated with the general trait of symptom reporting. Knowledge of these variables can help the symptom decoder in evaluating the patient's reported symptom levels (e.g., if demographic variables indicate that the person would be classified as a low symptom reporter, the physician may weigh the presenting complaints differently than if the patient were classified as a high reporter).

In all probability, virtually all patients who visit a physician *are* perceiving the symptoms that they report. This is true for those patients for whom no immediate physiological causes are apparent. The health care professional must be especially careful in dealing with such a patient for a number of reasons. Telling the patient that the problem is "in your head" will clearly be anxiety arousing and self-esteem deflating—both of which result in increased symptom reporting. Merely administering a placebo to the patient will only be effective in the short run. If the person is perceiving symptoms, they may be inferred from situational factors, represent an emotional state, and so on. A placebo will usually not cure these more basic problems and will simply cause the patient to return to your office in the near future. If all physiological tests fail, a referral to a psychologist or psychiatrist may be advisable. As a final note, however, a brief examination of the patient's current life-style and setting, along with background information, can go a long way in helping the decoder to isolate the psychological—if not physiological—precursors to the patient's complaints.

In addition to the decoding problem, physicians and others in the medical profession often must convey symptom information to the patient. For example, patients must be attentive to the effects and side effects of prescribed drugs or treatments, or even to normal changes in the body (e.g., the expectant woman should be informed about normal sensations during pregnancy). The way in which the medical authority

presents such sensation information will greatly influence the patient's subsequent interpretation and organization of symptoms—both during and after the medical regimen. Johnson and Leventhal (1974; Johnson, 1973) have presented impressive data indicating that subtle differences in the way sensations are discussed with patients about to undergo an aversive medical procedure will have profound effects on the patient both during and after the treatment. In other words, differences in presentations with patients can bring about significant reactions in symptom interpretation. By the same token, medical personnel should point out to patients that they may experience certain sensations more in some settings (boring, quiet) than others. In other words, a large number of situational and personality factors must be weighed in interpreting the patients' symptoms as well as in conveying symptoms to the patients.

The Parent

In most cases, the professional symptom decoder deals with a verbal individual. The parent of an infant or preverbal (or nonverbal) individual faces special problems in attempting to decipher the internal state of another. The parent must infer physical symptoms from overt behavior of the child. As virtually all child-rearing books note, the primary symptom that indicates that something is wrong is that the child becomes cranky or listless, or lacks energy (e.g., Brazelton, 1972; Caplan, 1977). Other signs, such as fever or diarrhea, may also be apparent. If these more salient symptoms are not present, however, the parents will be subject to the same perceptual biases in observing their child's symptoms as they would their own. For example, the orienting and/or competition-of-cues research would predict that the parent would be more likely to notice symptoms of the child when they were not forced to process a great deal of other types of information. Second, the parents will selectively perceive and organize signs and symptoms of the child based on *their* schemas (recall Mechanic's 1964 finding wherein mothers experiencing stress symptoms assumed that their children were experiencing the same symptoms). Third, the parents will influence the child to label and report symptoms in ways similar to them. In fact, it is not uncommon for a child who is acquiring language to grossly mislabel symptoms based on familiar words heard around the house that express discomfort. For example, Falkner (1977) notes that it is easy to find a 3-year-old holding his throat while insisting that his stomach aches (even though objectively the child has a throat and not a stomach disorder).

Each of the above issues deals with attempts to interpret the child's symptoms. In Chapter 7, a number of research findings indicated that symptom reporting in the child and developing adult will be influenced by such factors as family conflict, major illnesses, and reinforcement

for symptom reporting. Based on research by Minuchin et al. (1975), for example, the child's reporting of symptoms can serve as a cue for the parents that the child may be perceiving significant family discord. Hence, the child's symptoms can signal environmental problems to the parent. Reinforcement and punishment of symptom reporting will also influence the perceptual styles adopted by the child in the future.

