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Cognitive Processes as Determinants of Environmental Stress

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High-intensity noise and high levels of population density are typical of the environmental factors thought to be detrimental to our behavior and health. One basis for this assertion is the popular belief that the greater the intensity of unwanted stimulus, the greater its deleterious effect on behavior. Indeed, high-intensity noise can impair hearing and interfere with communication (Kryter, 1970; Miller, 1974 for reviews), and high levels of density interfere with tasks and behaviors that are impaired under conditions of restricted movement (Altman, 1975; Saegert, 1973). Evidence, however, for a direct relationship between the intensity of these environmental stressors and other aspects of health and behavior is weak. Increases in density and sound level are not consistently related to measures of performance, social interaction, and health (see reviews by S. Cohen, Glass, & Phillips, 1979; Loeb, 1979; Sundstrom, 1978). It is instead becoming increasingly clear that it is the meaning of a potential environmental stressor, not the objective, physical intensity of the stressor, that best predicts human response (cf. S. Cohen, 1979; Glass & Singer, 1972; Stokols, 1978).

This chapter argues that the physical characteristics of a potential environmental stressor are generally less important determinants of whether one is stressed than the psychological properties of the overall situation. The first main section of this chapter reviews a number of cognitive orientations to the study of environmental stress and presents some selected data providing support for these approaches. These data include field and laboratory research findings that support the argument that the meaning of a stimulus configuration is generally more important than its physical properties in producing stress effects. The other main section of the chapter emphasizes the role of context in laboratory studies of environmental stress. It attempts to explain inconsistency in the laboratory effects of high-density and high-intensity sound by suggesting a number of characteristics of the laboratory setting that may affect the meaning of the situation and thus whether or not an intense stimulus configuration is preceived as a stressor.

The review which follows is largely restricted to research on the impact of population density and environmental noise on humans. The analyses suggested in this chapter are not, however, meant to be restricted to these stressors. Selection of

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density and noise for discussion here was dictated by a number of investigations in these areas having examined the role of psychological factors in mediating the effects of the physical environment on behavior and health. I am suggesting a commonality among environmental stressors. Thus I argue that the effects of noise and density are mediated by similar psychological factors and that these factors are generally more important determinants of stress-related behavior than the physical properties of the stressor.

STRESS IS IN THE MIND OF THE BEHOLDER

The role that cognitive analyses of stress have played in the development of the noise and crowding literature is apparent in the lexicons of both of these literatures. Noise researchers have long made a distinction between sound (even high-intensity sound) and noise. Sound is a physical condition produced by changes in air pressure as detected by the ear. Noise is unpleasant, unwanted, or intolerable sound. Thus your neighbor might enjoy a 120-decibel rendition of the Rolling Stones' newest album, whereas you might find the same physical stimulus quite aversive. Analyses of the population density literature (cf. Stokols, 1972) have similarly distinguished between density and crowding. Density is defined as the physical condition of restricted space, whereas crowding is viewed as a psychological state in which the restrictive aspects of limited space are salient and aversive, that is, unwanted. Thus people often enjoy (or at least are unaffected by) extremely high levels of density while attending a sports event or cocktail party but find crowded elevators unpleasant. Therefore the physical conditions of density and sound are only considered environmental stressors when they are defined by the individual as unwanted.

Stressor Evaluation

For many stress theorists, the definition of a stimulus configuration as unwanted would not be sufficient to induce a stress reaction; instead the situation would need to be one that demanded a coping response (cf. Sells, 1970). This demand is often said to depend on the situation's being defined as a threat to one's psychological or physical well-being (cf. Lazarus, 1966). A model of the process involved in evaluating a stimulus configuration as threatening or benign is suggested by Lazarus (1966). Threat appraisal is proposed as a process that occurs between stimulus presentation and stress reaction. For a situation to be deemed threatening, the stimulus must be evaluated as harmful. This process is presumed to depend on two classes of antecedent conditions: the psychological structure of the individual and the cognitive features of the stimulus situation. When a stimulus is evaluated as threatening and an appropriate coping response is not available, a stress reaction occurs. Thus Lazarus suggests that we must evaluate whether the situation is a threat and whether we can adequately deal with this threat.

The evaluation of a stimulus configuration as threatening or benign is, of course, not independent of its physical properties. Thus, for example, S. Cohen (1978) argues that the higher the intensity of a sound, the greater its probability of being defined as a stressor. Likewise the greater the density, the greater the probability of others being defined as threatening. The meaning of an environmental stressor is not entirely dependent on its intensity, however, and often, especially when the

intensity is within the moderate ranges used in laboratory settings, other aspects of the situation and the coping capabilities of the subject are more important determinants of threat appraisal than the physical properties of the situation. While there is not an enormous literature on the impact of contextual factors in response to high-intensity sound and high density, there is enough evidence to provide strong support for this approach.

