
EFFECTS OF INTERIOR DESIGN ON WELLNESS: THEORY AND RECENT SCIENTIFIC RESEARCH

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Health facilities design traditionally has emphasized the functional delivery of healthcare, as expressed in such concerns as providing efficient spaces for laboratories or doors wide enough to accommodate beds. This emphasis has often produced facilities that are functionally effective but psychologically "hard." There is a growing recognition that hard designs are unsatisfactory from the standpoint of marketing facilities to patients. More fundamentally, hard facilities usually fail because they are stressful or otherwise unsuited to the psychological needs of patients, visitors, and staff. There is increasing scientific evidence that poor design works against the well-being of patients and in certain instances can have negative effects on physiological indicators of wellness. Research has linked poor design to such negative consequences for patients as, for instance, anxiety, delirium, elevated blood pressure, and increased intake of pain drugs (e.g., Wilson, 1972; Ulrich, 1984).

In this context, design should do more than produce health facilities that are satisfactory in terms of functional efficiency, marketing, cost, and codes. Another critically important goal of designers should be to promote wellness by creating physical surroundings that are "psychologically supportive" (Ruga, 1989). Supportive surroundings facilitate patients' coping with the major stress accompanying illness. The effects of supportive design are complementary to the healing effects of drugs and other medical technology, and foster the process of recovery. By comparison, hard settings raise obstacles to coping with stress, contain features that are in themselves stressors, and accordingly add to the total burden of illness. Unsupportive

design has effects that work against the process of healing.

Against the background of these comments, a major objective of this presentation is to discuss, from my perspective as a behavioral scientist who works in an architecture college, ways in which health facility design can be psychologically supportive and accordingly promote wellness. Another major purpose is to describe examples of scientific research that show how certain design choices or strategies can foster or hinder wellness. Such scientific research on health interiors can help designers achieve solutions that are successful in meeting the needs of patients and other user groups. Much of the research surveyed will focus on the effects of interior visual attributes of health facilities on physiological indicators of well-being and on health-related indicators.

Scientific research findings can also help designers in other ways. For example, compared to insights derived from intuition, they have more credibility in the medical profession and carry greater weight with healthcare decision-makers. This is especially the case for research that evaluates the effects of design in terms of physiological well-being and health. Further, there are instances when research findings concerning health-related effects of good design can be linked to dollar savings in healthcare costs. Therefore, research that yields credible evidence of the role of design in fostering or hindering wellness can create a greater awareness among healthcare decision-makers of the need to give high priority to psychologically supportive design in retrofitting or constructing new facilities.

However, the amount of scientific research to date on psychologically supportive health design is limited, and studies still need to be done on many

important issues. For many design questions, there is no sound research yet available to inform the designer's personal intuition, sensitivity, and experience. But in recent decades a large body of "indirectly" relevant research and theory has appeared in fields such as health psychology, behavioral

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medicine, and clinical psychology that offers well-founded compass points regarding general directions for successful health design.

Another major objective of this presentation is to relate this work directly to issues in health facilities design, and integrate it with new findings and theory from health design research. This makes it possible to outline the basic elements of a research-based theory of health facility design for promoting wellness. The theory proposed here is intended to help increase understanding of the needs of patients, visitors, and staff in relation to physical environments. The theory also suggests strategies or approaches for achieving supportive design. For design questions where specific research findings are lacking, the theory may help designers steer their intuition and creativity in the general direction of solutions that promote wellness.

The next section discusses a key concept in the theory, stress. Subsequent sections describe the theory of supportive design, and give several examples of design strategies suggested by the theory that should prove successful in promoting wellness. The theory also serves as an organizing framework for discussing findings obtained from scientific research.

Stress: A Major Obstacle to Healing

A starting point for a theory of psychologically supportive design is the well-documented fact that most patients experience considerable stress. In very general terms, there are two major sources of stress for patients: illnesses that involve, for instance, reduced physical capabilities, uncertainty, and painful medical procedures; and physical-social environments that, for instance, can be noisy, invade privacy, or provide little social support. Patient stress has a variety of negative psychological, physiological, and often behavioral manifestations that work against wellness. The psychological dimension can include, for instance, a sense of helplessness and feelings of anxiety and

depression. The physiological component involves changes in activity levels in numerous bodily systems (e.g., increased blood pressure, muscle tension, high levels of circulating stress hormones) (Frankenhaeuser, 1980). A rapidly growing body of research has shown that stress responses can have suppressive effects on immune system functioning (Kennedy et al., 1990). Reduced immune functioning can increase susceptibility to disease and work against recovery. Stress can also be associated with a wide variety of behaviors that adversely affect wellness, including verbal outbursts, social withdrawal, passivity, sleeplessness, alcohol or drug abuse, and noncompliance with medication regimes. To the extent that prolonged stress sometimes may be linked with lower compliance with medication regimes, this can be a significant problem working against wellness, especially for patients with chronic disease.

