

## CHAPTER

# 2

# Effects of Gardens on Health Outcomes: Theory and Research

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Roger S. Ulrich

The belief that gardens are beneficial for people with illness dates back centuries and has appeared in widely different cultures (e.g., Warner, 1994; Nightingale, 1996, 1860; Ulrich and Parsons, 1992; Horsburgh, 1995, 1997; Burnett, 1997). During the early decades of the twentieth century, however, healthcare designers and administrators understandably became preoccupied with creating environments that would succeed as functionally efficient delivery platforms for important new medical technology and science. The imperative need to accommodate modern technology in healthcare facilities overshadowed traditional beliefs about the importance of including presumed therapeutic features such as gardens. In the decades that followed, the functional emphasis produced environments that were efficient but often sterile and starkly institutional, and are now considered stressful and otherwise unsuited to the emotional or psychological needs of patients, visitors, and staff (Ulrich, 1992b; Malkin, 1992; Horsburgh, 1995).

In recent years a growing awareness has developed internationally among healthcare administrators and designers of the need to create functionally efficient environments that also

have patient-centered (Gerteis et al., 1993) or psychologically supportive characteristics that help patients cope with the major stress that accompanies illness (Ulrich, 1992a). Resurgent interest recently in healing gardens represents part of a broader international movement that seeks to improve the quality of healthcare by creating new types of facilities that are cost-effective yet emphasize *supportive* design coupled with patient-centered organizational practices.

### **GROWING EMPHASIS ON HUMAN-CENTERED HEALTHCARE ENVIRONMENTS**

One impetus for the growing attention to facility design has been the recognition by many healthcare providers that psychologically unsupportive facilities are unsatisfactory from the standpoint of marketing and provider image, especially in the highly competitive conditions of managed care and the changing healthcare system. The most important factor motivating awareness of facility design, however, has been mounting scientific evidence that environmental features or characteristics can play a role in improving patient health outcomes. Dozens of published medical and other scientific studies have shown that environmental design can, for instance, reduce patient anxiety, lower blood pressure, lessen pain, and in certain situations may shorten length of hospital stay. (For a survey of scientific studies, see Rubin et al., 1997.) Conversely, research has linked poor design—or psychologically inappropriate physical surroundings—to detrimental effects such as higher anxiety, delirium, increased need for pain medication, elevated blood pressure, and sleeplessness.

A recent report by Johns Hopkins medical researchers identified upwards of seventy published scientific-experimental studies concerned with the effects of healthcare design on medical outcomes (Rubin et al., 1997). The authors observed that this amount of scientific research is small by the standards of medical fields, but there is now enough quality research to justify the conclusion that “there is suggestive evidence that aspects of the designed environment exert significant effects on clinical outcomes for patients” (Ibid., p. 14). It is important to point out that the Johns Hopkins report also reveals that very little research directly relevant to gardens has used the types of experimental-scientific methods that are considered sound and persuasive by the medical community. Rather than addressing gardens, the preponderance of the rigorous scientific research has investigated influences on health outcomes of such envi-

ronmental characteristics as light, temperature, noise, and music. Although few of these latter studies are directly useful for persons interested in gardens, such investigations of non-garden environmental features nonetheless have been important in gaining credibility for this emerging research area generally, and for achieving broader acceptance within the medical community of the notion that the design of the health-care environment affects health outcomes. This growing acceptance probably has tended to bolster the credibility of research findings on gardens that for the most part are derived from less scientifically rigorous methods.

## CHAPTER OBJECTIVES AND OVERVIEW

Patients, visitors, and staff in healthcare facilities doubtless derive benefits from quite different types of experiences with gardens, including: active experiences such as physical rehabilitation and horticultural therapy; less physically active modes such as sitting and talking; and physically passive contacts such as looking at a garden through a window. This chapter gives particular emphasis to the effects of passive visual experiences with gardens on stress reduction and other medical outcomes, and devotes less discussion to the influences of active garden contacts. A major objective of this chapter is to selectively summarize research and theory relevant to the effects of gardens in healthcare facilities, with emphasis on material relating to medical outcomes. The research discussion concentrates on findings derived from empirical observation structured by a research design, ranging from controlled scientific-experimental studies to semiscientific methods such as post-occupancy evaluation. The nonempirically-based literature on healing gardens is largely omitted.

In the next section we define certain terms and concepts that are important throughout the rest of the chapter. Stress is discussed as a widespread problem for patients, a problem that affects many health outcomes. It is emphasized that by fostering patients' ability to cope with stress and promoting restoration from stress, gardens potentially can improve various health outcomes. The role of stress is central in subsequent sections, which outline a research-grounded theory for understanding how specific characteristics of gardens affect patients and staff. This theory serves as an organizing framework for later sections, which discuss research findings relating to the potential beneficial influences of gardens in healthcare facilities, including restoration from stress and other improved

health outcomes. The theory also suggests design strategies or approaches for achieving supportive, successful gardens. The final section summarizes the potential advantages of gardens for patients and healthcare providers, and identifies needs and directions for future research.

## KEY CONCEPTS

### What Is a "Healing" Garden?

The term "healing garden" is used here in a fairly broad sense to refer to a variety of garden features that have in common a consistent tendency to foster restoration from stress and have other positive influences on patients, visitors, and staff or caregivers. To qualify as a "garden," the feature should contain prominent amounts of real nature content such as green vegetation, flowers, and water. The better known examples of healing gardens are found in healthcare facilities such as hospitals and Alzheimer's facilities. Healing gardens can be either outdoor or indoor spaces, and vary greatly in size—ranging from atriums covering a few square meters to outdoor spaces the size of some urban parks. (For a useful typology of healing gardens see Chapter 4 in this volume, by Cooper Marcus.)

The contention here is that to justify the label "healing," a garden should have therapeutic or beneficial effects on the great majority of its users. Regardless of whether a garden might garner praise in professional design journals as "good" design, the environment will qualify as bad or failed design in healthcare terms if it is found to produce negative reactions. These points imply that use of the term "healing" in the context of healthcare gardens ethically obligates the garden designer to subordinate or align his or her personal tastes to the paramount objective of creating a user-centered, supportive environment. Designers who succeed in creating healing gardens will usually be those who seek input from patients and staff, and assiduously utilize the available research to inform their creativity and design approach.

### What Are Health Outcomes?

An important term relevant to healing gardens research and theory is "health outcome," which refers to an indicator or measure of a patient's condition or progress. Health or medical outcomes are numerous and varied. Some are based on subjective or verbal data such as self-reported depression and pain, whereas others are comparatively objective medical indicators such as blood

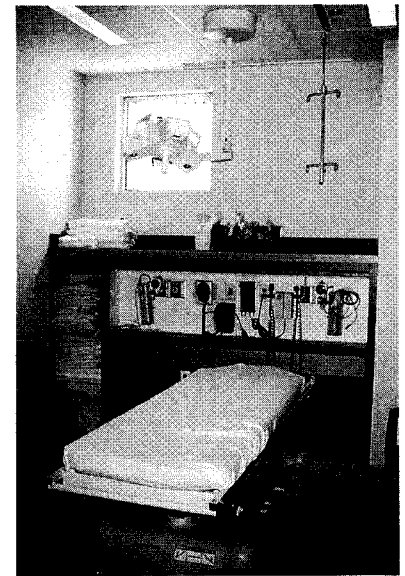
pressure, infection occurrence, intake of certain drugs, level of motor functioning, and length of hospital stay. Different clusters of outcomes are applicable to different types of patients or diagnostic groups. In the case of many surgical patients, for instance, relevant outcomes would include anxiety, self-reported pain, intake of pain drugs, occurrence of minor complications such as nausea, and length of time from surgery to discharge. For persons with chronic or terminal illness, however, recovery measures are much less applicable but such outcomes as perceived quality of life, depression, and ability to function independently become appropriate and important.

Outcome studies have long been of major importance in medicine because they provide the most sound and widely accepted basis for evaluating whether particular treatments are medically effective and cost-efficient. A related point, which cannot be overemphasized, is that outcomes research potentially can indicate the degree to which gardens in healthcare facilities are medically beneficial and cost-effective relative to such alternatives as not having gardens.

In recent years, as managed care has emerged as the predominant healthcare model in the United States, and as healthcare systems in most other countries likewise have faced strong pressures to be more medically—and cost—effective, outcomes research has become more influential than ever in affecting decisions by physicians and healthcare administrators. Outcomes studies increasingly exert a dominant influence on decisions concerning which medical treatments and therapeutic measures will be provided to patients and reimbursed. Importantly, there are clear indications that healthcare providers' decisions regarding the design and budget for facilities are taking into account the potential for certain design strategies and environmental features to positively affect outcomes. In view of these trends there is no question that the future importance of gardens in healthcare facilities will be strongly affected by the extent to which sound and credible research shows that gardens can promote improved health outcomes, foster higher patient/consumer satisfaction with healthcare providers, and be acceptably cost-effective.

### **STRESS: A MAJOR PROBLEM IN HEALTHCARE SETTINGS**

Stress is a centrally important concept, generally, in understanding the relationship between people's physical well-being and their surroundings (Gatchel et al., 1989), and, more specifically, for explaining why gardens in healthcare facilities should



*Figure 2-1 An ICU room, with all of the necessary equipment and supplies, is a strange and intimidating environment. Designed for efficiency, no attempt has been made to help people feel more comfortable. (Photo by Clare Cooper Marcus.)*

affect medical outcomes (Ulrich, 1986a, 1992a; Parsons, 1991a; Parsons et al., 1994). The fact is only too well-documented that the vast majority of persons with illness experience stress, and that many unfortunately suffer acute stress (e.g., Burish et al., 1987; Van Der Ploeg, 1988; Taylor and Aspinwall, 1993; Ott and Levy, 1994). The importance of stress as a problem in medical contexts implies considerable significance for the finding that restoration from stress appears to be the major benefit motivating persons to use gardens in healthcare facilities (Cooper Marcus and Barnes, 1995).

The term "stress" is used here in a broad sense to refer to a process of responding to events and environmental features that are challenging, demanding, or threatening to well-being. The demanding events and environmental features are called "stressors." Much research has shown that numerous aspects of the experience of hospitalization, as might be expected, engender stress and are appraised by patients as highly unpleasant and aversive. (For survey of research see Gatchel et al., 1989.) Examples of stressful aspects of hospitalization include: fearful things such as impending surgery, pain, and unknown diagnostic procedures; loss of control, including loss of privacy; depersonalization through, for instance, bureaucratic processing and uniform structuring of activity, dress, and visiting hours; and disruption caused by hospitalization on social relationships and job activities (Gatchel et al., 1989; Taylor, 1979; Connelly, 1992; Winkel and Holahan, 1985; Baier and Schomaker, 1985). Many of these stressors stem from characteristics of the healthcare provider organization, while others are unavoidable accompaniments of modern medical technology. It should be emphasized that additional major stress, including that produced by loss of control, results from poorly designed healthcare environments that, for instance, are noisy, confusing from the standpoint of way-finding, deny privacy, prevent personal control over television, force bedridden patients to stare directly at glaring ceiling lights, and have rooms arranged so that patients cannot see out of windows (Ulrich, 1992a).

In addition to affecting patients, stress is also a problem for families of patients and visitors, and is pervasive among healthcare staff (Parkes, 1982; Shumaker and Pequegnat, 1989; Ulrich, 1992a, 1992b; Miracle and Hovekamp, 1994). Healthcare occupations such as nursing are known to be stressful because they commonly combine lack of control, overload from demanding responsibilities, stress from rotating shifts, and stressful events such as the death of a patient (e.g., Foxall et al., 1990; Coffey et al., 1988). Further contributing to staff

stress are unsupportively designed healthcare facilities that reduce control by, for instance, lacking adequate employee lounges or break areas. When staff experience considerable stress, this can in several ways lower the quality of care and potentially worsen patient health outcomes. Job-related stress is associated with lower job satisfaction, increased absenteeism, and higher turnover rates, all of which detract from the quality of patient care (e.g., Waxman et al., 1984; Ulrich, 1992a).

### Patient Stress and Health Outcomes

Stress is centrally important in this chapter because it is both a significant outcome in itself, and it *directly affects many other health outcomes* (e.g., Cohen et al., 1991). These health effects stem from the fact that stress responses include numerous psychological/emotional, physiological, biochemical, and behavioral changes (Gatchel et al., 1989; Evans and Cohen, 1987; Selye, 1956). The *psychological* components include cognitive appraisal of the situation, and widely varying emotional reactions such as fear, anger, and sadness. The *physiological* aspect involves changes in activity levels in different bodily systems as indicated, for example, by increases in blood pressure, skin conductance, and respiration rate. The *neuroendocrine* component involves secretion into the bloodstream of stress hormones, including epinephrine and norepinephrine (also called adrenaline and noradrenaline) and cortisol, a natural steroid. These hormones have many influences, such as stimulating the heart and constricting the blood vessels. Examples of *behavioral* manifestations of stress in patients include sleeplessness, alcohol or drug abuse, angry outbursts, helplessness and passivity, and noncompliance with medical regimens.