What follows is not a thorough review of the relevant literature but an overview of some of the cognitive approaches that have been employed in studying environmental stress and selected data providing support for these approaches. The areas of research discussed include the roles of privacy, personal control, attribution, attitudes, and expectancies in mediating one's response to stimulus configurations that are potentially stressful. It is important to point out that these areas of research do not represent mutually exclusive categories or theories. In many cases data cited in one section could be appropriately reviewed in another. Moreover, the theoretical perspectives are all interrelated, and one theory can often be viewed as a subset or extension of another. The overriding common aspect of all the data and theories presented in this chapter is that they unanimously suggest the important contribution of the meaning of a situation in determining a stress-related response.

Privacy

The desire for privacy has been proposed as an important determinant of negative stress reactions to both density and sound. In general, privacy is viewed as the freedom to decide on the social activity in which one participates (Klausner, 1971, p. 130). Altman (1975) further distinguishes between desired levels of privacy and achieved levels of privacy. He argues that if one's achieved levels of interpersonal interaction are above or below desired levels, then one will be unhappy—possibly stressed—and will strive to regulate one's contact to reach the desired state. Thus according to Altman, too much or too little contact with others will result in a stress response.

A number of studies of perceived crowding support the privacy perspective. Thus when an interaction is unwanted, even fairly "roomy" situations are perceived as crowded; when an interaction is viewed as acceptable, even close contacts are not viewed as crowded. For example, Stokols and Resnick (1975a) found that subjects experiencing high-density conditions reported being more crowded when they were asked to "evaluate one another" than when they were asked "to get acquainted." In a second study, the same authors (Stokols & Resnick, 1975b) also found that perceived crowding in student residences was rated as higher by those who disliked the social aspects of the residence irrespective of the actual density. Similarly, Rall, Stokols, and Russo (1975) report that those expecting a "threatening" interview in either a large or a small room anticipated greater crowding than those expecting a less threatening experience. Thus the nature of the interaction is a more important determinant of reported crowding than the actual level of density.

The importance of spatial privacy in residential settings is suggested by a correlational study of 75 Chicago-area communities (Galle, Gove, & McPherson, 1972). Even after controlling for race, social class, and ethnicity, those living in areas with dwellings averaging fewer rooms per person showed increased use of community mental health facilities. Fewer rooms suggests that residents would have less privacy, that is, less ability to control the amount of interaction with other family members. Moreover, a recent review of residential crowding research suggests that residential

crowding with strangers (e.g., in institutions) is experienced more negatively than crowding within a family household (S. Cohen, Glass, & Phillips, 1979). Thus the nature of the social relationships between residents, especially as it affects the predictability of others' behavior may be a more important determinant of the impact of internal density than the actual level of density (cf. S. Cohen, 1978).

The effects of sound on behavior have also been viewed in a privacy context. For example, Berendt (cited in Klausner, 1971 p. 124) argues that people do not want to hear their neighbors nor do they want their neighbors to hear them. This is especially true if the sounds one is exposed to contain meanings that one would rather not hear. This approach is supported by community surveys that consistently find that sounds made by others are viewed as more annoying than sounds produced by one's own activities (cf. A. Cohen, 1969; Klausner, 1971). Moreover, the degree of annoyance increases with disapproval of the noise-producing activity. That is, "the nonparticipant in a noise producing activity is annoyed to the extent to which the meaning of the activity, rather than simply the volume of the noise, is bothersome" (Klausner, 1971, p. 123). Thus one's annoyance increases when one is forced to participate, even passively, in an unwanted interaction.

Studies of noise in institutional settings provide further examples of the role of the meaning of the sound in determining its intrusiveness. For example, a survey of noise conditions in a hospital (Goodfriend & Cardinell, 1963) reports that the second most prevalent source of noise annoyance was staff conversation in the hall. Patients found these sounds objectionable, not because of the sound level, but because of the information they conveyed including descriptions of other patients' conditions, symptoms, and so on. The next most prevalent source of noise annoyance was the sound of other patients in distress, including moaning and calling for a nurse. Similar results are reported in a study of the role of the meaning of sound in determining its effect on physiological response. Chotlos and Goldstein (1967) assessed hospital patients' responses to a variety of sounds, including weeping, tolling bells, and door slamming, among others. Physiological responses, including heart rate, digital temperature, and skin resistance, were primarily determined by the associations made with the sound. For example, there was a marked increase in heart rate following a recording of a man crying for help, whereas no such increase followed music. Thus it appears that the meaning of an intrusive sound is central in determining the degree of both one's annoyance and one's physiological response.