In addition to patients, stress is a problem for families of patients, visitors in health facilities, and for healthcare staff. As an example of the deleterious effects of stress on families of patients, recent research suggests that the severe stress experienced by caregivers of Alzheimer's patients has suppressive effects on their immune system functioning (Kiecolt-Glaser and Glaser, 1990). When health facility staff experience considerable stress, this can in several ways reduce the quality of healthcare and adversely affect patient wellness. Job-related stress is a widespread problem among health facility personnel (e.g., Pardes, 1982) that is associated with low levels of job satisfaction, high rates of burnout (Shumaker and Pequegnat, 1989), absenteeism, notoriously high turnover rates, and that possibly has been a factor — along with such economic issues as salaries — in strikes at health

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facilities. Recently, I toured hospitals that reflect laudable attempts to design attractive, supportive settings for patients, and in some cases, visitors, but reflect comparatively little concern for the design of staff areas. If health facilities are to be successful in delivering high quality care, it is critically important to attract and retain high quality healthcare personnel. It is probably the case that

supportive design in staff areas can be a positive factor in marketing a facility to prospective employees, in increasing productivity or efficiency (Sundstrom, 1986), enhancing job satisfaction, and perhaps reducing turnover.

A Theory of Supportive Design

The basic premise underlying the theory of supportive design outlined here is that to promote wellness, healthcare facilities should be designed to foster coping with stress. Therefore:

- Health facilities should *not* raise obstacles to coping with stress, contain features that are in themselves stressors, and thereby add to the total burden of illness.
- Healthcare environments should be designed to facilitate access or exposure to physical features and social situations that have stress reducing influences.
- Target groups should include patients, visitors, and healthcare staff.

In outlining below a theory of supportive design centered on the concept of stress, there is no suggestion here that the theory is comprehensive or that it encompasses in some complete way all factors that might influence wellness. For instance, it is conceivable that a patient's psychological well-being might also be positively affected if he or she rated, say, the hospital room furniture as high in quality or attractive, and this in turn somewhat enhance the individual's self-esteem or self-image. However, the reality is that there is a lack of sound research on this and many other possible mechanisms through which design might promote wellness. A related point is that many studies on health design have obtained data from verbal indicators of human reactions that have at best tenuous, weak links with wellness -- such as data on satisfactions, preferences, and attitudes. If a researcher administered a questionnaire to patients and learned, for example, that they preferred or were satisfied with, say, a certain bedside table or stand, this finding would not justify the conclusion that the furniture reduced anxiety, or lowered blood pressure, or in some other way had an effect that was linked directly to wellness. By comparison, stress is a well-established concept in health related fields, and well over 100 studies have shown that stress is linked with psychological, physiological, and behavioral dimensions of wellness. By focusing on the concept of stress, a theory of supportive design can be developed that conceptualizes human impacts of design in ways that are related directly

to scientifically credible indicators or interpretations of wellness.

If healthcare facilities should be designed to foster coping with stress, what theory or principles can

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be suggested that are most likely to prove to be sound, general guideposts for designers? On the basis of research and theory in the behavioral sciences and health related fields, it is justified to propose that healthcare environments will likely support dealing with stress and thereby promote wellness if they are designed to foster:

1. A sense of control with respect to physical-social surroundings.
2. Access to social support.
3. Access to positive distractions in physical surroundings.

What criteria were used to select these three components of supportive design? First, in the case of each component there is evidence from different scientific studies that it can influence wellness down to the level of physiological effects and health-related indicators. Further, these components, especially control and social support, have been found to affect stress and wellness across a wide range of groups of people and situations. Also, these concepts are sufficiently broad or overarching to subsume many other important issues and patient needs. For instance, control subsumes the issue of privacy, which can be interpreted as the need to control or regulate access to the self (Allman, 1976).

In the following sections, each of these three main components of supportive design will be defined, and relevant theory and research findings will be briefly surveyed. Examples of design strategies for fostering coping with stress will evolve from the discussions of each of the components. The discussion of the third component of supportive design — positive distractions — will be more extensive because new theoretical ideas will be set out, and findings will be described from recent studies on health facilities that my colleagues and I have performed in the U.S. and Scandinavia.