As suggested above, stress manifestations such as helplessness and increased blood pressure are themselves health outcomes, but these and other stress aspects have direct effects on additional health-related indicators. For instance, persistently elevated blood pressure from chronic stress heightens susceptibility to developing permanent high blood pressure or hypertension. As another example, stress manifestations such as helplessness, depression, and social withdrawal may be linked with noncompliance or reduced adherence by patients to prescribed medical regimens and advice from doctors. When stressed patients discontinue taking medications, do not adhere to a diet, or miss physician appointments, there are often serious negative health consequences. Additionally, a large body of research has shown that stress manifestations such as arousal of the central nervous system and elevated lev-



Figure 2-2 Nursing stations are busy areas. Often located on a central corridor with fluorescent lighting and no views to the outside, there is little escape from the often charged atmosphere. (Photo by Clare Cooper Marcus.)

els of stress hormones have significant suppressive effects on functioning of the immune system (e.g., Rabin et al., 1989; Calabrese et al., 1987; Kiecolt-Glaser and Glaser, 1991). Reduced immune functioning can worsen recovery outcomes as well as decrease resistance to infection and illness. For a recent review of studies, see Kiecolt-Glaser et al., 1998.

### **Emotional Manifestations of Patient Stress**

It was briefly mentioned above that negatively toned emotions such as fear and sadness are prominent aspects of patient stress. The particular emotions that characterize stress responses, however, can vary widely among different categories of patients and may change over time in a given patient. Very broadly speaking, *anxiety* (fear, tension) is the salient emotion experienced by patients in nonchronic disease categories with shorter hospital stays. These patients commonly also experience some degree of anger and depression, but feelings of anxiety and tension tend to be dominant. This stress category includes large numbers of persons who undergo surgery and suffer moderate to high anxiety, especially during the presurgical phase and the first few days following surgery (e.g., Janis, 1958). Anxiety is a major problem as well for the many patients who must undergo unpleasant diagnostic or treatment procedures such as cardiac catheterization, endoscopic examination, and chemotherapy (e.g., Pederson and Harbaugh, 1995; Peterson, 1991). Anxiety is also a common reaction to the uncertainty of waiting for a potentially serious diagnosis.

By contrast, *depression* is often the most serious emotional manifestation of stress in long-term patients, especially those with chronic and terminal illness. In this regard, depression is a debilitating problem for many patients with such chronic conditions as AIDS, kidney disease requiring dialysis, and heart disease (e.g., Holahan et al., 1995). These comments are, again, very general because anxiety and anger often occur together with depression in these diagnosis groups. It should also be mentioned that patients in nursing homes and other long-term care contexts often suffer from depression and boredom related to social-physical environments that are chronically *understimulating* and hence stressful—rather than overstimulating and stressful.

In sum, the vast majority of patients have in common the problem of stress, but the emotional and other manifestations of their stress responses vary widely as a function of type of diagnosis, length of treatment, and factors such as personality and coping style (e.g., Janis, 1958; Lazarus and Cohen, 1973). This



implies that for gardens to have supportive benefits for widely different patient categories, gardens are needed that effectively foster coping and restoration in persons who range from being anxious to depressed, and from overexcited to understimulated. Accordingly, it seems possible that certain garden characteristics that might be found effective for reducing stress in acutely anxious surgery patients, for instance, will not necessarily be as effective for, say, many elderly in nursing homes.

### **THEORETICAL PERSPECTIVES: WHY GARDENS SHOULD IMPROVE HEALTH OUTCOMES**

The foregoing discussion indicates that stress is a centrally important mechanism through which gardens potentially can have significant beneficial effects on health outcomes. There are sound scientific grounds for contending that gardens in healthcare facilities will improve health outcomes to the extent they are effective in fostering restoration and coping with respect to the stress that accompanies illness and hospitalization. Importantly, the concept of stress makes it possible to develop a scientifically grounded theory of supportive garden design that conceptualizes the impacts of environmental features and design approaches in ways that are directly and credibly linked to effects on health outcomes (Ulrich, 1992a). The term "supportive" here refers to gardens with environmental characteristics that facilitate or support stress coping on the part of patients, visitors, and healthcare staff. By having restorative and buffering effects on stress, supportive gardens can foster gains in numerous other patient medical outcomes. Accordingly, supportive gardens in healthcare facilities potentially can be an important complement to the healing effects of drugs and other modern medical technology, and help improve the overall quality of care.

The theory of supportive garden design outlined below has its origins in an earlier conceptual framework oriented mainly to architectural and interior design aspects of healthcare facilities (Ulrich, 1992a, 1992b), but has been modified and updated to pertain directly to gardens. The theory is not intended to be comprehensive or include all factors that conceivably play a role in the effects of gardens on health outcomes. Any conceptual framework for this topic must necessarily be tentative because research and theory on healthcare gardens is only at an embryonic stage of development.

Although theory development is hindered by the shortage of research focusing directly on gardens, this disadvantage is

offset partially by the existence of a large amount of high quality research on important related topics, including environments, stress, and health outcomes. The remaining sections draw heavily on pertinent material from this valuable multidisciplinary resource, which is found scattered through such fields as environmental psychology, health psychology, behavioral medicine, and clinical psychology. The discussion in subsequent sections relates this theory and research directly to healthcare gardens, and integrates it with the limited amount of work specifically on gardens. This makes it possible to outline research-grounded elements of a preliminary Theory of Supportive Garden Design.

### **A THEORY OF SUPPORTIVE GARDENS**

As suggested by previous sections, the basic premise underlying the conceptual framework is that the capability of gardens to have healing influences stems in large part from their effectiveness in facilitating stress coping and restoration. The appropriateness of a stress-centered theory is underscored by Cooper Marcus and Barnes' aforementioned finding that restoration from stress was by far the most important benefit reported by persons interviewed in four California healthcare gardens.

On the basis of theory and research in the behavioral sciences and health-related fields, and the limited literature on gardens, it is justified to propose that gardens in healthcare situations are important stress mitigating resources for patients and staff to the extent that they foster:

- Sense of control and access to privacy
- Social support
- Physical movement and exercise
- Access to nature and other positive distractions

The theory further contends that a requisite condition for these four stress-coping resources or mechanisms to be effective is that a garden must convey a sense of security. If the design or locational characteristics of a garden engender feelings of insecurity or even risk, the setting will likely have stressful rather than restorative influences, and many patients, visitors, and staff will avoid the space (Ulrich, 1983; Ulrich et al, 1991b; Schroeder and Anderson, 1984; Nasar et al., 1993). Persons who undergo medical treatment often feel psychologically vulnerable, which has been demonstrated to heighten their sensitivity to insecurity in an environment.

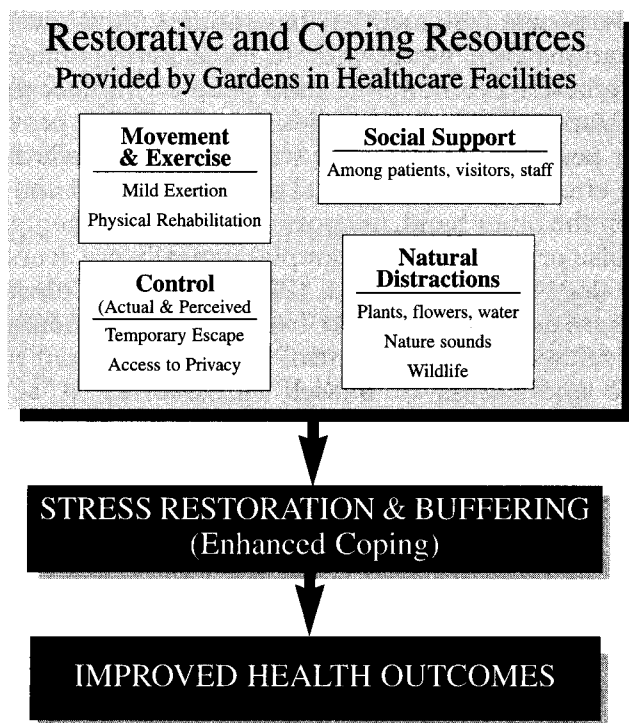


Figure 2-3 Conceptual model: Effects of gardens on health outcomes

In the following sections, each of the four main restorative resources of supportive gardens is defined, and related theory and empirical findings are discussed. As becomes apparent, there is evidence from scientific studies that each of the restorative components or coping resources can reduce stress in patients and improve other health outcomes. As this implies, a key criterion for including a restorative resource in the theoretical framework was the existence of a credible basis in scientific or medical research. The discussion of the fourth resource—natural distractions—will be more extensive because of the centrality of nature to the concept of “garden,” and the mounting scientific evidence that passive experiences with nature can effectively reduce stress.

### SENSE OF CONTROL

Much research has shown that a sense of control is an important factor affecting a person’s ability to cope with stressful events or situations, including stress associated with illness and hospitalization. Control refers to persons’ real or perceived ability to determine what they do, to affect their situations, and to determine what others do to them (Gatchel et al., 1989).

Generally, people who feel they have some control over events and situations cope better with stress, experience less stress, and have better health status than people who feel they lack control. Importantly, many studies have found that provision of actual or perceived control over stressors usually alleviates the negative effects of environmental stressors (Evans and Cohen, 1987). On the other hand, uncontrollable environmental conditions (noise or lighting, for example) typically are aversive and stressful (e.g., Glass and Singer, 1972; Evans and Cohen, 1987). Lack of *privacy* is considered here an environmental-social stressor related to lack of control over regulation of personal exposure and access to oneself (Proshansky et al., 1970; Altman, 1975). Stress stemming from lack of control has been shown to have many negative effects, including depression, helplessness, reduced cognitive performance, elevated blood pressure, higher levels of circulating stress hormones, and suppression of immune functioning (e.g., Schulz, 1976; Abramson et al., 1980; Weiss et al., 1990).

For persons who are ill, loss of the sense of control is a major problem that engenders much stress and adversely affects outcomes (Steptoe and Appels, 1989). Many experiences related to illness and injury are stressful in large part because they are uncontrollable—for instance, unavoidable and unpleasant diagnostic procedures, chronic pain, impaired physical capabilities, and demanding adjustments in the workplace (Ulrich, 1992a). Further, much of the stressfulness of hospitalization appears to derive from loss of control (Taylor, 1979; Allshouse, 1993). Examples of the many aspects of hospitalization eroding patients' feelings of control include: lack of information, loss of privacy, loss of control over eating and sleeping times, lack of authority over what to wear, inability to adjust room lighting and temperature, and way-finding difficulties in complex and unfamiliar buildings.

Growing awareness among healthcare providers that lack of control is a serious problem has motivated attempts to modify hospital routines and regulations in ways that enable patients to have more control. As a prominent example, several American and European hospitals have adopted the Planetree healthcare philosophy, which promotes a sense of control, for instance, by permitting patients access to their medical records, making extensive information available through a variety of means, and allowing patients to determine their own wake-up times (Orr, 1992). A number of studies have found that fostering control by providing information and allowing patients to take responsibility for some aspects of their care reduces helplessness and appears to improve other outcomes

(e.g., Langer and Rodin, 1976; Keeri-Szanto and Heaman, 1972; Johnson et al., 1985). In the case of healthcare staff, there is evidence that increased control achieved through greater involvement in decision-making improves job satisfaction and reduces turnover (Waxman et al., 1984).

### Gardens , Control, and Stress Coping

Against this background, it is justified to propose that one key stress mitigating property of appropriately designed gardens is the capacity to increase feelings of control in patients and other users (Ulrich, 1992a; Grant, 1994). Research support for this contention, however, is only indirect or circumstantial in the sense that it consists mainly of studies on environments other than gardens, and of a few garden studies that have dealt indirectly with control issues. No study has yet used an experimental research design to examine in a direct manner whether by altering certain garden features to increase control it is actually possible to reduce patient stress and thereby improve other outcomes.

Indirect support for the notion that healthcare gardens can benefit persons by providing control comes from a large body of research on nonpatient users of urban parks and wilderness areas. Findings from more than 100 published studies of recreationists in parks and other natural environments have shown



*Figure 2-4 Gazing out of a window and daydreaming are two ways to find a temporary escape from the immediate circumstances. Used as a means to gain a level of control over one's situation, these are vehicles for reducing stress. (Planetree Unit at a Hospital in Trondheim, Norway, photo by Marni Barnes.)*

that restoration through stress mediation is the most consistently important perceived benefit. (For surveys see Knopf, 1987; Ulrich et al., 1991a.) B. L. Driver and his associates identified a control-related benefit called *temporary escape* that has emerged subsequently in many such studies as being of high importance in restoration (e.g., Driver and Knopf, 1976). Temporary escape might be passive, such as gazing out of a window at a pleasant garden view, or in the mind only, as when daydreaming about a favorite nature area that one could escape to. Additionally, temporary escape includes active coping with stress, as when a person actually goes to a park (Driver and Knopf, 1976). Kaplan and Talbot (1983) use the phrase "being away" in a manner similar to temporary escape, in the context of distancing oneself from day-to-day work demands or from negative situations. Temporary escape appears to be strongly related to control, because persons who "escape" stressors or negative situations probably are achieving either actual or perceived control (Ulrich et al., 1991). It is important to mention here that several studies in nongarden settings have found that provision of either actual or perceived "escape" from aversive conditions mitigates stress responses (e.g., Corah and Boffa, 1970).