Personal Control

A number of recent papers have emphasized that feelings of control over one's environment are central in determining the effects of a stressor on behavior and health (e.g., Averill, 1973; S. Cohen, Glass, & Phillips, 1979; Glass & Singer, 1972). An early approach to the role of cognitive control in stress reactions was proposed by Sells (1970). Briefly, Sells argues that stress arises when: (a) one is called on to respond to a situation for which one has no adequate response and (b) the consequences of failure to respond effectively are important to one. Some specific effects of a continual inability to control important events are suggested by Seligman (1975) who argues that continual exposure to events one can do nothing about frequently results in a psychological state of helplessness. This state of helplessness includes a lessening in one's perception of control over outcomes, a depression of mood, and a decrease in one's motivation to initate new responses. Extreme effects of helplessness include fear, anxiety, depression, disease, and even death.

It is important to note that control theorists often attribute stress to one's lack of control per se That is, the physical stressor's role in the process is to elicit these feelings of helplessness Yet it is the perception that one lacks control over an important outcome, not the physical stressor itself, that causes stress-related reactions. This is an important distinction, for it suggests that reactions attributable to perceived losses of personal control should be similar for a wide variety of stressors.

The importance of cognitive control in determining "crowding" reactions has been discussed by a number of investigators (Baron & Rodin, 1978; Baum & Valins, 1977; S. Cohen & Sherrod. 1978; Rodin & Baum, 1978; Sherrod & Cohen, 1978). Research supporting this view is also proliferating. Experimental manipulations of control have included control over escape, control over activities ensuing during density, and information control (provision of information about how one should feel under crowded conditions). Such control has been shown to lessen reported crowding (Rodin, Solomon, & Metcalf, 1978), density-induced deficits in performance (Langer & Saegert, 1977), and negative behavioral aftereffects of short-term crowding (Sherrod, 1974).

There is also evidence that the effects of residential density are mediated by control (S. Cohen, Glass, & Phillips, 1979; S. Cohen & Sherrod, 1978). Specifically, it is suggested that residential density effects occur under conditions in which a "susceptible" population is exposed to high levels of uncontrollable density. Susceptible populations are ones that are characterized by a general lack of control over their environmental outcomes: the very young, the old, the poor and uneducated, and those living in institutions. For example, children are typically unable to control their outcomes, for their lives are largely determined by parents and other supervising adults (cf. Baldassare, 1977; Evans, 1978). Similarly, institutions (e.g., prisons and nursing homes) often deprive adults of control over both their social and physical environments by dictating where and with whom they interact. Finally, those with low incomes and low levels of education often lack the organization and power necessary to affect their environment. The addition of uncontrollable density to the stressors typically associated with the above-mentioned groups presumably operates to reinforce their feelings of powerlessness and helplessness. Such feelings are likely to increase susceptibility to both physical and mental distress (cf. Seligman, 1975).

Direct evidence for the hypothesis that household density is related to a susceptible population's perceptions of helplessness and associated cognitive, emotional, and motivational responses is provided in a paper by Rodin (1976). Rodin reports that, even after controlling for social class and race, children living in high levels of internal density are less likely to exercise their own choices than children from low-density apartments. In addition, children from high-density apartments are more adversely affected by a learned helplessness pretreatment (insoluble puzzles) than their low-density counterparts. Thus, at least for children, density can result in feelings of helplessness.

Evidence that those crowded in institutional, nonfamily settings are susceptible to density-produced helplessness effects and related negative outcomes is provided by Baum and Valins's (1977; also Baum, Aiello, & Calesnick, 1978) work on crowding in college dormitories. It is important to note that this work did not actually compare those under high and low density; it compared dormitory residents who, because of dormitory design, were exposed to prolonged and repeated personal encounters with large numbers of other residents (depriving them of control over their

level of interaction) to residents whose forced encounters included a comparatively small number of others. Baum and Valins report a number of behavioral and self-report measures suggesting passive surrender or learned helplessness among the crowded (high level of personal encounter) residents. Crowded residents used a withdrawal strategy more often in a prisoner's dilemma game and were less likely to assert themselves by asking questions in an ambiguous situation. Crowded residents also reported feeling more helpless and feeling that their attempts to change things and make them better were, relative to their less crowded counterparts, worthless.