One: Sense of Control

This well-established concept is familiar to many designers. A great deal of research has shown that, for diverse groups and situations (e.g., hospital patients, employees in workplaces), sense of control is an important factor influencing stress levels and wellness (Steptoe and Appels, 1989). This large body of scientific evidence indicates that humans have a strong need for control and the related need of self-efficacy with respect to environments and situations. Many studies have found that lack of control is associated with such negative consequences as depression, passivity, elevated blood pressure, and reduced immune system functioning. Situations or conditions that are uncontrollable usually are aversive and stressful. As an everyday example, music that can be heard coming through the wall of a neighbor's apartment is likely to be perceived as stressful noise; however, the same music that one has chosen to play in one's own apartment, at much higher decibel levels, is perceived as positive. As this example suggests, a consistent finding in stress research has been that if an individual has a sense of control with respect to a potential stressor, the negative effects of the stressor are markedly reduced or even eliminated (e.g., Evans and Cohen, 1987).

In healthcare contexts, lack of control is a pervasive problem that increases stress and adversely affects wellness. As noted earlier, patients are ex-

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posed to two general sources of stressors: illnesses and physical-social environments. Illness confronts patients with a number of challenges or problems that are quite stressful in part because they are uncontrollable — for instance, chronic pain, reduced physical capabilities, and restrictive diets that dictate what is eaten. At the same time, patients' sense of control can be markedly reduced by health facilities that are often, for instance, noisy, confusing from the standpoint of wayfinding (Carpman et al., 1986), invade privacy, and prevent personal control over lighting and temperature (Winkel and Holahan, 1985). In addition to patients, nurses and other healthcare staff experience stress and often burnout because their work is characterized by low control and high responsibility (Shumaker and Pequegnat, 1989). This problem can be aggravated by poorly designed work environments that, for instance, lack lounge or break areas and

accordingly reduce sense of control by making it difficult to escape briefly from work demands.

Whether the concern is staff, patients, or visitors, stress stemming from lack of control can be mitigated by psychologically supportive design — that is, by design strategies that foster sense of control. Examples of design approaches that should increase control and thereby reduce stress include providing the following: access to visual privacy for gown-clad patients in an imaging area; controllable televisions in patient rooms and visitor areas; gardens or grounds that are accessible to patients; a setting in a nursing home that allows residents to pursue personal interests and hobbies (Lawton, 1979); control of room temperature by hemodialysis patients who typically feel cold; break or “escape” areas for staff; and staff workstations designed and located to avoid frequent, unnecessary interruptions by visitors.

Although links among control, stress, and wellness have been established in many studies, only a small amount of design research has directly tested the extent to which specific design strategies in health facilities actually increase sense of control and accordingly reduce stress. With respect to the example design strategies listed above, theory suggests that such approaches should prove successful, yet research is needed to determine whether these and other strategies really are effective in promoting wellness. One research project that is currently in progress at Texas A&M University should shed light on the effectiveness of certain interior design approaches in increasing control, reducing stress, and promoting wellness. A major objective of this study, which is funded by the National Institutes of Health, is to investigate how interior design characteristics of kidney dialysis clinics influence patient stress and compliance indicators, and affect staff stress and job satisfaction. (The multi-disciplinary team of researchers, led by Dr. Sherry Bame, includes two architects, an interior designer, an environmental psychologist, a health planner, a nephrologist, and an expert on employee job satisfaction and turnover.)

Patients with chronic kidney disease typically experience pronounced loss of control and endure substantial stress for years. Among the many factors that reduce sense of control are restrictive diets, fatigue, pain, and complex medication regimens. Patients typically require frequent and lengthy visits to the dialysis facility, usually needing 2-4 treatments per week with each treatment lasting 3-5 hours. In rural areas, most of a patient's time is scheduled around the lengthy dialysis sessions and long distance commutes to and from the clinic.

Inside the clinic, control is further undermined by, among other factors, noise, crowding, arrangements that prevent self-regulation of privacy or social interaction (Olsen, 1973), blocked access to window views, uncontrollable television, and the inability of patients to control air temperature (most patients are cold during a dialysis session because their blood is circulated externally through an artificial kidney).

The initial phase of the study, which was directed by Dr. Bame, examined design characteristics for a sample of 16 urban and rural clinics. These findings indicated that the interior environments of several clinics approached theoretical perfection from the standpoint, unfortunately, of *denying* control to patients. The current phase of the Texas A&M project is investigating whether such features as controllable television and controllable privacy partitions are in fact associated with greater sense of control and reduced stress. Importantly, this research is also determining whether stress levels are in turn related to scientifically credible indicators of dialysis patient compliance and wellness, such as blood urea nitrogen levels.