A study of a park located adjacent to a sizable residential population found that provision of perceived control, in addition to actual control, appeared to be an important psychological benefit of the park (Ulrich and Addoms, 1981). Many residents derived important benefits associated with frequent on-site or actual use of the park, but low users and even nonusers of the park also appeared to derive substantial psychological benefits from the space. Nonusers reported it was important "just knowing the park is there" and "having it there because I know I can use it if I have to" (Ulrich and Addoms, 1981, p. 60). The findings suggested that mere awareness of the park's presence induced feelings in the residents that they could if necessary avoid or escape, for instance, work stresses, interpersonal conflicts, or the monotony of day-to-day routines. Perhaps perceived control applies as well to gardens in health-care facilities, and that mere awareness of the nearby presence of a pleasant garden might facilitate stress mitigation to some degree. If so, garden studies limited to on-site users might tend to underestimate the importance of gardens as stress coping resources.

A small amount of research focusing directly on gardens in health-care facilities has yielded some evidence consistent with the notion that one major way in which such settings reduce stress is by providing control. Cooper Marcus and Barnes

(1995) found that restoration from stress was the most important category of benefits derived by persons studied in four healthcare gardens. The investigators included in their report statements by several respondents that imply that the gardens fostered restoration in part by providing escape (control) from stress. For example, a patient using a garden commented: "It's a good escape from what they put me through. I come out here between appointments.... I feel much calmer, less stressed" (Cooper Marcus and Barnes, 1995, p. 27). A patient in a garden at another hospital said: "I felt really depressed in there [the hospital]; I was getting really teary. You go from having control of your life to less control. Out here you're on your own; there's time to forget about it. You feel relieved from all the medical aspects of your case" (*Ibid.*, p. 35). Cooper Marcus and Barnes further concluded that a major reason why many employees used gardens was to escape from work stress and aversive conditions in the hospital.

### **Design Considerations for Control**

If a garden in a healthcare facility is to foster restoration and coping by providing control, potential users must know the garden exists, be able to find their way to the setting without difficulty, and be able to use the garden in an active and/or passive manner. Accordingly, way-finding and access are very important design and planning considerations for gardens. If patients and visitors know a garden exists in a healthcare facility, but experience difficulty or frustration in trying to find or get access to the setting, such impediments will tend to produce loss of control and engender further stress.

Control-related benefits should be increased by garden designs that facilitate on-site usage by patients, including accessibility and independence for persons in wheelchairs. A given patient will be much more likely to engage in on-site use of a garden that is located close to his/her room and can be traveled to easily (Carpman and Grant, 1993). Generally speaking, on-site usage rates will be higher for gardens situated adjacent to building interior spaces that are used by large numbers of patients, visitors, and/or staff, such as cafeterias or major corridors. Other examples of garden design strategies that should foster control include providing: spaces in gardens that enable users to have privacy, including visual privacy with respect to windows looking on to a garden; variety in types of spaces, making choices possible; and an adequate number of spaces to help prevent crowding that would otherwise erode control advantages of the garden. In the case of staff, and

patients in long-term facilities, feelings of control may be enhanced by involving them as participants in designing gardens (Francis, 1989; Hester, 1984; Ware, 1994). Grant (1994) has described a site plan for a healthcare garden that attempts, among other main objectives, to boost control through design characteristics that facilitate way-finding and enable users to regulate privacy, thus preventing loss of control and crowding stress.

## SOCIAL SUPPORT

In addition to control benefits, there are strong grounds for proposing that another important salutary property of appropriately designed gardens is the capacity to increase social or emotional support for patients, visitors, and employees (Ulrich, 1992a). Very generally, social support refers to perceived emotional support or caring, and material or physical aid, that a person receives from others (Brannon and Feist, 1997). Specific definitions of social support vary, but most encompass a range of different kinds of supportive social behaviors including, for example: expressing to a sick person that he/she is cared about, loved, or esteemed; encouraging the patient to express beliefs and feelings openly; giving the patient a sense of belonging to a social network or support group; and providing tangible assistance (Wortman, 1984; Edgman-Levitan, 1993). Although certain types of supportive interactions may be more beneficial than others, studies of large groups have found there tends to be a general positive association between the overall number of social ties or contacts people have and their health status.

During the last two decades, a large body of research has shown across a wide range of healthcare and nonhealthcare situations (workplaces, for example) that people who receive higher levels of social support are usually less stressed and have better health status than persons who are more socially isolated (e.g., Cohen and Syme, 1985; Sarason and Sarason, 1985; Schwarzer and Leppin, 1989; Shumaker and Czajkowski, 1994). An indication of the major importance of social support for health is the finding that low social support may be as great a risk factor in mortality as is cigarette smoking (e.g., Berkman and Syme, 1979). Several studies have found that women tend to derive even greater health benefits from social support than men, possibly because women have larger social networks (Schwarzer and Leppin, 1989; Brannon and Feist, 1997).

As is often the case with findings in medical research, the mechanisms or reasons accounting for the association between



*Figure 2-5 Two staff members take a few minutes out of their busy day to comment on the garden and offer each other support. (San Francisco General Hospital, CA, photo by Marni Barnes.)*



social support and health are not well understood. It appears, however, that social support enhances health through a combination of effects that prominently include reduction of deleterious stress effects, and protection through *buffering* or dampening of stress responses when difficult challenges are experienced (e.g., Cohen, 1988). Importantly, studies in several healthcare contexts have consistently found that higher social support improves, for example, recovery outcomes in heart attack patients, survival length in patients with metastatic cancer, and immune functioning in family care givers of Alzheimer's patients (e.g., Spiegel et al., 1989; Kiecolt-Glaser et al., 1988). In view of the considerable scientific evidence showing social support to be robustly beneficial, many healthcare facilities have instituted programs to provide social support to patients and families (for survey see Edgman-Levitan, 1993). Further, there is a clear trend for hospitals to give greater attention to fostering social support for patients through interior environmental design strategies such as providing comfortable visitor waiting areas having movable seating, and bed sofas or sleep chairs for family members in patient rooms (e.g., Ulrich, 1992a).

### **Gardens, Social Support, and Improved Outcomes**

In light of the strong medical evidence concerning social support, there are convincing grounds for contending that gardens in healthcare facilities mitigate stress and improve other health outcomes to the extent that they foster access to social support for patients, families, and staff. There is a strong possibility that healthcare gardens in fact produce health-related benefits via social support, because research findings indicate that gardens and parks often are important settings for social interaction. As with research on control, however, there is a lack of studies that have used experimental-scientific methods to investigate directly whether social interaction or support produced by healthcare gardens actually improves patient outcomes.

The notion that healthcare gardens foster access to social support receives some circumstantial empirical support from studies of nonpatient users of urban parks and other outdoor nature settings, which show that social interaction is often perceived as an important benefit derived from the spaces (e.g., Driver and Brown, 1986; Tinsley and Kass, 1979; Ulrich and Addoms, 1981). In this regard, several studies of nature settings other than healthcare gardens have found that persons frequently report using the spaces to achieve psychological benefits that appear linked with social or emotional support—for

example, "companionship," "being with friends," and "family kinship" (Tinsley and Kass, 1979; Knopf, 1987; Driver and Brown, 1986). Other research has confirmed that on-site usage rates for parks and other urban public spaces can sometimes be very high for activities related to social contact (e.g., Whyte, 1980; Cooper Marcus et al., 1990). This work has also shown that whether or not usage rates for socializing are high depends heavily on such specific design features of the spaces as seating (Cooper Marcus and Francis, 1990). A recent noteworthy study by Kweon and her associates (Kweon et al., 1998) of inner-city adults living in high-rise public housing found that the residents' use of common outdoor nature spaces predicted both the strength of social ties and sense of community. Findings also suggested that the beneficial social integration that older adults derived from spending time in outdoor spaces was higher when the spaces had more trees and grass rather than fewer trees and less grass (Kweon et al., 1998). In addition to such findings for parks and other nongarden nature spaces, there is evidence that urban gardening projects may be especially effective in promoting social interaction and a sense of community, including among residents of inner-city areas where high crime rates and other social problems otherwise reduce local interaction (Lewis, 1996).

A small amount of research focusing on gardens in health-care facilities has produced evidence implying that these settings can be very important for increasing access to social support for patients, families, and staff. More specifically, the findings suggest that a large proportion of on-site garden users often engage in activities involving social interaction. In their report on four California healthcare gardens, Cooper Marcus and Barnes (1995) found that 73 percent of all users engaged in talking at one time or another. Importantly, 36 percent of the persons they interviewed reported using the garden at least sometimes to visit with a patient. Rates of use for talking/socializing varied considerably, however, among different groups of users. The vast majority of employees reported using the garden for talking, often with other employees, and about two-thirds of visitors likewise indicated they conversed in the garden. By contrast, less than half of the patients reported socializing. It is not clear if the lower rates of socializing by patients reflected a possibly greater need on their part for privacy, or perhaps that many patients were socially isolated in the hospital and did not know other patients and employees (*Ibid.*).

Singleton (1994) assessed feelings and attitudes toward gardens in two community hospitals in the United Kingdom by

conducting open-ended interviews with visitors, patients, and employees. He reported that users valued the gardens both for providing opportunities for social contact and for offering access to privacy. On the basis of case studies of three hospitals, Paine and Francis (1990) suggested that socializing was one of the principal types of activities engaged in by patients, visitors, and staff who used outdoor gardens and other nature spaces. In a more descriptive or anecdotal vein, Cohen and Day (1993) described three Alzheimer's care facilities having gardens or planted courtyards where administrators reported that family members preferred to visit with patients outdoors if weather permitted, rather than use alternative indoor locations.

It is worth digressing briefly to mention that research on social support also is relevant to understanding why horticultural therapy should be effective for reducing stress and improving health outcomes. In this regard, part of the therapeutic benefit of horticultural therapy almost certainly stems from emotionally supportive contacts with a caring and motivated therapist. Horticultural therapy probably provides patients social support as well through interaction with other patients in a therapy program.

To summarize briefly, a small but growing amount of research suggests that gardens can be important and effective for fostering social contact, and that the social contacts occurring in healthcare gardens probably include emotionally supportive interactions of the type known to mitigate stress and improve medical outcomes. Studies are needed, however, to confirm that social contacts in gardens actually are linked to positive health influences. Despite this gap in research, the pattern of evidence indicating that social support improves medical outcomes in other healthcare contexts is so convincing that it seems clearly justified to assume that gardens that foster opportunities for supportive contacts will tend to ameliorate stress and otherwise benefit user health (Ulrich, 1992a).

### **Design Considerations for Social Support**

At a general design level, social or emotional support benefits of gardens will be increased by design and planning that facilitate on-site access by patients, visitors, and staff, and provide settings conducive to social interaction among small groups. Because many hospitals have initiated programs that involve patients and families in social support groups, there may be instances when it is appropriate for the designer to create gardens that accommodate these larger social groups, yet provide the privacy such programs usually require. Also, there may be

ethnic or cultural considerations that sometimes favor designing social spaces for larger groups, including for visitors in large or extended families. In this regard, King (1995) found indications of a tradition among Hispanic families in south Texas of furnishing social support to sick persons by providing companionship and tangible assistance through large, often extended families. King used these findings to inform her design of a long-term care facility for predominantly Hispanic elderly in San Antonio, and accordingly provided a number of interior and outdoor spaces suited to larger family groups.

In discussing design considerations for promoting social support, attention should be called to a recent study by Barnhart et al. (in press, 1998) of the types of outdoor settings preferred by patients and staff in a large Canadian psychiatric hospital. Using an interactive computer survey procedure to assess responses to visual simulations of outdoor settings, the investigators found that both patients and employees preferred natural, spatially *enclosed* settings for active socializing such as "talking with others." By contrast, patients and staff both preferred natural, spatially *open* settings for more passive and often private activities such as "sitting and viewing scenery," or "sitting watching others." Settings dominated by vegetation and other nature were preferred over built-dominated settings by both groups across different types of activities (Barnhart et al., in press, 1998).

Finally, designers should be cautioned to avoid garden design approaches that strongly promote social interaction to the point of interfering with access to privacy. Garden settings that enforce social contacts but deny privacy will often undermine control, be appraised as crowded and aversive, engender stress, and accordingly be underutilized. In emphasizing the benefits of social support, it is important not to lose sight of the fact that providing privacy is likewise a significant function of gardens. In this regard, it appears that a large percentage of persons may use gardens in healthcare facilities to seek privacy or be alone (Cooper Marcus and Barnes, 1995).

Garden designers seeking to promote social support can, fortunately, take advantage of a large amount of quality environment-behavior research pertinent to creating settings that foster both social interaction and access to privacy (e.g., Altman, 1975). The knowledge gained from these and other studies has provided part of the underpinning for the useful design guidelines developed by Cooper Marcus and others for gardens and other outdoor spaces used by the general public (e.g., Cooper Marcus and Francis, 1990; Cooper Marcus and Barnes, 1995; Carpman and Grant, 1993; Carr et al., 1992).

Moreover, several of these studies have focused on patients in healthcare environments (e.g., Osmund, 1957; Sommer and Ross, 1958; Sommer, 1969; Holahan, 1972).