Cognitive control has similarly been implicated as a central determinant of the impact of noise on behavior and health. The perceived ability to control (escape from) high-intensity sound was studied by Glass and Singer (1972), who found that the adverse poststress effects following loud, unpredictable noise were substantially reduced if the subjects believed they had control over the termination of the noise. Increased control over high-intensity noise also resulted in an initially lower level of physiological response. The adverse poststress effects reported by Glass and Singer have been replicated with noise (e.g., Gardner, 1978) and a number of other stressors include bureaucratic stress (Glass & Singer, 1972), high density (Sherrod, 1974), cold press (R. T Mills & Krantz, 1979), and electric shock (Glass, Singer, Leonard, Krantz, Cohen, & Cummings, 1973). Moreover, studies of the learned helplessness phenomenon, in which subjects are administered escapable or inescapable bursts of high-intensity sound, similarly indicate that poststimulation deterioration of task performance occurs only after inescapable and not escapable sound exposure (e.g., Hiroto, 1974; Krantz, Glass, & Snyder, 1974).

There are a number of findings in the epidemiologic literature dealing with the effects of noise on health that are consistent with a control interpretation. Graeven (1975) reports that residents reporting an inability to control noise in their environment were more annoyed than those reporting control. Moreover, S. Cohen, Glass, and Phillips (1979) have suggested that community noise operates much like residential density. Thus noise is most likely to have a detrimental impact on those from susceptible population groups, those characterized by a general lack of control over their environmental outcomes.

Direct evidence for the hypothesis that community noise is related to a susceptible population's perceptions of helplessness is reported in a recent paper by S. Cohen, Evans, Krantz, and Stokols (in press). Elementary school children attending school under the air corridor of a busy urban airport tended to behave in a helpless manner by giving up on cognitive tasks more often than similar children attending quiet schools. Children attending noise-impacted schools also performed more poorly on a puzzle-solving task and had higher systolic and diastolic blood pressure than those attending quiet schools. This study provides data similar to those reported in the Rodin (1976) study of children living in high-density environments. That is, children continually exposed to an environmental stressor in their home or while attending school show feelings of helplessness.

It should be noted that the role of control is probably more complex than suggested above. Thus Averill (1973) has pointed out that the "stress reducing-properties of personal control depend upon the meaning of the control response for the individual" (p. 201). In experimental studies this meaning would depend on the context in which it is administered (see the following section on experimental studies). In the field, an interpretation of what is sufficient to provide people with feelings of control is often difficult. Such interpretations are, however, both possible (cf

Schulz, 1976) and essential if we are to understand human responses to stress in naturalistic settings.

Privacy or control? It is possible to subsume theories of privacy within the more general personal-control orientation. For example, Altman (1975) has suggested that privacy regulation involves one's ability to control one's level of social interaction. These interactions may be viewed as just one case of personal control.

Attribution

The attributional process has also been proposed as an important determinant of one's response to a potential stressor. For example, one recent theory suggests that perceived crowding be viewed in terms of Schachter's theory of emotion (Schachter, 1964; Schachter & Singer, 1962). According to this approach, perceived crowding occurs only when a nonspecific state of arousal is attributed to excessively close interpersonal proximity (Keating, 1979; Worchel & Teddlie, 1976). Both factors—arousal and the interpretation of the physical arousal as being due to crowding—are necessary. An interesting twist of this theory is that the state of arousal may or may not actually be caused by the closeness of others; it will however be experienced as crowding if, even mistakingly, it is attributed to density. In support of this hypothesis, Worchel (1978) and Gochman (1979) have demonstrated that perceived crowding occurs only under the above-mentioned conditions and irrespective of whether arousal is actually induced by the closeness of others or by another threatening or frustrating aspect of the situation. Moreover, crowding can be ameliorated when the attributional process is diverted from focusing on density. Thus this work emphasizes that for a potential stressor to be perceived as stressing, one must judge it to be the cause of one's stress response.

The attribution and control perspectives have been combined in a theory of crowding proposed by Baron and Rodin (1978). Specifically they argue that density may not be experienced as uncontrollable unless the other people present are perceptually salient and unless blame for restriction on one's freedom is attributed to their presence rather than to other factors in the situation. Thus density is only a stressor when one (a) is deprived of control over one's outcomes and (b) blames the loss of control on the close contact with others (see also Schmidt & Keating, 1979).

Attitudes about the Stressor and Its Source

The community noise literature suggests that one's attitudes about a stressor, the purpose it's serving, and those responsible for it are important mediators of stress response. These data could be viewed as support for any of the approaches presented so far and provide strong support for the argument that the meaning of the stressor is a central determinant of its effects.