Two: Social Support

Patients derive important benefits from frequent or prolonged contact with family and friends who are helpful, caring, or otherwise supportive. Many studies in the fields of behavioral medicine and clinical psychology have found across a wide variety of health and non-health situations (e.g., work situations) that individuals with high social support, compared to those with low support, experience less stress and have higher levels of wellness (e.g., Cohen and Syme, 1985; Sarason and Sarason, 1985). For instance, employees in demanding positions who have supportive family or friends evidence less stress than people with similar jobs but low social support. Studies have found links between low social support and both higher rates of illness and less favorable recovery indicators following serious illness (e.g., Berkman and Syme, 1979). As an example, myocardial infarction patients with high social support have more favorable long term survival rates. The fact that social support has been found rather consistently to be an important factor in stress and wellness suggests that it should be included in a contemporary theory of stress-reducing design.

However, only a small number of studies have examined how health facility design can facilitate or hinder access to social support. Nearly all research has focused on psychiatric units and nursing homes. These studies have typically investigated

how furniture arrangements and floor/room layouts affect levels of social interaction among patients (e.g., Sommer and Ross, 1958; Holahan, 1972). For example, studies of day rooms or lounges have found that social interaction is reduced considerably when chairs are arranged side-by-side, espe-

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cially along the walls of the room. Also, heavy, unmovable furniture usually inhibits social interaction. These studies indicate that the interior designer can considerably increase social interaction among patients by specifying comfortable, movable furniture that can be arranged in small, flexible groupings.

Despite these and other useful findings, there is a lack of research that has examined whether design that increases levels of social interaction in health facilities actually reduces patient stress or in other ways promotes wellness. Although a few studies have linked increased social interaction with such positive indicators of patient well-being as alertness (Knight et al., 1978), there is a conspicuous need for sound, controlled studies that examine whether increased social interaction over prolonged periods is also manifested, for instance, in positive changes in physiological indicators of well-being and in health-related behaviors. Remarkably, there is even a lack of scientific research concerning the extent to which patients' social interaction with visitors in hospitals actually promotes wellness. In this regard, it seems conceivable that in some situations visitors may increase rather than reduce patient stress.

Despite the gaps in research on health facilities, the findings on health benefits of social support for other types of contexts are so convincing that it seems justified to assume that health facility design strategies that facilitate access to social support will probably tend to lower stress and promote wellness. Examples of design strategies that should foster social support include providing the following: convenient overnight accommodations for families of patients who live considerable distances from health facilities; comfortable visitor waiting areas with movable seating that allow family or friends of seriously ill patients to support one another; outdoor gardens or sitting areas that foster

patient/visitor social interaction (e.g., Calkins, 1988); and, in nursing homes, designing one wing so that companion animals can be accommodated (in this regard, research suggests that pets facilitate social interaction among pet owners). Finally, as a caution to designers, it should be emphasized that designs should be avoided that strongly promote social interaction to the point of denying access to privacy. An interior arrangement that enforces social contacts but denies privacy will be stressful and work against wellness. The earlier section on control implies that providing patients with some degree of control over their contacts both with other patients and perhaps with visitors will help ensure that social contacts will be positive and stress reducing rather than stressful.

Three: Positive Distractions in Physical Environments

Research in environmental psychology suggests that human well-being is usually fostered when physical surroundings provide a moderate degree of positive stimulation — that is, levels of stimulation that are neither too high nor too low (Wohlwill, 1968; Berlyne, 1971). If stimulation levels are high due to sounds, intense lighting, bright colors, and other environmental elements, the cumulative impact on patients will likely be stressful. At the other extreme, prolonged exposure to low levels of environmental stimulation produces boredom and often negative feelings such as depression. Also, when there is a lack of external positive stimulation or distractions, patients may focus to a greater degree on their own worries or stressful thoughts, which can further increase stress. In the case of certain groups, such as many elderly in nursing homes and long term hospital patients, chronic understimulation can be a significant threat to wellness.

Some of the most striking scientific evidence regarding negative human consequences of poor design has emerged from studies of patients exposed to low stimulation or sensory deprivation in health facilities. For instance, research on intensive care units has shown that sensory deprivation stemming from, for instance, lack of windows is associated with high levels of anxiety and depression, and with high rates of delirium and even psychosis (e.g., Wilson, 1972; Parker and Hodge, 1967; Keep et al., 1980). In intensive care units, windowlessness appears to aggravate the deleterious effects of low levels of environmental stimulation associated with such conditions as unvarying lighting and the repetitive sounds of respirators and other equipment. In addition to research on patients, several studies of employees in different

types of workplaces in the United States and Europe have found that windowless rooms are consistently disliked and can be stressful (e.g., Heewagen and Orians, 1986; Collins, 1975).