## PHYSICAL MOVEMENT AND EXERCISE

Exercise is associated with a spectrum of significant physical health benefits, and clearly is a positive factor in reducing risk for mortality in the general population. Regular physical exercise, for example, is known to be very important for cardiovascular health, and appears to lower risk for certain types of cancer (e.g., Lee et al., 1992). However, the main concern here is with *psychological* or emotional benefits of exercise and related therapeutic effects on stress. As with social support and control, there is substantial scientific evidence that exercise reduces stress, including in patient populations. The research provides a strong foundation for proposing that healthcare gardens that promote exercise should improve psychological well-being and foster gains in other health outcomes.

While physical exercise often produces broad improvements in psychological well-being, several studies have found it to be especially beneficial in reducing depression. Both aerobic and nonaerobic strengthening exercise such as lifting weights are so effective in reducing depression that they are commonly used for helping clinically depressed patients (Greist, 1984). In fact it has been suggested that regular exercise is as effective as any form of psychotherapy in reducing depression (Brannon and Feist, 1997). The potential importance of exercise as a psychologically beneficial intervention in healthcare situations is underscored by the point emphasized earlier that depression is a widespread and serious problem among patients, especially for the elderly and those with chronic illness such as heart disease.

As an example of a study relevant to healthcare situations, Ruuskanen and Parketta (1994) found that higher levels of physical activity were associated with lower depression among elderly in nursing homes. Several investigators have reported that exercise significantly alleviates depression and produces other positive psychological changes in physically impaired older adults, such as patients with chronic obstructive lung disease (for survey of studies, see Emery and Blumenthal, 1991). Although beneficial effects are often greater when exercise is regular or strenuous, even comparatively mild exercise can be associated with significantly reduced depression. For example, a controlled study of moderately depressed elderly found that simply taking a twenty-minute walk three times a week reduced



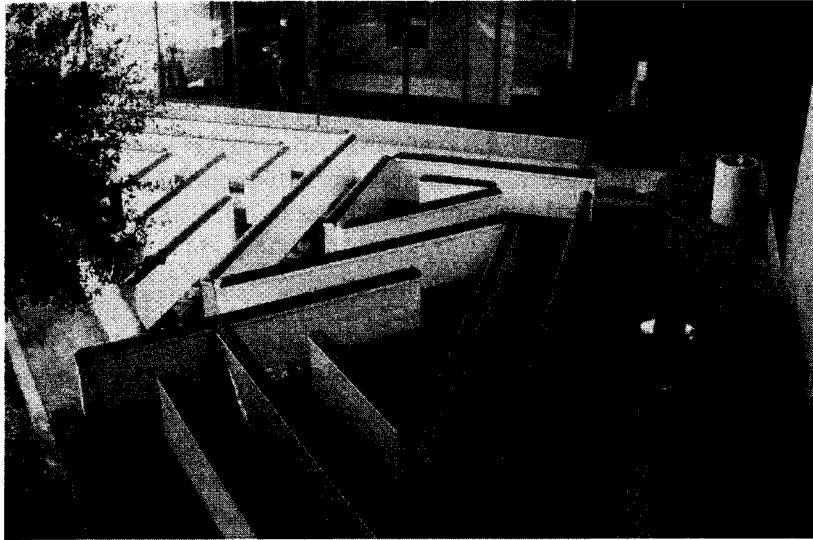
Figure 2-6 Outdoor spaces at medical facilities can meet a variety of patient needs. Here we can see a woman relaxing and reading the newspaper—a means of psychological escape—while a gentleman is getting his exercise. (Homerton Hospital, London, UK, photo by Clare Cooper Marcus.)

depression symptoms (McNeil et al., 1991). Exercise likewise mitigates depression in younger groups, including adolescents and children, as illustrated by Koniak-Griffin's research (1994) on pregnant adolescents. Importantly, several studies have suggested that exercise also tends to lower anxiety effectively, as do other procedures such as meditation and biofeedback (Brannon and Feist, 1997). Finally, there is evidence that physical activity can broadly reduce stress in adolescents and children.

### **Design Considerations for Exercise**

There are several ways in which designers can capitalize on gardens as effective vehicles for fostering exercise. Because gardens are widely perceived as much more pleasant settings than most healthcare interior ward and treatment spaces (Cooper Marcus and Barnes, 1995), they can be designed and sited to serve as positive trip destinations that motivate increased patient walking and wheelchair movement. Even a small atrium garden, or a lounge with an attractive window view of an outdoor garden, might foster exercise by stimulating corridor trips that would promote patient emotional restoration as well as physical rehabilitation. To encourage longer patient trips involving greater exertion (and perhaps more restoration), ease of way-finding should be given considerable attention in design decisions for gardens. In regions with long cold winters or hot humid summers, it would be possible to plan corridor sequences in larger facilities to enable lengthy indoor walks that provide a continuous series of exposures to indoor nature features, atrium gardens, and window views of exterior nature settings. For on-site users of gardens, opportunities for deriving restoration through mild exercise can be increased by design that facilitates patient accessibility and independence, and provides features such as walking loops. While strenuous exercise is not possible or medically advisable for many patients, there may be instances when consideration should be given to creating spaces in gardens that enable adult patients to engage in comparatively strenuous exercise (aerobic and non-aerobic). Indoor physical rehabilitation settings might be designed so that patients are exposed to large window views of gardens or other attractive outdoor nature areas.

Designers of healthcare gardens for children should give particular consideration to providing spaces for stress-reducing physical activities and play. (See Robin Moore's chapter in this volume. See also a recent discussion of play equipment and barrier-free design for children's outdoor play spaces in



*Figure 2-7 Three children run off steam in this outpatient facility while their parents and staff can keep a watchful eye on them from two adjacent pediatric waiting rooms. (Kaiser Permanente Medical Center, Vallejo, CA, photo by Marni Barnes.)*

Shepley et al., 1998.) At the other extreme in age, elderly in nursing homes and assisted residential settings may derive especially important long-term restoration benefits (reduced depression) from garden design approaches that facilitate walking and other mild exercise. (See Deborah McBride's chapter in this volume.) Do elderly in assisted living or nursing homes comply better with physician instructions to take frequent walks if they have access to landscaped grounds or a large garden for walking, rather than a street with noisy traffic or a windowless shopping mall?

### **NATURAL DISTRACTIONS**

A positive distraction is an environmental feature or situation that promotes an improved emotional state in the perceiver, may block or reduce worrisome thoughts, and fosters beneficial changes in physiological systems such as lowered blood pressure and stress hormones (Ulrich, 1992a, 1992b). In other words, positive distractions can be thought of as environmental design elements that effectively promote restoration from stress in patients, visitors, and healthcare staff (Ulrich, 1992b). Types of positive distractions that have received the most attention in healthcare include: comedy or laughter (Cousins, 1983); companion animals (e.g., Friedman et al., 1980; Beck et al., 1986); art (Kaye and Blee, 1997); music (e.g., Moss, 1988; Caine, 1991); and nature. This section focuses on the last of these, nature, giving particular emphasis to restorative influ-

ences of viewing settings dominated by such nature as foliage, flowers, and water. As will be evident from the findings surveyed below, there is mounting evidence that viewing certain types of nature scenes can significantly reduce stress. Accordingly, it seems very likely that one major way in which gardens in healthcare facilities can improve medical outcomes is by providing visual exposure to nature.

### **Theoretical Perspectives: Why Nature Is Restorative**

The intuitive belief that viewing vegetation, water, and other nature can ameliorate stress dates as far back as the earliest large cities in Persia, China, and Greece (Ulrich and Parsons, 1992; Ulrich et al., 1991b). This traditional idea is echoed by a number of contemporary theoretical arguments, as widely different as cultural and evolutionary positions, that converge in predicting that most nature scenes tend to reduce stress, whereas many settings lacking nature hinder recovery from stress (Ulrich et al., 1991b; Hartig and Evans, 1993). One important category of theories emphasizes *learning* as the major mechanism by which people acquire restorative and positive responses to nature (Ulrich and Parsons, 1992). It has often been argued that people learn to associate restoration with nature settings, for example, during vacations in rural areas. On the other hand, people probably acquire stressful associations with urban environments because of such phenomena as traffic congestion, work pressures, and crime. *Cultural* explanations likewise emphasize learning, proposing that people are taught or conditioned by their society to have positive associations with certain types of environmental features and perceive others as negative or unsettling (Ulrich and Parsons, 1992). Several writers have contended that contemporary Western and East Asian cultures condition their urban populations to revere nature and to associate cities with stress (Tuan, 1974). However, in the face of steadily mounting empirical evidence showing broad similarities across diversely different cultures in terms of positive responses to nature, cultural and other learning-based explanations increasingly appear inadequate. (For a review of cross-cultural studies on responses to nature scenes, see Ulrich, 1993).

Alternatively, proponents of *arousal* and *overload* theories have proposed that built environments are often taxing or excessively stimulating, and accordingly, work against restoration, because of high levels of visual complexity, noise, intensity, and movement (Berlyne, 1971; Mehrabian and Russell, 1974). Nature settings dominated by vegetation or water usu-



ally have lower levels of complexity and other stimulating properties, and hence should be more restorative (Wohlwill, 1983; Ulrich et al., 1991b). Arousal or stimulation theory has been tested directly as an explanation of stress-reducing effects of nature, and found to have certain merits but also major shortcomings (Ulrich, 1981; Ulrich et al., 1991b).

In recent years, authors have increasingly proposed *evolutionary* theories, partly because these explanations are easy to reconcile with the growing evidence that there can be high agreement across cultures and different socioeconomic groups in positive responsiveness to nature. Most evolutionary explanations have in common the argument that, as a remnant of two or three million years of evolution, modern humans may have a partly genetic readiness to respond positively to types of nature content (such as vegetation or water) and environments that were favorable to well-being and survival for premodern people (e.g., Appleton, 1975; Orians, 1986; Kaplan and Kaplan, 1989; Ulrich, 1983). Although most evolutionary writings have focused on aesthetic preferences for nature, an evolutionary perspective can also plausibly explain why certain types of nature scenes should have restorative or stress-reducing effects across diverse groups of people.

An evolutionary theory developed in detail elsewhere (Ulrich, 1993; Ulrich et al., 1991b; Ulrich, 1983) contends that acquiring a partly genetic or biological capacity for a restorative response to certain nature settings held major survival-related advantages for early humans. This capacity would have fostered emotional well-being and health, and enhanced survival chances in several ways, such as by promoting faster and more complete recovery from the negative stress effects of flight-or-fight responses that were essential for dealing with demanding situations and threats. A basic proposition is that the advantages of restoration were so critical for survival as to favor the selection of individuals with a biologically prepared disposition to quickly acquire and persistently retain restorative responses to certain nature settings. This conceptual perspective suggests that the several health-related benefits of restoration from stress should include, for instance, a shift toward a more positive emotional state, alleviation of deleterious effects of physiological mobilization (reduced blood pressure, reduced levels of circulating stress hormones, enhanced immune function), the recharging of energy, and gains in cognitive performance (Ulrich, 1993). It also follows from this theory that restorative responses to nature should occur fairly rapidly—usually within a few minutes rather than over several hours (Ulrich et al., 1991b). A further implication is that humans may have a biolog-

ically prepared disposition that motivates them, following a stressful experience, to seek out, approach, and spend time in nature settings with restorative properties.

This perspective also predicts that modern humans, as a partly genetic remnant of evolution, have a biologically prepared capacity for acquiring and retaining restorative responses to certain nature settings and content (vegetation, flowers, water), but have no such disposition for most built environments and their materials (Ulrich, 1993). Finally, these evolutionary arguments suggest that nature settings will tend to be especially effective in promoting restoration if they possess the following characteristics: verdant plants, calm or slowly moving water, some spatial openness, parklike or savannalike properties (scattered trees, grassy understory), unthreatening wildlife (e.g., birds), and a sense of security or low risk (Ulrich, 1993).

### **Restorative Effects of Nature in Parks and Gardens**

It will be recalled that a large body of research on nonpatient users of parks has found that restoration from stress is perceived as the most consistently important benefit. Recreation experiences are often complex and involve a number of coping mechanisms and types of experiences that ameliorate stress—including social support, physical exercise, and temporary escape. There are also indications in these studies that a major part of the restoration benefit often stems from simply viewing nature. In this regard, some urban park studies have found strong associations between users' restoration ratings and certain nature properties of an environment, including vegetation, water, and savannalike qualities such as scattered trees, grass, and spatial openness (Ulrich and Addoms, 1981; Grahn, 1991). Schroeder (1986, 1991) found that the moods most commonly reported by users of a large arboretum near Chicago were serenity, tranquillity, and peacefulness, and such feelings were most often linked to areas having water, lush vegetation, large trees, flowers, and openness. In research using a different method, Francis and Cooper Marcus (1991) asked a sample of university students in California to identify settings they sought out during times when they felt stressed or depressed. A considerable majority of the individuals (75 percent) identified outdoor nature settings that were rural or urban nature settings (e.g., wooded urban parks, places next to water features such as lakes or the ocean). The selection of nature dominated settings was corroborated by Barnes (1994) in a study of working adults living in urban and suburban areas.