Although social surveys often report a positive relationship between noise intensity and the average level of felt annoyance, intensity alone seldom explains more than one-quarter of the variance in individual annoyance reactions (cf. McKennel, 1973). The major determinants of annoyance, often explaining over half of the variance, are the respondents' attitudes and beliefs about the noise source. A summary of the community noise literature (Borsky, 1969) suggests that annoyance is heightened when: (a) The noise is perceived as unnecessary; (b) those responsible for the noise are perceived as unconcerned about the exposed population's welfare; (c) the respondent dislikes other aspects of the environment; (d) the respondent believes

that noise is harmful to health; and (e) the noise is associated with fear. This list is abstracted from several social surveys, and the operative factors affecting annoyance reactions vary from study to study. Nevertheless, attitudes and expectancies concerning the sound are consistently more important determinants of individual annoyance than the acoustic properties of the sound.

A striking example of the impact of attitudes on noise annoyance is presented in an attempt by Cerderlöff, Jonsson, and Sörenson (1967) to lessen annoyance by changing community attitudes about the noise source. A group of residents of an area surrounding a Swedish air force base were sent a souvenir book commemorating the 50th anniversary of the Royal Swedish Air Force. The book led the residents to think that their neighbors all felt that the air force was of vital importance to the country. Surveys conducted several weeks later and even several years later found that this group was less annoyed by aircraft noises than a control group drawn from the same community. Thus, redefining the importance of the noise source drastically reduced annoyance reactions.

Expectancies

One's beliefs and expectancies about effects of noise are also important determinants of the effects of high-intensity sound on behavior. In an early study, Mech (1953) showed that the effects of noise on performance could be altered by providing subjects with different pretest expectancies about the effects of noise on their work efficiency. The group of subjects expecting detrimental effects did in fact show loss, whereas those expecting improvement improved.

Expectancies about the effects of density have similarly proved important in determining one's response to high-density settings. Thus two recent studies by Baum and his colleagues (Baum & Greenberg, 1975; Baum & Koman, 1976) demonstrate the anticipation of crowding results in subjects preparing for the experience of crowding by taking steps to reduce the impact of the crowding before its onset. Moreover, subjects seemed to experience "crowding" and discomfort during the anticipatory period. Thus, to some extent, reactions to an environmental stressor can be determined before actual exposure to the stressor.

Summary

The data and theory presented in this section suggest that the psychological properties of a situation are important determinants of whether one experiences stress. Overall it appears that the relationship between a potentially stressful level of environmental stimulation and a stress response is mediated by a number of cognitive processes. Moreover, in a great number of situations, the psychological properties of the overall situation are better determinants of stress response than the physical properties of the stressor.

THE IMPORTANCE OF CONTEXT IN LABORATORY STUDIES OF STRESS

Studies of density and high-intensity noise in laboratory settings have been rather inconsistent in their conclusions. There are few truly reliable nonauditory effects of high-intensity sound (Kryter, 1970; Loeb, 1979) and density (Sundstrom, 1978) on human performance and behavior. It is my premise that the emphasis on a

high-intensity approach to laboratory research is responsible for the lack of consistency among laboratory studies of noise and crowding. This approach assumes that if the noise is loud enough or the space is restricted enough effects should occur. After all, it seems intuitively reasonable that placing someone in a room and playing 85-110 decibel blasts of noise in her or his ears will affect her or his behavior. Similarly, putting 10-20 people in an area the size of a closet also appears to be quite a stressing experience. Certainly noise at these intensities does interfere with communication and these levels of density do restrict a subject's movements through space. Yet these situations do not consistently or, oddly enough, even usually create noticeable stress responses (cf. Kryter, 1970; Stokols, 1978). To understand why such apparently aversive situations are not necessarily stressing, we need to evaluate the total experimental setting in an attempt to determine the meaning of the situation and the potential stressor for the subjects. There are a number of factors that are usually present in experimental settings that are likely to lower the probability of the situation being defined as threatening (cf. S. Cohen, 1979).

First, participants in studies are aware that the exposure to the aversive stimulus will last only for a short period (cf. Altman, 1975). Thus subjects will often view the experiment as a challenge—pitting themselves against the stressor. This increased motivation is observed in subjects' reports that they tried harder during noise or found working under noise to be more interesting, challenging, and important than working in quiet (cf. Judge, 1978; Krantz et al., 1974; Weinstein, 1977). Thus what on the surface appears to be an aversive experience may in fact be viewed at least as a challenging if not an enjoyable one. Those suffering prolonged exposure, however, are unlikely to view high-intensity sound or high density in this manner.