The concept of a positive distraction implies that apart from stimulation levels per se, certain types of environmental elements are especially important in reducing patient stress and promoting wellness. Positive distraction is an environmental feature or element that elicits positive feelings, holds attention and interest without taxing or stressing the individual, and therefore may block or reduce worrisome thoughts (Ulrich, 1981). Findings from a growing number of studies indicate that responses to positive distractions also involve positive changes across different physiological systems (e.g., reduced blood pressure). The most effective positive distractions are mainly elements that have been important to humans throughout millions of years of evolution: (1) happy, laughing, or caring faces; (2) animals; and (3) nature elements such as trees, plants, and water. In recent years, theory advanced by authors in different fields has tended to converge in contending that a combination of evolutionary/biological influences, as well as learned effects such as cultural conditioning, account for positive human responses to such elements as trees, water, animals, and happy faces (e.g., Ulrich and Parsons, 1990; Ulrich, 1983; Kaplan and Kaplan, 1989; Orians, 1986; Katcher and Beck, 1988; Öhman, 1986). A premise shared by most authors is that the long evolutionary development of humans in natural and social environments has left its mark on our species in the form of unlearned predispositions to pay attention, and respond positively to, these specific types of content and elements.

Nature as Positive Distraction: Stress-Reducing Effects

This section focuses on research concerning stress-reducing effects of viewing nature, and on ways that nature can be used in health facility design to reduce stress and promote wellness. Although perception of nature is multi-sensory, and involves responses to sounds and smells as well as visual content, research to date has been limited almost completely to influences of viewing nature. The intuitively-based belief that visual exposure to trees, water, and other nature tends to produce restoration or recovery from stress dates as far back as the earliest large cities, such as ancient Rome (Ulrich and Parsons, 1990). In the U.S. in the 19th century, intuitively-based arguments about stress-reducing, healthful effects of viewing nature

were influential in establishing urban pastoral parks, such as New York's Central Park, and later in preserving wilderness for public use (Olmsted, 1865, 1976). Historically, a theme running through these beliefs is the notion that if individuals are stressed, views of most natural settings will have stress-reducing influences, whereas views of urban or built settings will tend to impede recuperation, especially if they lack nature content such as vegetation and water. More recently, my colleagues and I have suggested that acquiring a capacity for restorative or stress-reducing responses to certain natural content and configurations (e.g., water, savannah-like settings) had important survival advantages for humans during evolution (Ulrich et al., in press). Accordingly, modern humans might have a biologically prepared readiness to quickly and readily acquire restorative, stress-reducing responses to unthreatening natural settings or content, but have no such preparedness for most urban or built content.

Stress-reducing Effects of Viewing Nature: Non-patient Groups

A small but rapidly expanding body of research has tested the old belief that visual contacts with nature have restorative or stress-reducing influences (for survey of research see Ulrich and Parsons, 1990). Findings from a sequence of studies on non-patient groups such as university students suggest that views of everyday, unspectacular nature, compared to urban scenes lacking nature, are significantly more effective in promoting recovery in the psychological component of stress (e.g., Ulrich, 1979; Ulrich and Simons, 1986; Honeyman, 1987). This research suggests that many nature scenes or elements foster stress recovery because they elicit positive feelings, reduce negatively toned emotions such as fear, anger, and sadness, effectively hold attention/interest, and accordingly might block or reduce stressful thoughts. Research also indicates that views dominated by nature content, in contrast to built or urban scenes lacking nature, foster more rapid and complete restoration in terms of another critical component of stress, the physiological. In laboratory research, visual exposure to everyday nature has produced significant recovery from stress within only about five minutes, as indicated by positive changes in physiological measures such as blood pressure and muscle tension (Ulrich and Simons, 1986; Ulrich et al., in press). Also, a study of unstressed individuals found that slides of nature sustained attention much more effectively through a lengthy viewing session, and produced more positive feeling states, than did built scenes

(Ulrich, 1981). In the same study, recordings of brain electrical activity in the alpha frequency range suggested that individuals were more wakefully relaxed during the nature exposures (Ulrich, 1981). In sum, these studies indicate that for stressed individuals, restorative influences of viewing nature involve, among other responses, a broad shift in feelings towards a more positively-toned feeling state, positive changes in activity levels in different physiological systems, and that these changes are accompanied by moderately high levels of sustained attention.

