

FOREWORD

Unlike animals, man is subject to not only biological but also cultural evolution. This means that we ourselves create a major part of our environment.

In this context, the western world is developing in a remarkable way, which is steadily alienating us from our natural environment.

In contrast to the situation in the home, there are no longer any plants, shrubs or even trees in and around many office buildings.

This situation has arisen even though there are good grounds for assuming that plants not only put us in touch with nature but that, in mental and physical terms, they are able to counteract the damaging effects of sick building syndrome.

Plants are not only visually important but also play a role in combatting odours and improving the humidity levels in many buildings.

When plants are around, productivity and wellbeing are enhanced. Moreover, plants have a favourable impact on energy consumption in offices and on creativity, absenteeism and stress levels.

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EFFECTS OF VEGETATION VIEWS ON STRESS AND HEALTH INDICATORS

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INTRODUCTION

This presentation reviews theoretical explanations and scientific findings concerning the influences of *visual* experiences with plants on people. Emphasis is given to the effects of viewing plants on restoration or recovery from stress, and on health-related indicators or outcomes. As will be evident from the research survey, the limited amount of scientific findings to date pertain mainly to large-sized vegetation such as trees and shrubs rather than to small plants and flowers.

Intuitively-based beliefs that visual contacts with plants and other nature can foster psychological well-being, promote restoration from stress, and have beneficial health effects, date back many centuries in both Western and Eastern urban civilizations (Ulrich and Parsons, 1992). Since at least the twelfth century in Europe, these beliefs have played a recurring role in motivating the provision of gardens for patients in healthcare institutions (Warner, 1987). Further, in America, Europe and Asia, these beliefs have long formed part of the justification for providing parks, gardens, landscaping, and other nature in cities (Parsons, 1991; Ulrich, 1993). Given the persistence of these intuitive notions, it is perhaps surprising that scientific studies to test them have begun to appear only in recent years. Such studies, by yielding tangible, scientifically convincing evidence of plant benefits, could prove important for garnering higher priority or value for plants among decision makers, policy makers, and the public.

EXPLANATIONS FOR POSSIBLE BENEFICIAL EFFECTS

If informal beliefs about plant-people benefits date back centuries, what explanations or theories have contemporary researchers proposed to account for possible benefits derived from visual exposures to plants or other nature ? Until fairly recently, most ..2/

had survival-related significance, including signalling a high potential for finding food (Heerwagen and Orians, 1993; Ulrich, 1993).

Additionally, it is plausible to suggest that acquiring a partly genetic capacity for *restorative* responding to certain nature configurations and contents, including many plants, likewise had major advantages for humans during evolution (Ulrich et al., 1991; Ulrich, 1993). Daily living for early humans was precarious and involved fatiguing, often demanding activities to obtain the necessities for survival. Further, encounters with predators and other threats required stressful, energy-draining psychological and physiological mobilization, and avoidance or flight behaviour. Accordingly, a capacity for restorative responding would have enhanced survival chances, for instance, by fostering rapid reduction of stress responses following an encounter with a dangerous threat, or by promoting the recharge of physical energy after fatiguing and demanding activities.

It should be mentioned that evolutionary perspectives on restorative and other positive responding to plants and flowers have recently garnered support from a rather unexpected source. Several studies of fear responses in pairs of twins have shown convincingly that there is a robust genetic role (30%-40%) in *negative* responses to certain quite specific natural objects (such as snakes) that have been survival-related risks through-out evolution (surveyed in Ulrich, 1993). This strong evidence of genetic role in responses to evolutionary dangers adds credibility to the notion of a partly genetic basis for positive responses to natural features, such as plants and flowers, that represented survival-related advantages throughout evolution.

RELATIONSHIPS BETWEEN STRESS AND HEALTH

All the explanations reviewed above, despite different theoretical underpinnings, agree with the notion that visual experiences with environments having plants or other nature should tend to have restorative or other beneficial psychological and physiological influences on people. To extend this reasoning to include potential health benefits, it is necessary to digress briefly and discuss a key health-related concept, *stress*. This will help provide a basis for considering in the next session the health implications of studies that have evaluated whether visual exposure to plants may tend to promote restoration or recovery from stress.

Although there is no single, universally accepted definition, many researchers interpret *stress* as a process of responding to, or coping with, a situation that is demanding, challenging, and/or threatens well-being (Evans and Cohen, 1987). Depending on the

explanations offered by social scientists emphasized *cultural* and other learning-based mechanisms. For instance, some authors have suggested that inhabitants of most Western nations learn from their cultures - or are "culturally conditioned" - to like plants and other nature, but are conditioned to dislike cities where nature is lacking. Alternatively, a few researchers looked to an influential theoretical perspective in psychology, *arousal* or stimulation theory (Wohlwill, 1976). An arousal-based explanation might argue that stimulating environments such as cities - especially those with high levels of visual complexity, noise, intensity, and movement - can affect people negatively by producing excessively high, stressful, and fatiguing levels of psychological and physiological "excitement". Because environments containing prominent plants or other nature tend to be lower in intensity and less perceptually jumbled than many urban environments (Wohlwill, 1976), they should have comparatively positive, stress-reducing effects on people (Ulrich and Parsons, 1991).