Second, there is an implied contract between the experimenter and the subject that suggests no harm will come to the subject during the experimental procedure. Thus subjects entering an experiment assume that it is being conducted by a competent scientist who would not expose them to potentially dangerous situations. This contract is often made explicit by the signing of an informed consent slip (required for most federally funded research in the United States and often for nonfunded research as well) that explicitly outlines the nature of the stressor and usually suggests that it is perfectly safe. A recent study (Gardner, 1978), in fact, reports that it was possible to replicate the Glass and Singer (1972) noise aftereffects *without* use of a standard informed consent form; but when the form *was* used, there were no aftereffects of unpredictable, uncontrollable noise.

Third, the subject in an experiment has chosen to participate in the study, usually after receiving a description of the stressor involved. Although this choice sometimes creates a subject selection problem (those who find the particular stressor most aversive do not participate), the psychological effects of *choosing* to participate are even more important. Choice can lead to a need to minimize the perceived aversiveness in order to justify the original decision to participate (cf. Glass & Singer, 1972), or it can create a challenge for the subject to endure without complaint or impact. In line with this argument, it is interesting to point out that many of the earlier studies reporting noise-induced effects on performance, especially in Great Britain, used military personnel as subjects (e.g., Broadbent, 1954; Broadbent & Gregory, 1965; Wilkinson, 1963). It is likely that these subjects were not asked whether or not they would like to participate in a study. Presumably this would lead to a more negative interpretation of the situation than would result for volunteers and for those giving informed consent.

Another aspect of the choice variable is the option, often offered to subjects, to terminate participation in the experiment. In fact, HEW guidelines for the protection of subjects suggest that they should be informed that they can terminate their participation at any point in the study without loss of pay. As outlined earlier, when allowed such an option, subjects performance in laboratory studies is unaffected by high-intensity sound (e g . Glass & Singer, 1972) or high density (Sherrod, 1974).

Fourth, intense environments, which in many cases may have their effects because of their inappropriateness in a particular situation (e g., unnecessary noise or density), can be viewed as legitimate in a laboratory setting (cf. Judge, 1978). After all, if the experimenter is investigating the effects of environmental stress on performance, it is necessary for the stressor to be present in the situation.

Other contextual factors that often vary from study to study (and are seldom reported in methods sections) could also affect a subject's judgment of the potential threatening quality of a situation and a potential stressor. For example, the dress and demeanor of the experimenter could be a central factor. An experimenter wearing a white laboratory coat and treating subjects in a very formal manner may produce a very different interpretation of the stressor and setting than an informally dressed experimenter who precedes the study with friendly chatter. Similarly, a study set in a laboratory with complex-looking equipment may result in a different interpretation than one set in an environment that resembles a living room.

One intrepretation of this analysis of laboratory studies of environmental stress is that the laboratory setting is of such a fragile nature that data collection in such a setting is relatively useless, but it is too early in the game to suggest such a pessimistic view. The challenge now is to determine the kinds of information that are used in evaluating a potential stressor and particularly in identifying those factors that are critical in mediating laboratory stress effects. Unless we have a better understanding of the role of these various factors in the mediation of the effects of high-intensity sound and high density, it seems unlikely that studies of the relationships among environmental stress, performance, and behavior will yield many reliable findings.

To predict the impact of environmental stressors in naturalistic settings, we will also require an understanding of critical mediators. Naturalistic settings are inevitably more complex than labortory settings, and the number of factors that may play roles in determining stressor evaluation is enormous. Previously cited work on the characteristics of susceptible populations and on the role of attitudes and expectancies in community response to noise suggest important factors that require further investigation. Moreover, the factors that mediate responses to potential stressors in the laboratory may provide clues to those that operate in naturalistic settings. This was illustrated in the earlier discussions (a) of the role of perceptions control in mediating response to density in the laboratory (e g., Sherrod, 1974) and in the field (cf. S. Cohen, Glass, & Phillips, 1979; Rodin, 1976) and (b) of the role of privacy in both laboratory (Stokols & Resnick, 1975a) and field (e.g., Galle et al., 1972). Thus further analysis of the ecological validity of the laboratory may help us to understand human response to potential environmental stressors in both simulated and naturalistic settings.

CONCLUSION

We cannot definitively conclude at this time that contextual factors are more important determinants of reactions to environmental stress than the physical prop-

erties of the stressor There is, however, enough evidence to suggest that we will not be able to predict the impact of intense environmental conditions consistently without taking the meaning of the stressor and the setting into account

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*ADDENDUM**

This chapter has provided an overview of the role of cognition in determining when a situation is perceived and responded to as stressful. I would like to update the chapter by providing short summaries of three recent research projects. The projects examine (1) the role of stressor anticipation in producing stressor effects; (2) the predictive validity of perceived as opposed to objective stress measures; and (3) the role of perceived social support in moderating the relationship between stress and health.