Effects of Nature in Healthcare Environments

The findings surveyed above suggest that short-term visual contacts with nature can be effective in promoting recovery from stress. This has also been found in a few studies where patients in healthcare settings were exposed for comparatively short periods, such as 10 minutes, to views of nature. For instance, in research by Heerwagen and Orians on patient anxiety in a dental fears clinic (Heerwagen, 1990), questionnaire data suggested that patients felt less stressed on days when a large mural depicting a natural scene was hung on a wall of the waiting room, in contrast to days when the wall was blank. Likewise, heart rate measurements also indicated that individuals were less stressed or tense when the nature mural was visible. In a study of patients who were about to undergo dental surgery, Katcher and his associates (Katcher et al., 1984) found that contemplation of a different configuration of nature content — an aquarium with fish — significantly reduced anxiety and discomfort, and increased scores for patient compliance during surgery. Coss (1990) studied the effects of displaying different types of ceiling mounted pictures to acutely stressed patients who were on gurneys in a presurgical holding room. His findings

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indicated that patients exposed to “serene” pictures (primarily displaying water or other nature) had lower systolic blood pressure than patients exposed to either “arousing” pictures (e.g., a sailboarder leaning into the wind, view of nearby zebras looking directly at the observer) or to a

control condition of no picture. Despite the fact that the arousing pictures were rated as aesthetically pleasing, Coss concluded that such pictures were inappropriate for highly stressed patients.

While short-term exposures to nature can foster impressive stress recovery, it seems possible that wellness benefits may tend to be greatest in certain situations involving long duration exposures to nature, especially when individuals who experience considerable stress are required to spend long periods in a confined setting (Ulrich, 1979, 1984; Clearwater and Coss, 1990). Apart from many healthcare situations, such long term contexts also include prisons and certain high stress work environments (Ulrich and Parsons, 1990; Clearwater and Coss, 1990). In these types of settings, prolonged visual contact with nature may have persistent positive effects on psychological, physiological, and possibly behavioral components of stress. Over time, these effects may be manifested in higher levels of wellness or health.

In this regard, findings from a few studies of hospitals and prisons suggest that prolonged exposure to window views of nature can have important health-related benefits. A study of hospital patients recovering from gall bladder surgery found that individuals had more favorable postoperative courses if windows in their rooms overlooked a small stand of trees rather than a brick building wall (Ulrich, 1984). Patients with the natural window view had shorter postoperative hospital stays, had far fewer negative evaluative comments in nurses' notes (e.g., "patient is upset," "needs much encouragement"), and tended to have lower scores for minor post-surgical complications such as persistent headache or nausea. Further, the wall-view patients needed more doses of strong narcotic pain drugs, whereas the nature view patients more frequently received weak analgesics such as acetaminophen. Likewise, a questionnaire study of patients who were severely disabled by accidents or illness (and presumably stressed) found that a highly preferred category of hospital window views included scenes of natural content such as trees (Verderber, 1986). These results are echoed in findings from studies on prisons suggesting that prison cell window views of nature, compared to such views as walls and buildings, are associated with higher levels of prisoner wellness, as indicated by lower frequencies of stress symptoms such as headaches and digestive illness, and with fewer sick calls (Moore, 1982; West, 1986).

In an extension of this direction of research, Outi Lundén and I recently completed a two-year study at Uppsala University Hospital in Sweden that

investigated whether exposure to visual stimulation in intensive care units, including views of nature promotes wellness with respect to the postoperative courses of open heart surgery patients (Ulrich and Lundén, 1990). One hundred sixty-six patients who had undergone open heart surgery involving heart pump (extracorporeal circulation) were randomly assigned to a visual stimulation condition consisting of a nature picture (dominated either by water or trees), an abstract picture dominated by either curvilinear or rectilinear forms, or a control condition consisting either of a white panel or no picture at all. Previous research suggests that surgery involving a heart pump produces mild temporary brain injury and cognitive impairment in 50-60 percent of patients. To evaluate effects on the patients of the different visual conditions, a wide variety of verbal, physiological, and behavioral data were collected before surgery and at different times following surgery.

Findings from this heart patient study suggested that the individuals exposed to the nature with water picture experienced less postoperative anxiety than the control groups and the groups exposed to the other types of pictures. Designers should note that the abstract pictures were associated with higher anxiety than were the control or no picture conditions. Also, four days after surgery, patients who had been exposed to any type of picture (either nature or abstract) were able to complete a visual/perceptual functioning test faster than individuals in the control groups. This latter finding is important because it suggests that by providing exposure to visual stimulation, it may be possible to facilitate recovery from reversible brain injury, especially with respect to visual/perceptual, but not necessarily verbal functioning. Future articles stemming from this project will report findings based on physiological and behavioral indicators of wellness (e.g., drug intake).