The parent as a socializing agent must consider two extremes implicit in shaping a person to over- rather than underreport symptoms. As noted earlier in the chapter, the former case may result in the child's becoming less attentive to external cues, whereas the latter may increase the chances that the child will ignore internal state, which may ultimately be deleterious to health. Interestingly, Bruch (1973) has suggested that parents' disregarding their children's reports about satiety following eating (i.e., "you must eat all of your food whether you are hungry or not") essentially trains the child to ignore hunger-relevant sensations and results in externally oriented eating habits and obesity. Similar training that teaches the child to ignore internal information may ultimately hamper the development of normal self-regulatory behaviors.

Whether examining the psychology of physical symptoms from the perspective of the reporter, the medical personnel, friends, or parents, an understanding of the perceptual and cognitive biases can be useful. Research programs by those who have studied physical symptoms have produced a number of practical applications that help the patient perceive and cope with symptoms and that aid the observer in interpreting symptoms in others. At this point in the evolution of symptom research, however, many of the studies have been most valuable in pointing to current theoretical problems and areas that must be examined in much greater detail. The remainder of this chapter briefly lists some of our current problems and expectations concerning future research endeavors.

Current Problems and Future Directions

The understanding of symptoms is a problem that cuts across a number of psychological and medical subdisciplines. In attempting to examine when and how people perceive and report physical symptoms, it has become clear that many approaches have offered important—but often limited—insights. Some of the problems that symptom researchers are encountering depend on a number of basic questions that must be addressed in these subdisciplines themselves. For example, many of the explanations used in this book have evolved from work in perception and cognition. Early sensory psychology was valuable in demonstrating that there is, in fact, some relationship between stimulus events and our

perception of these events. An understanding of visceral perception requires that we need to know more. Specifically, how do organisms perceive events in the real world? In other words, in naturalistic settings, what is the link between stimulus variables and the perception of them? Rapid strides are being made by assuming that the observer is active rather than a passive entity. Much of this research is beginning to link sophisticated mathematical models of stimulus events to perceptual events. In order to understand symptoms better, perception researchers also need to help us learn the degree to which visual, auditory, and internal sensory information sources are mathematically related concerning encoding and processing. Physiological level or change *must* be an important element in the organism's understanding of the world (cf., Cacioppo, 1979; Rodin, 1978). Despite the difficulties of measuring various physiological parameters, we must ultimately learn the specific stimulus properties inherent in the physiological signals that are being picked up.

As noted in Chapter 3, the concept of schema is one of dozens of slippery psychological constructs that have as many definitions as researchers who study them. As with other psychological constructs, the idea of schema or set, or hypothesis, or expectation, and the like is intuitively appealing. What are the properties of schemas and related constructs? How are they related to memory and learning? These issues are particularly important in understanding how symptoms are organized by the individual. Clearly, it is efficient and adaptive for the organism to cluster symptom information, but at this point we need to know what the clustering rules are.

Research in psychophysiology, medicine, and related disciplines can be especially useful for the symptom researcher. The development of simple assessment techniques to determine the ways in which individuals react to various stressors, emotions, and other events on physiological levels is needed. For any given individual, for example, it would be useful to know how the various systems (e.g., blood pressure and glucose, adrenal activity) interact over time. Are there classes of individuals who react in relatively similar ways? As discussed above, it would be invaluable to know the nature of the relationships between various actual (as opposed to perceived) stimulus events and changes in physiological activity. Although there has been work within this domain (e.g., dose-response curves), what are the fundamental dimensions that underlie changes in the various physiological systems? The ultimate understanding of visceral perception will depend on the links between perception and physiological research. This interface will require elegant mathematical models if we hope to predict people's perception of physiological activity across a number of settings.

Will there eventually be a grand theory that explains how people perceive and report physical symptoms? Probably not; physical symptoms

represent phenomena that are influenced by several different psychological and physiological processes. The grand theories must be devised around the basic processes rather than the phenomena themselves. Whereas a grand theory of symptoms may never be devised, theory development in allied areas will allow us to predict the when, why, and who of symptom reporting.