EFFECTS AND AFTEREFFECTS OF STRESSOR ANTICIPATION

We have argued in this chapter that it is the meaning of a potential environmental stressor, not the objective, physical properties of the stressor that best predicts human response. Empirical work related to this approach has focused almost exclusively on the role of various cognitive factors in lessening or totally ameliorating the effects of stressor exposure. The work on control, privacy, attribution, and attitudes discussed above exemplifies research on this process. To a great extent, however, existing work has failed to test the ultimate question posed by the cognitive stress model. Specifically, is stressor exposure necessary to produce stress effects or are these effects a result of stress appraisal alone? If the latter is true, the mere (and imminent) anticipation of exposure to a situa-

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tion that is appraised as stressful would result in the same effects (and aftereffects) found for those actually exposed to a stressor

Our earlier review of the stressor expectation literature provides suggestive evidence regarding this point. Recall for example, that the anticipation of being exposed to a high density situation is sufficient to produce apparent coping behaviors (Baum & Greenberg, 1975; Baum & Koman, 1976). The anticipation of receiving electric shocks similarly produces elevations in physiological response during anticipatory periods (e.g., Birnbaum, 1964; Nokimos, Opton, Averill, & Lazarus, 1968)

Shirlynn Spacapan and I (Spacapan, 1982; Spacapan & Cohen, 1983) undertook a set of studies to investigate whether we could find stressor effects occurring as a result of stressor anticipation in the absence of actual stressor exposure. The effect of stressor exposure that we attempted to replicate with "mere" anticipation was decreased tolerance for frustration (e.g., Glass & Singer, 1972; see review in Cohen, 1980).

The first three studies focused on effects that occur during the anticipation period. Subjects were led to believe that they would be required to immerse one hand in an ice water bath. During the anticipation period, they were administered a tolerance for frustration measure. In all three studies, subjects anticipating immersion in ice water had less tolerance for frustration than either subjects expecting room temperature water immersion or those expecting to perform a nonstressful task. Moreover, providing subjects with the perception that they would be able to remove their hand from the water if it was absolutely necessary (perceived control) ameliorated this effect. Hence, an effect that had been documented during and after stressor exposure was produced during stressor anticipation.

Although others have reported "stress" effects occurring during the anticipation period, there is no research on *aftereffects* of stressor anticipation. Two experiments, one threatening ice water immersion and the other threatening exposure to the sound of a dentist's drill on a tooth, provided a test of the proposition that stress effects will occur after stressor anticipation is terminated. In these studies, subjects were led to anticipate stressor exposure but then were informed that because of time restrictions, they *would not be exposed* to the stressor. At this point, the tolerance for frustration task was administered. Remember that if the appraisal process is all that is necessary to create stressor responses, we would expect effects after anticipation termination that are similar to those found after exposure termination. In both studies, those initially anticipating exposure but later told that they would not be exposed to the stressor showed less tolerance for frustration than control groups not anticipating exposure. Moreover, those initially anticipating exposure with *perceived control* did not show post-anticipation effects. You may recall that these results perfectly parallel aftereffects reported when persons are actually exposed to a stressor (cf. Cohen, 1980; Glass & Singer, 1972).

In sum, we have demonstrated that the mere anticipation of exposure is equivalent to actual exposure both in terms of during- and aftereffects. This work not only supports the hypothesis that stressor appraisal is a sufficient cause of a commonly reported stressor effect, but also raises the possibility that previously reported effects of stressor exposure may in fact not be caused by exposure but may merely be aftereffects of anticipation.

PERCEIVED VERSUS OBJECTIVE STRESS MEASURES

The cognitive stress model clearly suggests that a measure of perceived stress level would be a better predictor of stress outcomes than an objective measure of stressor level. This again is a reflection of the hypothesis that one's perception of the stressfulness of a situation is more important than an objective measure of stressor level. Tom Kamarck, Robin Mermelstein, and I have tested this notion in three longitudinal studies of the effects of stress on symptomatology, health service utilization, and smoking cessation (Cohen, Kamarck, & Mermelstein, 1983).