A limited amount of park research has identified stress reducing effects of nature while controlling for other potentially restorative variables such as exercise and temporary escape. Hartig and his associates first produced stress in individuals with a demanding cognitive task, and then measured recovery effects of either (1) a forty-minute walk in an urban fringe nature area, (2) a forty-minute walk in an attractive urban area, or (3) reading magazines or listening to music for forty minutes (Hartig et al., 1991). Findings suggested that persons assigned to the walk in nature reported more positively toned emotional states than individuals assigned to the other two activities.

In their study of garden users in four healthcare facilities, Cooper Marcus and Barnes (1995, p. 5) found that the most frequently mentioned positive garden qualities were visual nature elements, especially trees, greenery, flowers, and water. Study participants strongly associated these nature features with beneficial influences on their moods—principally enhanced feelings of relaxation and restoration. In addition to prominently naming vegetation and water as promoting positive emotions, many respondents also mentioned other types of nature elements and qualities, including birds and squirrels, sunshine, and fragrances.

#### **Restorative Effects of Viewing Nature: Findings for Non-Patient Groups**

Findings from several studies on nonpatient groups such as university students suggest that simply looking at everyday nature, as compared to built scenes that lack nature, is significantly more effective in promoting restoration from stress. One early study focused on students who were experiencing mild stress because of a final course exam (Ulrich, 1979). A self-ratings questionnaire was used to assess restorative influences of viewing either a diverse slide sample of unblighted built settings lacking nature, or slides of undistinguished nature settings dominated by green vegetation. Results suggested that the nature views fostered greater psychological restoration as indicated by larger reductions in negative feelings such as fear and anger/aggression and much higher levels of positive feelings. Also, the scenes with vegetation sustained interest and attention more effectively than did the urban scenes without nature (Ulrich, 1979). Honeyman (1992) replicated this study but added a third stress recovery condition consisting of a sample of urban scenes *with* prominent vegetation. Her findings suggested that greater restoration was produced by the urban envi-

Figure 2-8 Example of a nature setting (urban park) found effective in promoting stress recovery (from Ulrich et al., 1991b).



ronments with vegetation than by the urban scenes without nature. In a study performed in Sweden using *unstressed* students (Ulrich, 1981), self-ratings data similarly supported the conclusion that everyday nature scenes promoted more positive emotional states and more effectively sustained attention than did townscapes with attractive buildings but without nature. In the same study, self-ratings results were broadly concordant with findings obtained by recording brain electrical activity (EEG) in the alpha frequency range (Ulrich, 1981). The brainwave recordings suggested that the undistinguished nature settings were significantly more effective than the built scenes in eliciting a relaxed yet wakeful state.

Nakamura and Fujii performed studies in Japan (1990, 1992) that also recorded brainwave activity as unstressed subjects viewed either vegetation or human-made objects. In an innovative experiment, they recorded the electroencephalogram (EEG) in a field setting while subjects viewed either a hedge of greenery, a concrete fence with dimensions similar to the hedge, or a condition consisting of part hedge and part fence (1992). Results showed that the ratio of alpha activity to beta activity was high when persons viewed the hedge; the ratio reversed, however, when the same persons looked at the concrete fence. These EEG findings were interpreted as suggesting that the hedge elicited relaxation or reduced stress whereas the concrete fence had stressful influences. In another intriguing experiment, Nakamura and Fujii (1990) analyzed the quantity of alpha rhythm recorded as unstressed subjects viewed: two types of potted plants, each with and without flowers (*Pelargonium* and *Begonia*); the same pots without plants; or a

cylinder similar to the pots. Alpha quantities were highest when persons observed plants with flowers, second highest when subjects viewed plants without flowers, and lowest when looking at pots without plants (Nakamura and Fujii, 1990). (For a comprehensive survey of Japanese studies on people-plant relationships, see Matsuo, 1996.)

Hartig and his associates in Sweden (Hartig et al., 1996) performed a sequence of two experiments on psychological restoration; in one study participants were exposed to a stressor, in the other study subjects were not stressed. Participants in both experiments were assigned to a slide-simulated "walk" that progressed through either a nature area dominated by vegetation or urban streets lacking nature. Findings were broadly consonant with results obtained in the studies mentioned above—that is, in both experiments the visual nature "walk" engendered more positive emotional self-ratings than did viewing built environments. Further, the findings added to evidence that restorative emotional influences of viewing nature occur rather quickly—that is, can be detected within the space of a few minutes (Hartig et al., 1996).

Other studies have examined stress-reducing influences of nature using physiological measures as well as emotional self-reports. One controlled experiment monitored a battery of physiological responses in 120 stressed nonpatient subjects who were randomly assigned to a recovery period consisting of videotapes of one of six different nature settings (vegetation and/or water) or built settings lacking nature (Ulrich et al., 1991b). Results indicated that persons recovered from stress much faster and more completely when exposed to the nature settings. Greater recovery during the nature exposures was evident in lower blood pressure, muscle tension, and skin conductance. These physiological results showed that nature produced significant restoration by all physiological measure within only three to four minutes. (See Figures 2-8 to 2-10.) Further, affective self-ratings suggested that the nature settings produced significantly more restoration in the psychological component of stress, as evident in much higher levels of positive feelings and lower levels of fear and anger (Ulrich et al., 1991b).

In other research using physiological methods, Hartig (1993) studied a sample of Los Angeles area residents who were experiencing stress either because they had just driven in city traffic or had performed attentionally demanding tests. Findings obtained from blood pressure recordings and emotional self-reports converged in suggesting that recovery was greater—and occurred within only a few minutes—if persons were looking at a nature setting dominated by vegetation rather

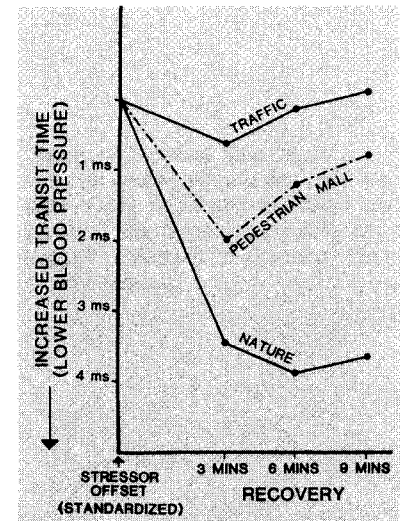


Figure 2-9 Systolic blood pressure (via pulse transit time) during recovery from stress in subjects exposed to nature settings (see Figure 2-8) or urban settings lacking nature (from Ulrich et al., 1991b).

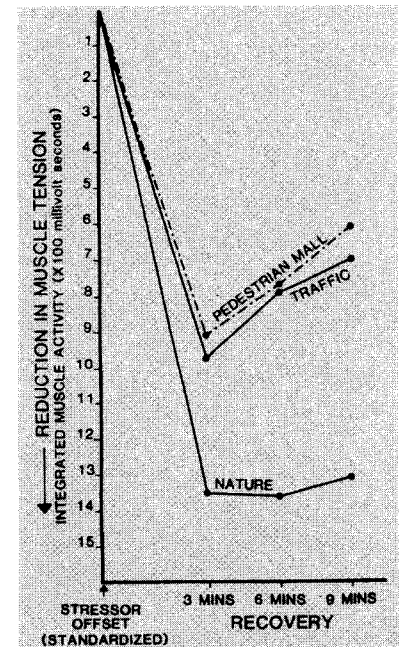
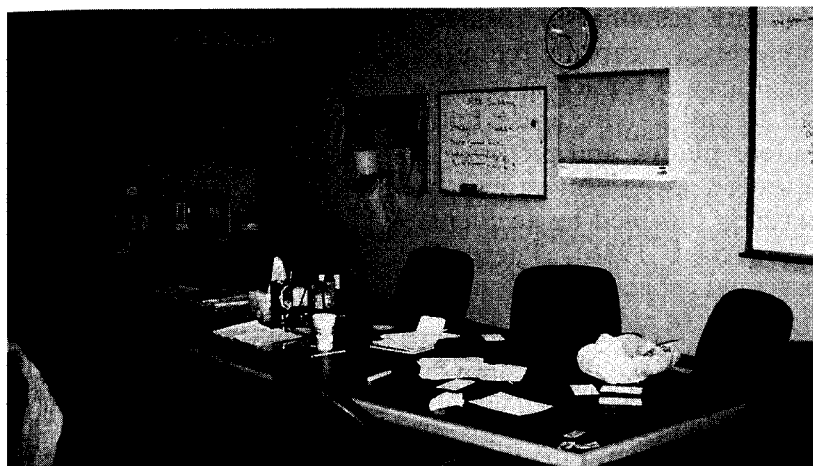


Figure 2-10 Muscle tension during recovery from stress in subjects exposed to nature settings (see Figure 2-8) or urban settings lacking nature (from Ulrich et al., 1991b).

that a built environment without nature. Hartig's study also included groups of unstressed participants who were similarly found to derive greater physiological and emotional restoration from contact with nature. While nature produced significant restoration in both stressed and unstressed persons, it is noteworthy that the greatest therapeutic effects in terms of positive physiological and emotional changes were found for people who initially were stressed (Hartig, 1993). Using methods similar to Ulrich et al. (1991b), Parsons obtained a pattern of physiological and self-report findings indicating that videotapes of preferred landscapes, some containing water, promoted greater stress recovery than less preferred outdoor settings (Parsons, 1991b).

In an extension of this line of research, a recent controlled experiment compared restoration in stressed subjects exposed to simulated auto drives (videotapes displayed on a 6 foot  $\times$  4 foot screen) that were comparable except for having either vegetation-dominated or built-dominated roadside environments (Parsons et al., in press, 1998). One hundred sixty subjects were randomly assigned to one of four nature-dominated or built-dominated ten-minute auto drives. Immediately following the drives, subjects arrived at "work" and were assigned stressful tasks consisting of mental arithmetic. Findings from physiological measures such as blood pressure suggested that built-dominated drives lacking nature, compared to nature/vegetation-dominated drives, slowed and hindered stress recovery during the auto "trips." Moreover, while performing the tasks persons were much less stressed (skin conductance,  $p < .001$ ) if their earlier "drive" to work had been through a nature-dominated rather than built-dominated environment (Parsons et al., in press, 1998). In this study the effectiveness of nature in fostering stress reduction was impressive, considering that the drives lasted only a few minutes, the nature or built roadside content was visible to subjects only in narrow portions in the right and left peripheries of the "windshield," and the central portion of the windshield view in all drives was dominated by road surface and traffic. (For more detailed discussions of physiological research methods and findings concerning human responses to nature, see Ulrich et al., 1991a; Parsons et al., 1994; Parsons and Hartig, in press, 1999).

Other evidence suggesting restorative influences of visual contacts with nature has come from research on workplaces. For example, a recent office study using an experimental design found subjects' moods were more positive when plants were present than when not present (Larsen et al., 1998). A European study of 100 white-collar and blue-collar employees in diversely different work settings suggested that window views of nature appeared to buffer aspects of job stress and pos-



*Figure 2-11 Many hospital staff can work an entire shift and never see the light of day. This staff break room has no views, nor is the lighting sufficient to support potted plants. (Photo by Clare Cooper Marcus.)*

itively affect self-reports of general well-being (Leather et al., 1998). R. Kaplan (1993) found that office workers with a window view of nature reported feeling less frustrated and had higher life satisfaction and overall health.

While several studies have investigated stress reducing influences of settings containing water or comparatively large vegetation such as trees and shrubs, little work has focused on the role of flowers in fostering restoration. One of the few studies on flowers has been conducted by Adachi and colleagues (1998), who obtained affective self-ratings from unstressed subjects assigned to one of three room decor conditions: with floral displays (sweet peas), with green foliage plants, or without any floral or foliage displays. Findings suggested that the room condition with flowers had the most positive emotional influences, as indicated by significantly higher levels of feelings such as "relaxed," "composed," and "agreeable," and lower scores for feeling "discouraged" (Adachi et al., 1998).

### **Restorative Effects of Viewing Nature in Healthcare Settings**

It seems likely that the restorative benefits of viewing nature are greatest when persons experience high levels of stress, such as those who are obliged to spend time confined in hospitals or other types of healthcare facilities (Ulrich, 1979). Evidence implying that nature can have important restorative influences across a diverse range of healthcare contexts comes from a recent interview study of groups of former patients in ambulatory care, acute care, and long-term care (MacRae, 1997). MacRae interviewed former patients living in different regions of the United States who varied in age and diagnosis category.

Patients' responses indicated that their most widely shared preference regarding the physical environment of healthcare facilities was for access to nature—including gardens, outdoor sitting and walking areas, balconies, views from patient rooms, indoor plants, and pictures of nature. Another study used a questionnaire to investigate preferences of patients who were severely disabled by accidents or illness and were bedridden (Verderber, 1986). These findings showed that patients assigned especially high preference to having a hospital window view of nature.