Appendix A

Symptom/Emotion Checklist: A State Measure

Sample Symptom-Emotion Checklist

Right now, at this moment, I am experiencing:

No Headache

No Watering eyes

No Racing heart

No Congested nose

No Tense muscles

No Upset stomach

No Flushed face

No Sweaty hands

No Shortness of breath

No Cold hands

No dizziness	_____	_____	_____	_____	_____	Dizziness
No ringing in ears	_____	_____	_____	_____	_____	Ringing in ears
<i>Right now, at this moment, I am feeling:</i>						
Not happy	_____	_____	_____	_____	_____	Happy
Not anxious	_____	_____	_____	_____	_____	Anxious
Not angry	_____	_____	_____	_____	_____	Angry
Not guilty	_____	_____	_____	_____	_____	Guilty
Not sad	_____	_____	_____	_____	_____	Sad

Measurement Parameters of Checklist

This checklist is a sample of a number of similar checklists that we have used in dozens of experiments. The exact symptom items have varied, depending on the nature of our research question. Interestingly, the internal consistency, reliability, and validity of the scales remain relatively constant regardless of the specific symptom items that are included. Although the following information is based on the above symptom items, researchers interested in symptom reporting in general may use other symptom items and keep the basic properties of the scale intact. The only times that altering the symptom items will not produce comparable results will be when fewer symptom items are present and/or the variability of reporting the specific symptoms is too low.

Scoring. A total symptom score can be obtained by summing all of the symptom items together. Although one can also add the negative emotions (all emotions except for "happy") to form an emotion scale, we have typically not done so. Rather, in most experiments, each emotion is examined separately. In the remainder of Appendix A, only the symptom items will be discussed.

Based on the reports of 1,286 undergraduates who have completed the 12-item symptom in mass testing sessions, 79.6% of the students have reported experiencing at least one symptom to some degree. For the total symptom scale, the mean score for these students has been 22.0.

Internal consistency. Based on the large undergraduate sample of 1,286 students, the mean intersymptom correlations average +.21, indicating that a person reporting one symptom is likely to report others. Across samples, the mean Cronbach alpha coefficient has been .75. Taken together, these data indicate that the symptom checklist is internally consistent and taps a general proclivity to report symptoms.

Test-retest reliability. The symptom-emotion checklist is designed to measure a person's present awareness of symptoms. As such, the reliability of the state measure of symptom reporting should be only moderate. Based on a sample of 177 undergraduates who completed the symptom checklist once a month for 4 months, the correlations between the total symptom scores dropped over time: 1-month reliability = .21; 2-month reliability = .14; 3-month reliability = .16; 4-month reliability = .07.

Factor structure. For all samples of all symptom checklists, various types of factor analyses were computed on the symptom items. Although we have tried principal components and related approaches (e.g., alpha, image) with varimax and oblique rotation solutions, we have never found stable or meaningful symptom factors.

Caveat. All of the data reported in this Appendix are based on between-subjects analyses. As discussed in Chapter 6, substantial differences are found for these measurement parameters when within-subject designs are employed.

Appendix B

The PILL: A Trait Measure

Inventory of Limbic Languidness: Form 7F

On the following pages several common symptoms or bodily sensations are listed. Most people have experienced most of them at one time or another. We are currently interested in finding out how prevalent each symptom is among college students. All data will be confidential.

On the answer sheet, next to the number corresponding to the symptoms shown below, blacken the circle which indicates how frequently you experience that symptom. For all items, use the following scale:

A	B	C	D	E
Have never or	Less than	Every	Every week	More than
almost never	3 or 4	month	or so	once every
experienced	times per	or so		week
the symptom	year			

For example, if your eyes tend to water once every week or two, you would blacken the circle marked D next to item # 1 on your answer sheet.