We designed the Perceived Stress Scale (PSS) as a measure of one's level of perceived stress. The 14-item scale does not focus on a particular situation or stressor, but rather asks questions about how one has felt in general during the last month. The questions were written to represent three concepts central to the conceptualization of stress: lack of control, overload, and unpredictability. Examples of items are: In the last month, how often have you felt confident about your ability to handle your personal problems? In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

In all three studies, we have compared the predictive validity of the PSS to that of a 99-item life events scale. We used both the number of life events as well as life event impact scores (cf. Sarason, Johnson, & Siegel, 1978). The PSS is a better predictor of both depressive (correlations range from .65-.76) and physical symptomatology (.52-.65) than any of the life event scores (.26 to .30 and .29 to .43 respectively). Moreover, the PSS prospectively predicts use of health facilities (physical illness) for college students, while life events scores do not. We are still collecting data on the PSS as a predictor of who quits smoking and of abstinence maintenance.

In sum, a general level of perceived stress is a better predictor of stress outcomes than an objective measure. It is important to point out, however, that life event scales (even those with large numbers of events as used in our studies) do not cover the domain of events that can actually influence one's stress level. In other words, the difference between perceived and objective measures of stress used in our studies may have to do with sensitivity to a broader range of events as well as with the role of the appraisal process in moderating stressor-outcome relationships.

SOCIAL SUPPORT AS A STRESS BUFFER

In a final series of studies, Harry Hoberman, Tom Kamarck, and I have been studying the possible role of perceived level of social support in moderating the relationship between stress and symptomatology. By social support, we mean the resources provided by one's interpersonal relationships. I will limit my discussion to our first study (a cross-sectional one) which is the only one completed at this point (Cohen & Hoberman, 1983). A number of investigators (e.g., Andrews et al., 1978; Brown & Harris, 1978; Miller & Ingham, 1979) have reported that strong social networks or having a "confidant" protects one from the presumed deleterious effects of stress on health and health behavior. Our own work has had two major emphases. The first is to develop scales (college student and general population) that tap the perception of available support. If one assumes that the effects

of social support are cognitively mediated, e.g., support operates by affecting one's interpretation of the stressor, knowledge of coping strategies, or self-concept (cf. Cohen & McKay, 1984), then a measure of perception of the availability of support would be a more sensitive indicator of its buffering effects than objective network measures. This is so because a cognitive analysis is concerned only with a person's beliefs about available support as opposed to its actual availability. Hence use of a perceived availability measure should provide a sensitive assessment of support as it enters into the appraisal process.

Our second emphasis has been on developing subscales that measure different functions of support. We have specified four such subscales. The tangible support subscale is intended to measure the availability of material aid; the appraisal subscale the perceived availability of someone to talk to about one's problems; the self-esteem subscale, the perceived availability of a positive comparison when comparing oneself with others; and the belonging subscale, the perceived availability of people one can do things with. Our purpose is to determine the relative contribution of each of these functions in buffering the effects of various stressors.

Data from our cross-sectional study of college students indicates that perceived availability of social support moderates the relationship between negative life stress and depressive and physical symptomatology. In the case of depressive symptoms, the data suggest that social support protects one from the pathogenic effects of high levels of life stress but are relatively unimportant for those with low levels of stress. In the case of physical symptoms, the data suggest that social support protects one from the pathogenic effects of high levels of stress, but harms those with low levels. Further analyses suggest that self-esteem and appraisal support were primarily responsible for the reported interactions between negative life stress and social support.

Why are appraisal and self-esteem support effective buffers? One possibility is that life event scales tap mostly stressor experiences that elicit coping requirements that are best met by appraisal and self-esteem resources. This is consistent with Cohen and McKay's (1984) argument that social support functions as a buffer of stress only when the available support meets the coping requirements elicited by the specific stressor or stressors experienced by an individual. It is also possible that having someone to help you evaluate potential problems and help you come up with strategies to deal with those problems (appraisal support) is a broadly effective means of coping with stressors. Moreover, threats to self-esteem may be the most serious of stressful events and thus may be the type of stress that is most important to counter.

It is clear that further research comparing the relative contributions of different kinds of social support to the buffering process will be necessary to help us understand how the process operates. Moreover, by focusing on the perceived function of support, we can examine the role of support in appraising the stressfulness of an event. Hopefully, the work reported above provides an initial framework by which this research can proceed.

SUMMARY AND CONCLUSIONS

Recent work in our own laboratory has replicated and extended research on the role of cognition in determining the effects of stressors on behavior and health. Work on the effects of anticipating a stressor suggests that the appraising an event

as stressful is a sufficient cause of stress effects. Work comparing objective to subjective stress measures indicates the superiority of the perceived stress measure and work on the perceived availability of social support suggests that support availability plays a role in the appraisal of and consequent impact of life events. In short, our data has provided further evidence for the importance of cognition in the stress process.

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