Findings surveyed earlier from studies of stressed non-patient groups suggested that even short-term visual contacts with nature—lasting only a few minutes—can produce significant restoration. This finding has similarly emerged in a few studies where stressed patients in healthcare facilities were exposed for short periods, such as five to fifteen minutes, to views of nature. In an early experiment, Katcher and his colleagues examined restoration from anxiety in groups of patients waiting to undergo dental surgery (Katcher et al., 1984). They found that visual contemplation of an aquarium with fish reduced anxiety and discomfort, and increased scores for patient compliance during surgery. Coss (1990) used an experimental design to evaluate the effects of viewing ceiling mounted nature posters on acutely stressed patients lying on gurneys waiting to undergo surgery. His findings suggested that patients assigned to "serene" arousal-reducing nature scenes had lower blood pressure than patients assigned to either stimulating, arousal-increasing outdoor scenes (e.g., a sailboarder leaning into the wind) or to a control condition of no picture. A pilot study by Heerwagen and Orians obtained heart rate data and affective self-ratings to assess the restorative effects of a nature scene on anxious patients in a dental fears clinic (Heerwagen, 1990). Both the heart rate and self-report data suggested that patients felt less stressed on days when a large nature mural was hung on a wall of the clinic waiting room, in contrast to days when the wall was blank.

In the United Kingdom, Stiles (1995) used questionnaire and observation methods to study hospital patients seated in a large waiting room during two different environmental conditions—with interior plants versus without plants. On days when the waiting area contained plants, patients rated the room as more restorative and pleasant—as indicated, for example, by substantially higher ratings for "relaxed," "unstressful," "welcoming," and "cheerful." Also, patients chose a different pattern of seating location when plants were present; that is, they positioned themselves where they could look at plants (Stiles, 1995).



### Effects of Viewing Nature on Health Outcomes

The studies described above strongly suggest that even a few minutes of visual exposure to nature can significantly reduce patient stress. It is reasonable to expect that longer duration exposures to nature in healthcare facilities (several hours, a few days) could have comparatively persistent and perhaps larger restorative effects on emotional, physiological, and behavioral components of stress. If so, these stress mitigating effects in time probably would be associated with improvements in a number of health outcomes. In this regard, findings from a few studies of hospital patients suggest that prolonged exposure to window views and other visual nature can have important positive influences on health outcomes (Ulrich, 1984). One study of patients recovering from gall bladder surgery evaluated whether assignment to a room with a window view of nature might improve postsurgical outcomes. Data on recovery outcomes were obtained for matched pairs of patients who were similar for variables that could affect recovery such as age, weight, tobacco use, and previous medical history. The patients were assigned in a random manner to rooms that were identical except for window view: one member of each patient pair had a window overlooking a small grove of trees, whereas the other's window looked out on a brick building wall. Patients with the nature window view had shorter postsurgical hospital stays, tended to have fewer minor postsurgical complications such as persistent headache or nausea, and received far fewer negative evaluative comments in nurses' notes (e.g., "patient is upset," "needs much encouragement to do breathing exercises"). Moreover, the wall view patients required far more injections of potent narcotic pain drugs (e.g., synthetic morphine equiva-



Figure 2-13 Hospital window view of trees (from Ulrich, 1984).

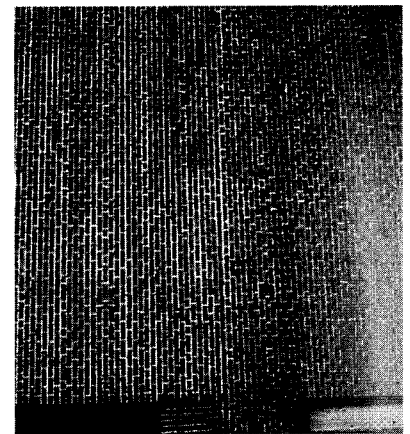


Figure 2-12 Hospital window view of brick wall (from Ulrich, 1984).

**Comparison of Analgesic Doses per Patient for Wall-View and Tree-View Groups**

		Number of Doses of Pain Drugs					
		Days 0-1		Days 2-5		Days 6-7	
		Wall Group	Tree Group	Wall Group	Tree Group	Wall Group	Tree Group
Mean		2.56	2.40			0.22	0.17
Standard Deviation		4.00	5.00			0.35	0.17
Standard Error		0.23	0.30			0.96	1.09

Figure 2-14 Pain drug intake of patients with brick wall window view versus tree view (from Ulrich, 1984).

lents), while the nature group took more oral doses of weak pain drugs such as acetaminophen (Ulrich, 1984).

Additional evidence of the importance of a nature window view comes from a case study based on participant observation of a cancer patient (Baird and Bell, 1995). The patient—a doctoral student in psychology—was hospitalized several times in various types of medical units as her disease became terminal. On every admission she expressed a clear and adamant preference for a room with a nature view over rooms with little view at all. On one occasion, upon initial admission to a bone marrow transplant unit, “the only view was of brick walls and neighboring buildings. After about three weeks, a room on the unit with a more natural view became available, and Carol chose to move to it immediately. Her affective state improved quickly, and optimism replaced despair” (Baird and Bell, 1995, p. 849). During the last stages of her illness, the patient evidenced strong positive attachment to a nature window with mountains and, ironically, a distant cemetery. In the patient’s last weeks, she chose as her final resting place a plot in the cemetery in the nature area she could view through the window of her hospital room (Baird and Bell, 1995).

These findings are consistent with the notion that visual settings with prominent nature tend to reduce stress and improve outcomes in patients groups that include those experiencing stress accompanied by feelings of anxiety (fear, tension). Some investigators, however (Ulrich, 1984), have pointed out that the findings cannot be extended to all patient groups, such as many long-term patients in nursing homes, who may suffer from boredom or low arousal rather than from the anxiety and excessive arousal typically associated, for instance, with surgeries. Perhaps for certain patients a lively street setting with people might be more therapeutic than many serene arousal-reducing nature scenes (Ulrich, 1984). Limited empirical support for this interpretation has emerged from research by O’Connor et al. (1991) that focused on nursing home patients. They found that during the first month following admittance to a nursing home, patients with a window view of people had somewhat more favorable health outcomes than patients with a nature view lacking people. The pattern of findings changed, however, after the initial month—specifically, data for longer time periods suggested that the nature window view was associated with more positive outcomes than the view of people (O’Connor et al., 1991).

In other research on health outcomes, Ulrich and colleagues (1993) used an experimental design to investigate whether exposure to simulated nature views in intensive care

units improved recovery indicators in heart surgery patients. At Uppsala University Hospital in Sweden, 160 patients who had undergone heart surgery were assigned to one of six visual stimulation conditions: two were nature pictures (either an open view with water and trees or an enclosed forest scene); two were abstract pictures (dominated by either rectilinear or curvilinear forms); and two were control conditions (a white panel, or no picture or panel). The pictures were large color photos mounted above the foot of the bed in the patient's line of vision. Results suggested that patients exposed to the open view of water and trees experienced significantly less postoperative anxiety than patients assigned to the other pictures and the control conditions. Moreover, persons with the water/trees view required fewer doses of strong, intravenous pain drugs. The enclosed forest setting with shadowed areas, however, did not reduce anxiety compared to the control conditions. Unexpectedly, the rectilinear abstract picture was associated with higher anxiety than the control conditions, indicating that psychologically inappropriate visual stimulation can sometimes elevate rather than reduce anxiety in acutely stressed patients (Ulrich et al., 1993).

A study of patients suffering intense pain because of severe burns evaluated the therapeutic effects of an environmental distraction consisting of a videotape of scenic nature (e.g., forest, flowers, ocean, waterfalls) accompanied by a music soundtrack (Miller et al., 1992). The investigators found that use of the videotape during burn dressing changes benefitted the patients by significantly reducing both anxiety and pain intensity. The nature videotape almost certainly contributed to these improved outcomes, but the precise role of the nature scenery is unclear because of possible influences of the music soundtrack. Nonetheless, these findings bolster evidence from studies of surgical patients (Ulrich, 1984; Ulrich et al., 1993), suggesting that visual exposure to nature can mitigate the perceived intensity of pain and reduce patient needs for potent analgesic doses.

The possibility that exposure to nature can improve outcomes even in patients with late stage dementia, including Alzheimer's disease, has been supported by findings from a quasi-experimental study that examined levels of agitated aggressive behavior triggered by a shower bath (Whall et al., 1997). One patient group was assigned to being bathed in a nature room condition with recorded nature sounds (e.g., birds, babbling brooks) and large color pictures. A comparison group of patients received their baths in the same room without nature sounds and pictures. Ratings by trained observers revealed that the nature condition significantly reduced agitation.

## NEGATIVE DISTRACTIONS IN GARDENS

In sharp contrast to nature and other positive distractions, negative distractions in gardens can be considered a subset of stressors that encompass unpleasant or disliked environmental elements or stimuli (visual, auditory, or olfactory). Negative environmental distractions are typically intrusive and demand attention, are often imposed on patients without possibility of personal choice or control, are appraised as stressful, and promote detrimental changes in emotional states and physiological systems (Ulrich, 1992a). Put simply, negative distractions tend to worsen rather than mitigate the stress experienced by patients, visitors, and staff in healthcare facilities. It is important for garden designers to be sensitive and cautious regarding potential negative distractions, because the presence of such distractions in a healthcare garden can reduce or even negate restorative benefits. As will be evident from findings surveyed in this section, there is preliminary evidence that negative distractions imposed on patients may, in certain scenarios, significantly worsen health outcomes.

### Urban Noise

Intrusive human-made noises may frequently be negative distractions in healthcare facility gardens. Cooper Marcus and Barnes (1995) found that users of healthcare gardens reported they reacted negatively to incongruent mechanical sounds, for instance, from air conditioners or street traffic. This finding is paralleled by results obtained in research on nonpatient groups concerning the impacts of urban sounds on affective responses to nature scenes (Anderson et al., 1983). This work has shown that the presence of incongruent urban sounds (e.g., traffic, overhead jets) in nature settings such as city parks can have strong negative effects on users' evaluations. Barnes (1994) found that nonpatient subjects seeking solace in outdoor urban settings reported noises (traffic, other voices) as the primary "drawback" in the environment, disrupting their healing process. On the other hand, the presence of congruent or fitting nature sounds (e.g., birds, brook, breeze) often positively influences evaluations and affective responses.

A recent study by Mace and colleagues (1999, in press) is noteworthy because it indicates that restorative psychological effects of viewing nature can be substantially diminished or even negated by low-level intrusive human-made noises. In a laboratory experiment that approximated visual and auditory conditions at Grand Canyon National Park, nonpatient sub-

jects were exposed to nature scenes with three background sound conditions: nature sounds (e.g., birds, brooks, breeze, natural quiet); background noise from a sightseeing helicopter at 40 dB; or helicopter noise at 80 dB. (By comparison, verbal conversation occurs in the 60–65 dB range.) Mace et al. (1999, in press) reported that even low level helicopter noise (40 dB) produced highly significant negative affective, aesthetic, and cognitive effects, including on self-ratings relating to restoration. Findings from these studies together imply that designers should attempt either to exclude intrusive urban sounds from healthcare gardens or mask them with nature sounds such as water. The presence of positive auditory qualities in healthcare gardens (e.g., quiet, bird sounds, breezes, moving water) may increase effectiveness in promoting restoration.

### **Smoking**

As might be expected, there is some evidence indicating that *smoking* is an aversive negative distraction for many users of healthcare gardens (Cooper Marcus and Barnes, 1995). The fact that smoking increasingly is banned internationally within healthcare facility interiors may be putting smokers under more pressure to seek out gardens and other nearby outdoor spaces. Physicians are reluctant to ask certain patients, especially those with terminal illness, to stop smoking because the difficulty of giving up cigarettes would add to their stress. Shepley's (in press, 1998) post-occupancy study of an AIDS facility is useful for designers because it identified problems associated with a patio garden that served as a pleasant outdoor space immediately accessible to both smoking and nonsmoking patients. Her findings indicated that areas where smokers concentrated included just outside the entrance door to the patio garden, and under a tent that provided the only location sheltered from rain and direct sun. Nonsmoking patients who wished to use the space had to move through a cloud of smoke as they entered, only to find that the single sheltered area with seating also was occupied by smokers. Nonsmokers accordingly tended to avoid the space, leading Shepley to underscore the importance for designers of providing separate outdoor areas for smokers and nonsmokers (in press, 1998).

### **Sunlight: A Positive and Sometimes Negative Distraction**

Sunlight can have distinctly healthful influences on many patients, but negative effects on others. Across a variety of set-

tings (healthcare facilities, workplaces, classrooms), studies have found that persons prefer window views of nature settings illuminated by sunlight or clear lighting conditions, rather than cloudy conditions (e.g., Kim, 1997). Patients may respond negatively, however, if their windows are exposed directly to the sun, creating bright glare patches in room interiors (Boubekri et al., 1991).