Economic Implications

Some of this research that has linked nature to health-related effects raises the possibility that supportive design can be credibly related to dollar savings in healthcare costs. For instance, the study of gall bladder surgery patients (Ulrich, 1984) found that individuals with attractive window views required fewer moderate and strong analgesic injections, but received more tablets of weak pain drugs. In hospital charge schedules, injections of strong analgesics usually are more expensive than oral doses of acetaminophen. Because patients with the window views of nature needed far fewer of the costly doses, this suggests a dollar savings

benefit for the positive distraction of the view. Likewise, it seems conceivable that large dollar savings might eventually be linked to such possible benefits of good design as somewhat shorter stays in intensive care units for certain categories of patients.

Negative Distractions

In contrast to positive distractions, negative distractions are environmental elements that assert their presence, are difficult to ignore, and are

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stressful. In general, elements are more likely to be negative distractions if they are imposed on patients without possibility of personal choice or control. Also, designed features are more likely to be negative and stressful if the patient is stressed and needs calming distraction, but the designed distraction (e.g., wall art mounted directly in a patient’s line of vision) is stimulating, arousing, and characterized by uncertainty.

Research Example: In 1986, psychologist Robert Simons and I conducted a study of a blood bank that yielded some insights concerning the effects on stress of one of the most common and important distractions that is placed intentionally in healthcare facilities — television. Donor stress is an important problem for blood banks because most people consider giving blood to be painful and unpleasant. Apparently, many health facility administrators and designers assume on the basis of intuition or common sense that a television playing continuously in a waiting room, whether in a blood donor clinic or a hospital, is a positive distraction that benefits stressed patients or visitors. The well-intentioned policy of the blood bank we studied was to have daytime television playing continuously in the waiting area where donors typically spent 10-15 minutes before the phlebotomy phase. The waiting room contained appealing, comfortable seating, many well-maintained plants, and a wall that was covered by a large mural of an attractive forest setting. We expected that the nature decor in the waiting area would tend to reduce stress among donors. Permission was obtained to turn the television off on randomly selected days, and have

it on continuously during other days. Data obtained for the waiting room phase for 440 donors indicated that for days when the television was on, donor stress was actually higher than for days when the television was off. Greater stress associated with daytime television was indicated by higher heart rate and systolic blood pressure. In view of the pervasive use of television as a distraction in healthcare facilities, much more research is needed that examines under what conditions television can be either a positive, stress-reducing distraction, or a negative, stressful feature.

Research Example: A widespread assumption is that paintings and other visual art are positive distractions for patients. This notion is formally expressed in the policies adopted by different European countries of devoting one to two percent of the budgets for health facility construction to interior art. Given the fact that the style and content of paintings and other art varies enormously, and that the content of many paintings is strongly emotional, it seems important to investigate scientifically whether some types of art tend to have especially positive influences on patients, and if certain categories of content might even have stressful effects (Ulrich, 1986).

I explored these issues in a small-scale, preliminary study of the effects of wall art in a psychiatric ward at a Swedish hospital (Ulrich, 1986). The ward was for comparatively short-term patients, whose stays range from 10 days to two or three months. Nearly all the individuals could engage in meaningful conversation. The ward was extensively decorated with paintings and prints reflecting a wide variety of styles and subject matter. Unstructured interviews suggested that patients had positive attitudes to paintings dominated by nature content (e.g., rural landscape, vase of flowers). By contrast, abstract paintings and prints, where the content was either ambiguous or completely unclear, elicited many negative comments, and some patients reported that this type of wall art disturbed them. More convincing evidence emerged from an analysis of paintings and prints in the ward that during the previous 15 years had elicited overt negative responses or actions from patients. These actions included: physical attacks (e.g., tearing the picture from the wall and smashing the frame), and unsolicited strong complaints to the staff (e.g., “the painting disturbs me terribly — take it away”). The physical attacks were dramatic actions given that these patients were considered to be unaggressive and not at all prone to violent behavior (the ward was not locked).