-
- | | |
|--|-------|
| 1. Eyes water | _____ |
| 2. Itching or painful eyes | _____ |
| 3. Ringing in ears | _____ |
| 4. Temporary deafness or hard of hearing | _____ |
| 5. Lump in throat | _____ |
| 6. Choking sensations | _____ |
| 7. Sneezing spells | _____ |
| 8. Running nose | _____ |
| 9. Congested nose | _____ |
| 10. Bleeding nose | _____ |

A	B	C	D	E
Have never or almost never experienced the symptom	Less than 3 or 4 times per year	Every month or so	Every week or so	More than once every week
11. Asthma or wheezing				
12. Coughing				
13. Out of breath				
14. Swollen ankles				
15. Chest pains				
16. Racing heart				
17. Cold hands or feet even in hot weather				
18. Leg cramps				
19. Insomnia				
20. Toothaches				
21. Upset stomach				
22. Indigestion				
23. Heartburn				
24. Severe pains or cramps in stomach				
25. Diarrhea				
26. Constipation				
27. Hemorrhoids				
28. Swollen joints				
29. Stiff muscles				
30. Back pains				
31. Sensitive or tender skin				
32. Face flushes				
33. Severe itching				
34. Skin breaks out in rash				
35. Acne or pimples on face				
36. Acne or pimples other than face				
37. Boils				
38. Sweat even in cold weather				
39. Strong reactions to insect bites				
40. Headaches				
41. Sensation of pressure in head				
42. Hot flashes				
43. Chills				
44. Dizziness				
45. Feel faint				
46. Numbness or tingling in any part of body				
47. Twitching of eyelid				
48. Twitching other than eyelid				
49. Hands tremble or shake				
50. Stiff joints				
51. Sore muscles				
52. Sore throat				
53. Sunburn				
54. Nausea				

Measurement Parameters of the PILL

The PILL, or Pennebaker Inventory of Limbic Languidness, taps the frequency of occurrence of a large number of common physical symptoms and sensations. Although initially scaled along 7 points (from 1 = have never experienced the symptom to 7 = daily), we have since changed the scale to 5 points. This change allows for computer scoring. For a brief discussion of the original scoring, see Pennebaker et al. (1977).

Scoring. Although we originally scored the present version of the PILL by summing items 1-54, we have since found a much simpler technique. Now we simply sum the total number of items for which the subject responds C, D, or E (every month or so, or more frequently). The total score, based on the 54 items, can range from a low of 0 to a maximum of 54. The original scoring approach (referred to as the summed method) correlates .96 with the recent simpler approach (hereafter called the binary method).

The binary scoring technique yields a mean score of 17.9, with a standard deviation of 6.9. These PILL statistics are averaged over five samples ranging in size from 124 to 286 subjects (total $N = 939$).

Internal consistency. The internal consistency of the PILL is high. When scored using the binary method, the Cronbach alpha is .88; the summed method alpha equals .91. Mean interitem correlations for the two techniques are .11 (binary) and .16 (summed).

Test-retest reliability. The test-retest reliability of the PILL can be assessed in a number of ways. The reliability of the binary and summed methods over a 2-month period (for 177 subjects) was .79 and .83, respectively. In addition to the total score, Pennebaker et al. (1977) found the item reliability averaged across all 54 symptoms to be .725, based on a sample of 60 subjects tested 2 weeks apart.

Factor structure. Factor analyses on PILL responses yield a large number of small and relatively unstable factors across samples. Representative factors include running nose and congested nose, stiff muscles and sore muscles, and the like.

A final note. One of the major advantages of the PILL is that it allows the researcher to see which specific symptoms are commonly experienced by the subject. For example, in our accuracy experiments (see Chapters 4 and 6) we have been able to learn if the frequency of experiencing heart-related sensations correlates with accuracy of heart rate perception. In other words, the PILL can be used in ways other than assessing one's *general proclivity* for reporting physical symptoms.

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