Cooper Marcus and Barnes (1995) reported that at least 25 percent of the persons they interviewed in healthcare facility gardens mentioned sunlight as a garden quality that helped foster improved mood and restoration. Importantly, this notion has also received support from medical studies. A controlled study in Canada, for example, found that patients hospitalized for severe depression had shorter hospital stays if they were assigned to a sunny rather than a "dull" room (Beauchemin and Hays, 1996). It has been speculated that such depression-reducing influences of sunshine underlie the rather dramatic finding from another Canadian study that mortality of myocardial infarction (heart attack) patients was significantly lower if they were assigned to sunny intensive care rooms rather than to dull north-facing rooms in the same unit (Beauchemin and Hays, 1998). Additionally, an important healthful effect of outdoor gardens is implied by the fact that sunlight plays a key role in enabling humans to benefit from intake of vitamin D. Lamber-Allardt (1984), for example, found that serum vitamin D concentrations in groups of elderly were positively related to individuals' levels of outdoor exposure; serum vitamin D concentrations were low and inadequate in elderly with the lowest outdoor exposure, and highest and most adequate in those who spent the most time outdoors (Lamber-Allardt, 1984). Because gardens are widely perceived as especially pleasant and preferred settings, they may entice many people in nursing homes and other healthcare facilities to spend additional time outdoors, resulting in more exposure to sunlight and hence improvements in emotional well-being and health.

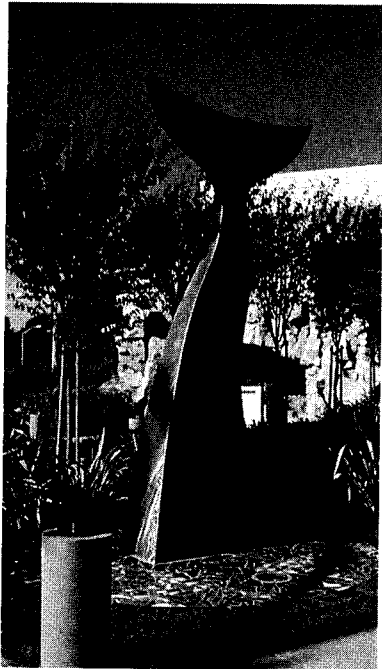
These and other clearly beneficial effects notwithstanding, garden design approaches that emphasize opportunities for direct sun exposure but provide little or no access to shade should usually be avoided. Designers must keep in mind that many patients' medical conditions or treatments, including several commonly prescribed drugs (tetracycline, for example), markedly alter the body's response to sunshine, and often make patients acutely and negatively sensitive to direct sun exposure. This medical reality underscores the importance of providing adequate shaded areas in gardens for healthcare facilities, especially for sites in lower latitudes or higher elevations.

### **Differences in Designer Versus Patient Aesthetic Preferences**

Some designers may unwittingly create gardens containing negative distractions if they focus exclusively on design qualities that please their personal aesthetic tastes. To explain why this effect can result, it is pertinent to mention that several studies conducted in different countries have found that the aesthetic preferences of artists and designers often vary widely from those of their clients or the general public (e.g., Devlin and Nasar, 1989; Melamid and Komar, 1994). Further, the types and styles of environmental design and art that many designers and artists personally prefer can be those that elicit distinctly negative reactions from the public. Accordingly, if a designer creates a garden to suit his or her personal tastes, and fails to consult or empathize sufficiently with patients, the visual outcome may be disliked by the patients and other potential users. To impose such a visual setting on patients without possibility of their personal choice or control would be to risk burdening them with a stressor.

The potential for designers and artists to miss the mark of patient and public tastes when selecting art for garden settings is implied by research on preferences for paintings and sculpture. Several investigators have reported that the majority of adults (85 to 90 percent) in North America, Europe, and Asia prefer realistic or representational art depicting nature (e.g., Winston and Cupchik, 1992; Melamid and Komar, 1994; Kettlewell, 1988). A considerable number of adults across different countries report that they dislike abstract paintings and sculpture. Importantly, the majority of the general public prefers art that produces positive feelings. For example, a study of a random national sample of Americans found that most adults strongly agreed with the statement: "I only want to look at art that makes me happy" (Melamid and Komar, 1994). The same study revealed that 77 percent of the public agreed that "art should be relaxing to look at." These findings are consonant with those from research on patient preferences for visual art in healthcare settings. Carpman and Grant (1993) showed a diverse collection of 71 color pictures to 300 randomly selected inpatients at the University of Michigan Medical Center, and asked patients to rate each picture for how much they would like to have it hanging in their hospital room. Results indicated that the patients consistently preferred representational nature scenes and disliked abstract art.

The art preferences of artists, designers, and persons seriously interested in art are, however, vastly different from those



*Figure 2-15 A sculpture that might be considered interesting and attractive to a healthy individual may have a negative effect on others who are acutely stressed or mentally ill. This piece is installed outside the main entry of a locked psychiatric facility and has been perceived as a fish leaping from the upper floors, to its death. (Photo by Marni Barnes.)*

of the general public. Most artists and experienced art viewers report liking visual art that is “provocative” or provides “challenge” (e.g., Winston and Cupchik, 1992). In direct contrast to the public, artists and experienced viewers reject the notion that art should make them feel happy or relaxed (Winston and Cupchik, 1992). Further, most artists and designers report liking a wide range of art styles, abstract as well as representational.

### **Ambiguous and Abstract Garden Features as Negative Distractions**

Research advances in the behavioral sciences on the influences of emotional states on perception and cognition raise the possibility that acute emotional stress may make many patients vulnerable to detrimental, stressful reactions to certain abstract or ambiguous visual elements in art and design. Much evidence has accumulated during the last decade showing that persons' emotional states affect virtually all aspects of their thinking and remembering. One influential concept to emerge from this work is that of emotional congruence—the notion that when an individual is presented with an array of environmental information or stimuli, the subset that matches the emotional state of the perceiver will most likely be the focus of attention (Niedenthal et al., 1994). Related theory holds that a person encountering a designed environment will more readily and efficiently process, recognize, and remember information congruent with his/her emotional state (e.g., Bower, 1981; Singer and Salovey, 1988). Emotional congruence thus unifies internal emotional states with external stimuli; evidence suggests that fear promotes processing of the fearful, sadness the sad, and happiness the happy. Further, studies have suggested that the perceiver's emotional state can enhance recall of emotionally congruent memories. Sad feelings accordingly may tend to cue sad memories, whereas happy feelings cue positively toned associations and memories (e.g., Isen, 1987).

An important prediction of this theory and research is that the perception of ambiguous environmental stimuli might be biased such that “...the emotion-congruent elements of the stimulus are visually enhanced, or the elements are organized or combined in a manner that is congruent with the perceiver's emotional state” (Niedenthal et al., 1994, p. 109). Accordingly, designers who wish to create supportive gardens for healthcare facilities should be cognizant of a stark incongruity. The positive emotional state that the creation of art may engender within the artist and the highly negative state wrought by illness and stress upon their captive audience, may result in the



same garden or work of art being experienced quite differently. The difference between designer/artist and viewer/user in a medical setting will tend to diverge even further as the level of ambiguity in the design increases.

### Evidence of Negative Patient Responses to Ambiguity

A preliminary study of the influences of wall mounted pictures on psychiatric patients yielded insights concerning responses to ambiguous or abstract visual content compared to representational nature scenes (Ulrich, 1986b). Patients in a Swedish hospital were studied in a ward decorated with paintings and prints reflecting a wide variety of subject matter and styles. Interview responses suggested that patients responded positively to representational pictures dominated by nature (a nature landscape, a vase of flowers), but responded negatively to pictures having either ambiguous or unintelligibly abstract content. Figure 2-16 shows an example of an ambiguous print that could be perceived and interpreted in different ways. The print elicited negative interview responses from patients, whereas most of the staff gave positive reactions. Perhaps the negative emotional states of many of the patients (several were clinically anxious or depressed) biased their processing and associations in negative ways congruent with their feelings. The emotional states of the staff probably were comparatively positive, and accordingly they may have processed and interpreted the ambiguous picture content in an affectively equivalent positive manner.

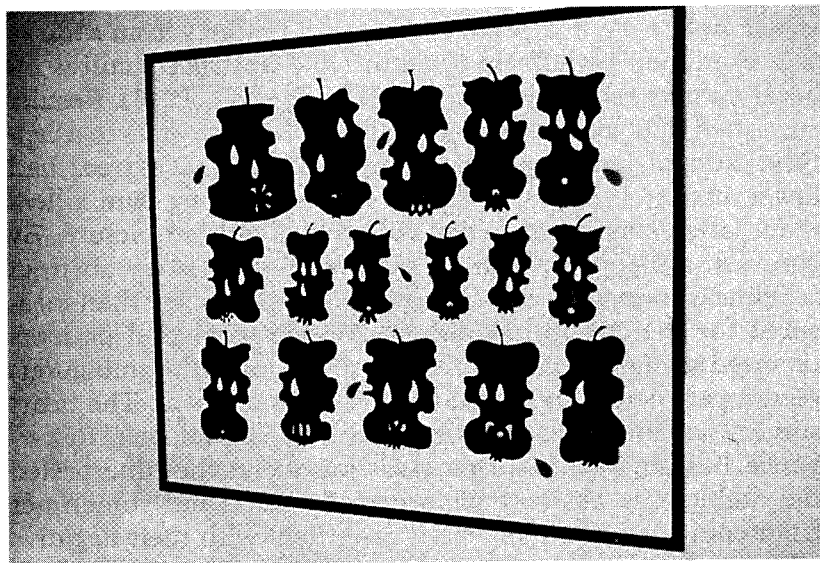


Figure 2-16 Ambiguous art print that elicited different responses from staff and patients (Ulrich, 1986b). Examples of staff comments:

"I think it's fun. Whimsical. I'd like to have it in my home."

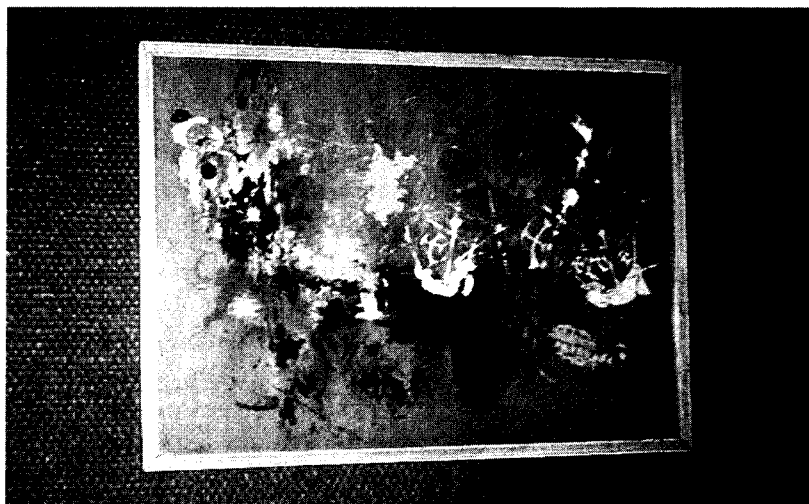
"Funny little talking apple cores. Maybe some are sweating."

Examples of patient comments:

"Charred skulls. Drops of blood are flying."

"Wounded people. They're in pain and crying out."

Figure 2-17 An abstract print that was physically attacked by a patient (from Ulrich, 1986b).



The same study (Ulrich, 1986b) analyzed records kept during a fifteen-year period regarding incidents recorded by staff of negative patient responses and behaviors directed to the pictures. These events included unsolicited strong complaints to the staff and incidents when patients physically attacked pictures (such as tearing the picture from the wall and throwing it on the floor). The latter were dramatic actions given that these patients were considered unaggressive. (The ward was not locked.) Records indicated that seven paintings and prints had been targets of one or more attacks each, and all had ambiguous or abstract content. (See Figure 2-17.)

In the context of possible negative patient influences of visual ambiguity, it is pertinent to recall findings from a study that examined the effects of nature and abstract pictures on heart surgery recovery outcomes (Ulrich et al., 1993). Results suggested that patients exposed in intensive care units to a representational landscape photograph of water and trees had lower anxiety and required fewer doses of strong pain killers than patients assigned to control groups with no picture. By contrast, a highly ambiguous picture dominated by abstract rectilinear forms was associated with higher anxiety than measured for the control conditions. Moreover, several patients reported strongly negative affective reactions to the ambiguous rectilinear picture, necessitating its early removal. The heart surgery patients had no history of serious psychological disturbance, but similarly to the psychiatric patients they interpreted the ambiguous abstract picture in negative and sometimes frightening ways that appeared congruent with their negative affective states.

These findings from healthcare studies, together with the theory and research on emotional congruence surveyed earlier, influenced the development of the conceptual model depicted in Figure 2-18. The figure portrays hypothesized influences on stressed patients of exposures to "aesthetic" visual displays ranging from low to high in ambiguity (that is, that vary from being readily and clearly identifiable to highly uncertain or indeterminate). Figure 2-18 reflects the assumption that the content of a given visual display of nature, if presented in a realistic and clearly identifiable manner, will have restorative influences on both mildly and acutely stressed patients. (A realistic display of built content, however, may not be restorative.) Consistent with an emotional congruence perspective, Figure 2-18 predicts that as the ambiguity of stimuli or designed features increase, patients will increasingly process and respond in a stressful manner that matches their negatively toned emotional condition. This framework predicts that if a potentially restorative and positive stimulus, such as a verdant nature scene with water, is displayed unambiguously to a stressed patient, the scene will tend to have restorative influences even on acutely stressed patients.