Seven paintings and prints were identified as

having been the targets of physical attacks; five had been attacked more than once and therefore had been removed. None of the total of seven paintings showed a natural landscape or was dominated by nature content such as flowers. In the case of the attacked art, there was a consistent pattern of abstract content. These paintings and prints lacked clarity of content, and portrayed disordered, comparatively chaotic arrays of contrasting colors and abstract elements. To many mental patients, the world may seem chaotic, uncertain, or frightening, and they may have great difficulty perceiving order and security in their surroundings and lives. Perhaps for some patients, an abstract painting of unintelligible disorder displayed prominently in their room might threaten whatever fragile security and sense of order they retain (Ulrich, 1986). Accordingly, the art could be profoundly disturbing, and might elicit an extreme response such as physical attack. Although this study was preliminary, and the findings should be interpreted with caution, the results nonetheless raise the possibility that some types of wall art may sometimes have distinctly unhealthful effects. Along with the research of Coss and Clearwater (Coss, 1990; Clearwater and Coss, 1990), and the study of heart surgery patients in Sweden (Ulrich and Lundén, 1990), this psychiatric ward study implies the need for research to establish scientifically grounded guidelines to help interior designers select art that is reliably stress-reducing and psychologically supportive for different patient groups. It appears that art and posters can indeed have important effects on patients; appropriate visual distractions can have positive influences, but inappropriate art can be stressful.

As tentative guidelines, the safest course for the present may be to choose representational pictures showing serene, spatially open nature settings containing water or park-like areas, and avoid chaotic abstract art, surreal art, works containing incongruous elements, and scenes containing little depth or openness (Ulrich, 1986; Ulrich and Lundén, 1990; Coss, 1990; Clearwater and Coss, 1990). Also, it seems prudent to avoid pictures depicting close-up animals that are staring directly at the observer (Coss and Towers, 1990). It also seems likely that many "cheerful," arousing pictures that may be aesthetically pleasing to designers and healthcare staff can be stressful to anxious patients for whom calming stimulation is more psychologically supportive. Some interior designers may be disappointed by these tentative guidelines, since the recommended style and types of content might be considered pedestrian or unimaginative.

However, these studies imply that when designers or hospital art committees select art styles or content for patient areas that would pass critical muster in, say, a New York gallery, such art in many cases will increase stress and work against wellness.

Summary and Discussion

To summarize briefly, key general points in this presentation include the following:

- To promote wellness, healthcare facilities should be designed to support patients in coping with stress.
- As general compass points for designers, scientific research suggests that healthcare environments will support coping with stress and promote wellness if they are designed to foster:
 1. Sense of control;
 2. Access to social support;
 3. Access to positive distractions, and lack of exposure to negative distractions;
- A growing amount of scientific evidence suggests that nature elements or views can be effective as stress-reducing, positive distractions that promote wellness in healthcare environments.

In considering the needs of different types of users of healthcare facilities — patients, visitors, staff — it should be kept in mind that these groups sometimes have conflicting needs or orientations with respect to control, social support, and positive distractions. It is important for designers to recognize such differing orientations as potential sources of conflict and stress in health facilities (Schumaker and Pequegnat, 1989). For instance, a receptionist in a waiting area may understandably wish to control the programs on a television that he or she is continuously exposed to; however, patients in the waiting area may experience some stress if they cannot select the programs or elect to turn off the television. Some staff may prefer bright, arousing art for corridors and patient rooms where they spend much of their time; however, for many patients, such art may increase rather than reduce stress. A difficult but important challenge for designers is to be sensitive to such group differences in orientations, and try to assess the gains or losses for one group vis-a-vis the other in attempting to achieve the goal of psychologically supportive design.

Designers should also consider programs or strategies that combine or mesh different stress-reducing components. For example, it seems possible that a program enabling patients to select at least some of their wall art or pictures would foster

both control and access to positive distraction. As another example, the theory outlined in this paper suggests that an "artist-in-residence" program, wherein an artist with a caring, supportive disposition would work with patients, might foster social support in addition to control and access to positive distraction.

Running through this presentation is the conviction that scientific research can be useful in informing the intuition, sensitivity, and creativity of designers, and thereby can help to create psychologically supportive healthcare environments. Scientific research and design are complementary activities from the standpoint of the common goal of creating healthcare facilities that promote wellness. While

"Scientific research and design are complementary activities from the standpoint of the common goal of creating healthcare facilities that promote wellness."

sound research findings have the potential to empower the creativity of the designer in achieving successful solutions, the amount of research on supportive design is limited, and studies are lacking on many important issues. One general need is for more research that goes beyond collecting verbally expressed information, or data obtained from questionnaires, to include information on physiological, behavioral, and health-related effects of design. Apart from deepening our understanding of the characteristics of design that foster well-being, findings from such research will have more credibility in the medical community and will carry greater weight with healthcare decision-makers. Further, the survey of research in this paper pointed to instances when scientific findings concerning health-related effects of good design can be linked to dollar savings in healthcare costs. Future research that contributes tangible, credible evidence of the role of design in facilitating or hindering wellness will likely be effective in creating greater awareness among both health care decision-makers and the public of the need to give high priority to psychologically supportive design.

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