This conceptual perspective may be useful in explaining certain isolated instances when ambiguous design features in healthcare gardens have unexpectedly elicited negative rather

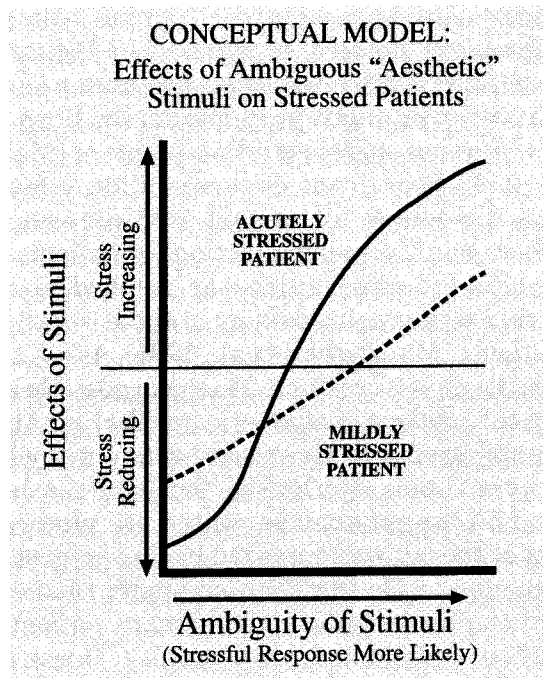
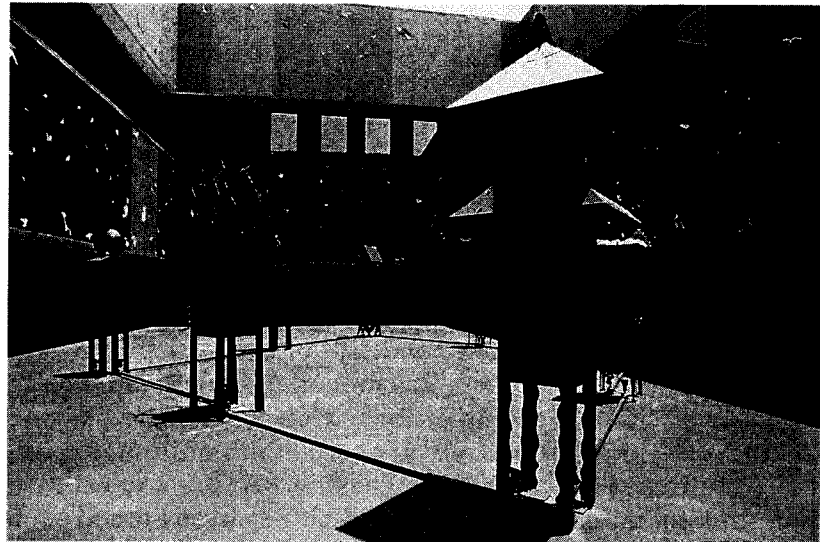


Figure 2-18 Conceptual model of effects of ambiguous environmental stimuli on stressed patients.

Figure 2-19 The Bird Garden, removed after negative patient comments.



than restorative responses from patients. One documented example is that of a "Bird Garden" created to provide a therapeutic window view for cancer patients hospitalized in a leading medical center. Located on a rooftop courtyard surrounded by taller units housing patients, the Bird Garden contained ceramic tile and metal birds executed in representational and abstract styles. Other prominent features included several metal "totem" sculptures dominated by rectilinear or geometric abstract forms. Although termed a "garden," the space contained no greenery, flowers, or water. (See Figure 2-19.) The design for the Bird Garden was approved after a careful review process that included input from artists, the hospital's design department, nursing staff, and administrators (McLaughlin et al., 1996). It is clear from documentation concerning the process that the goal of all persons involved was to create a soothing, therapeutic visual distraction for patients.

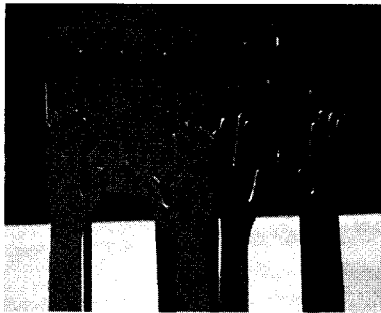


Figure 2-20 Closeup of one of the Bird Garden totems, that a patient interpreted as hands reaching out of a grave.

Shortly after the Bird Garden was installed, anecdotal concerns were raised by nursing personnel about negative reactions by some patients (McLaughlin et al., 1996). As a result of these concerns, a survey was conducted to make possible an objective assessment of patient responses to the art installation. Questionnaire-based interviews were conducted with forty-six patients whose rooms overlooked the Bird Garden, and the nursing staff on the patient care units were surveyed. Twenty-two percent of the patients reported having an overall negative affective reaction to the Bird Garden (Hefferman et al., 1995). Open-ended comments indicated that many patients found the art installation ambiguous (for example, "Doesn't make any

sense," or "What is it?"). This ambiguity may explain why some of the cancer patients responded in strongly negative ways that appeared affectively congruent with their internal duress. Although most patients gave positive or neutral responses about the Bird Garden, administrators deemed the percentage of negative reactions unacceptably high, and the decision was made to remove the installation. Consistent with the finest traditions and values of medical science, the arts program at the medical center has forthrightly disseminated information about the Bird Garden episode, thus enabling many other healthcare designers and administrators to gain important new knowledge.

## CONCLUSION

This chapter has emphasized findings and theory derived from the types of scientific-experimental methods that are considered sound and persuasive by medical researchers and healthcare administrators. The survey has omitted the large literature on healing gardens based on intuition, anecdote, or informal methods that cannot be replicated or falsified. Particular emphasis has been given to the effects that passive contacts with healthcare gardens have on patient stress and other medical outcomes. The concentration on outcomes is justified by the fact that outcomes research is widely considered to provide the most credible basis for evaluating the medical effectiveness and cost-efficiency of particular medical treatments, technologies, and healthcare design approaches. There can be little question that the priority and resources accorded to gardens in healthcare facilities in the future will be largely shaped by the extent to which sound research demonstrates that gardens improve health outcomes, promote increased patient or consumer satisfaction with healthcare providers, and are cost-effective compared to alternatives such as not having gardens.

It is clear from the survey that research on healthcare gardens is at an early stage of development—only a small number of studies have used scientific-experimental procedures to investigate the potentially favorable influences of gardens on patient stress and other medical outcomes. One of the few findings to emerge in a fairly reliable manner from different studies is that certain types of nature views can have significant restorative effects on emotional, physiological, and behavioral components of stress in patients. It appears that even acutely stressed patients can experience significant restoration after only a few minutes of viewing nature settings with greenery, flowers, or water. Another potentially important finding that

has emerged in at least three studies is that gardenlike scenes apparently mitigate pain, as indicated both by patient ratings of perceived pain and observed intake of analgesic medications. Despite these and other promising scientific findings, conspicuous research gaps exist in virtually all areas. For many important questions relating to gardens, there is no sound research yet available to inform the designer's or administrator's intuition, sensitivity, and experience.

The disadvantages associated with the shortage of studies on healthcare gardens are counterbalanced to a considerable extent, however, by major strengths and advantages arising from a large body of quality research on key related topics. Fortunately, designers and researchers concerned with gardens can take advantage of the comparatively well-developed and advanced research available on such issues as stress responses in patients, interventions that are effective for reducing stress, and links between stress and other health outcomes. The chapter draws heavily from this multidisciplinary resource to establish a more research-informed foundation for a proposed Theory of Supportive Gardens. The basic premise underpinning this theory is that the capability of gardens to improve health outcomes arises mainly from their effectiveness as stress reducing and buffering resources. The stress-centered conceptual framework contends that gardens in healthcare facilities should be effective in ameliorating stress and improving other outcomes to the extent that their environmental characteristics promote increased sense of control, social support, opportunities for physical movement and exercise, and access to natural distractions.

The overall state of knowledge on healthcare gardens is somewhat paradoxical. As noted, the area is limited by the shortage of rigorous studies that have examined directly the links between gardens and medical outcomes. Much is known, however, about effective "nonenvironmental" interventions for reducing patient stress and improving outcomes (for example, programs that provide social support for cancer patients or encourage walking by cardiovascular patients). Gardens in healthcare facilities can function as important and perhaps especially effective vehicles for fostering opportunities for such therapeutic experiences. Nature in gardens, apart from promoting restoration through its visual and auditory properties, largely accounts for why gardens are perceived as much more pleasant and attractive settings than the majority of healthcare interiors and other "built" spaces (Cooper Marcus and Barnes, 1995; Ulrich, 1993; Ulrich and Parsons, 1992). Because gardens stand out as exceptionally pleasant and soothing spaces in the

often starkly institutional surroundings prevalent in healthcare facilities, they should be effective in enticing people to seek them out and spend time in them (Ulrich, 1983, 1993). In this way, gardens may indirectly stimulate increases in restorative and health promoting activities: if viewing a garden engenders relaxation and improved moods in patients, they may be more likely to engage in additional healthy activities such as talking with a friend or walking. Healthful effects of gardens thus may arise not only directly from exposure to nature, but also indirectly through the enhanced access to other important stress-reducing resources or activities that a well-designed garden provides.

If a researcher had seriously proposed two decades ago that gardens could improve medical outcomes in healthcare facilities, the position would have met with skepticism by most behavioral scientists, and probably with derision by many physicians. In recent years, however, the mainstream knowledge base and conceptual outlook of the medical and behavioral sciences has been altered by a flood of mind-body studies showing that psychological and environmental factors can affect physiological systems and health status. Knowledge in such fields as health psychology, psychoneuroimmunology, and behavioral medicine has now demonstrated that there need not be anything magical about the possible mechanisms and processes through which gardens in healthcare facilities should be capable of ameliorating stress and fostering gains in other outcomes. Accordingly, a balanced appraisal of the overall state of relevant knowledge suggests that cautious optimism is justified regarding the long-term potential for the role of gardens in healthcare facilities. What remains to be accomplished is the considerable but achievable task of generating a much larger body of research linking improved outcomes directly to these types of therapeutic conditions or interventions as provided by gardens in healthcare facilities.

### **Advantages of Gardens in Healthcare Facilities**

Given the limited amount of scientific knowledge currently available on healthcare gardens, what advantages might be claimed as justifications for creating these settings? Put somewhat differently, in the event that a designer proposed a supportively designed garden for a healthcare facility, what benefits could a cost conscious administrator reasonably expect to achieve from the setting? On the basis of a broad assessment of the research that is both directly and indirectly relevant to healthcare gardens, we list the improved outcomes

and other advantages that seem realistically attainable by a supportively designed healthcare garden. The list of advantages is not intended to be comprehensive.

#### PROBABLE ADVANTAGES

- Patients, visitors, and staff will experience reduction of anxiety/stress (very likely). Also, stress will be buffered in subsequent stressful episodes (likely).
- Reduction of depression (likely, especially if garden fosters exercise).
- Higher reported quality of life for chronic and terminal patients (likely, especially if garden fosters exercise).
- Reduced pain in patients (likely).
- Improved way-finding in healthcare facility (very likely, especially if garden has distinctive appearance and is in prominent location).

#### POTENTIAL OR POSSIBLE ADVANTAGES

- Reduced provider costs:
  - Patients need fewer costly strong pain doses.
  - Length of stay shorter for certain patient categories.
- Increased patient mobility and independence (if garden, for instance, serves as destination for walks and wheelchair travel).
- Higher patient satisfaction with facility and perhaps provider.
- Increased staff job satisfaction.

The improved health outcomes and other advantages listed above pertain to appropriately designed gardens. The chapter points out, however, that there is nothing inherently healing about any type of setting that is called a "garden." In fact, there is some evidence that inappropriately designed gardens can hinder stress recovery and may worsen other outcomes. The review of research findings and the discussion of the Theory of Supportive Gardens identified a number of supportive design strategies or characteristics. Examples of these supportive design considerations include: convenient way-finding to the garden; accessibility; access to privacy; seating that facilitates social interaction; exercise opportunities; and contact with nature. Concerning the last of these, nature contact, the research review suggested that gardens will tend to ameliorate stress effectively if they contain verdant foliage, flowers, non-



turbulent water, parklike or savannalike qualities (grassy spaces with scattered trees), congruent nature sounds (birds, breezes, water), and visible wildlife (birds, squirrels). On the other hand, environmental qualities that tend to hinder recovery or even aggravate stress include: predominance of hardscape or starkly built content (concrete, for example); appraised risk or insecurity; crowding; cigarette smoke; intrusive urban or human-made sounds (for example, traffic, air-conditioning equipment, loud aircraft); and ambiguous design features or art works that can be interpreted in multiple ways.

Regarding ambiguity, theory and some empirical findings imply that designers should exercise caution before including ambiguous or abstract features in a healthcare garden. Patients suffering from acute stress might tend to be especially vulnerable to having stressful rather than positive reactions to ambiguous art or design. On the basis of emotional congruence theory, it is suggested that the negative emotional states of many patients may lead them to process and interpret ambiguous content in an affectively matching negative manner. However, positive feelings experienced by designers and artists may distort their responses to ambiguous features in emotionally congruent positive ways, conceivably making them more susceptible to misjudging the effect of ambiguous designs on stressed patients. Current research implies that the safest course for garden designers is simply to capitalize on the restorative, unambiguously positive qualities of most nature content and configurations.

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