The prominence of cultural and arousal explanations, however, has receded somewhat during the last decade as researchers have increasingly shifted to *evolutionary* explanations for human benefits derived from nature. An evolutionary explanation typically holds that nearly two million years of development in natural environments has left its mark on modern humans in the form of a partly biological or genetic predisposition to respond positively to certain nature contents (e.g., vegetation, water) and configurations (e.g., Orians, 1980; Wilson, 1984; Kaplan and Kaplan, 1989; Ulrich, 1993). This partly genetic affinity for nature - which E.O. Wilson has termed *biophilia* (1984; Kellert and Wilson, 1993) - presumably was adaptive or increased survival chances for early humans. One influential evolutionary argument has been that modern humans should respond in especially positive ways to environmental contents and forms characteristic of natural settings that were favourable to the well-being or survival of early humans. An example of this perspective is the intriguing work of Orians and his associates (1980; Heerwagen and Orians, 1993) who have shown that diverse cultural groups evidence similarly high levels of positive responding to quite specific types of vegetation structure and shapes (Orians, 1986; Sommer and Summit, 1995). In Orians' persuasive analysis (1980, 1986), such vegetation structures signalled to premodern humans a high potential for obtaining water, food, and security. Hence, as a remnant of evolution, a predisposition for positive responses to such vegetation configurations should be represented in the gene pool because it contributed to the survival chances of early humans. Following a similar line of reasoning, acquiring a capacity to notice, pay attention, and respond positively to flowers or blooms should have been highly advantageous for early humans because such features

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intensity and duration of a stress response, there can be numerous negative manifestations that can be grouped into three broad categories:

- * *Psychological manifestations*

Examples: feelings of anxiety or tension, depression, anger

- * *Physiological manifestations*

Examples: increased blood pressure, tense muscles, release of stress hormones (e.g., epinephrine), suppressed immune function

- * *Behavioral manifestations*

Examples: sleeplessness, verbal outbursts or other hostility, alcohol or drug abuse, reduced performance on thinking tasks

As this list of well-documented symptoms implies, stress is associated with distinctly detrimental effects on psychological well-being, performance and health. Not surprisingly, much research has linked major stressors such as divorce or job loss to declines in health. But even comparatively mild stressors or annoyances (work pressures, commuting by car in congested traffic), especially if encountered daily, can produce significant declines in well-being (e.g., Novaco, Kliever, and Broquet, 1991). In view of the deleterious health-related influences of both daily annoyances and major stressors, the studies discussed in the next section concerning stress-reducing effects of plants help provide a logical basis for later considering potential benefits.

RESEARCH FINDINGS: STRESS REDUCING EFFECTS

A small but growing number of studies have analyzed the effects on stressed individuals of viewing different types of outdoor settings, including views dominated by green vegetation such as trees, bushes, and grass (for survey see Ulrich, 1993; Ulrich and Parsons, 1992). Considered together, the studies support the preliminary conclusion that merely viewing settings having prominent vegetation can often foster restoration from stress.

Early studies assessed restoration using the straightforward but limited method of having stressed individuals rate their feelings on a standardized questionnaire. One such experiment studied two groups of university students who were mildly stressed because of a course exam (Ulrich, 1979). Colour slides of unblighted urban or built scenes lacking vegetation were shown to one group of students; the second group was shown slides of

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undistinguished rural settings dominated by green vegetation. Findings suggested that the views with vegetation held attention more effectively and fostered greater psychological restoration, as indicated by greater declines in feelings of fear and anger and much greater increases in positive feelings.

More recently, a few studies have recorded physiological responses to achieve more indepth assessment of stress recovery influences. In a laboratory experiment, 120 persons were first exposed to a stress-inducing movie and then randomly assigned to a "recovery" period during which they viewed videotapes of either urban environments lacking nature or natural settings (Ulrich et al., 1991). Data concerning stress recovery were obtained from self-ratings of feelings and four physiological measures: skin conductance, muscle tension, pulse transit time (a measure which correlates highly with systolic blood pressure), and heart rate. All findings converged to indicate that recovery from stress was much faster and more complete when people were exposed to the natural settings, which included a park-like setting dominated by green vegetation. Greater recovery was indicated, for instance, by faster and larger reductions in blood pressure, muscle tension, and skin conductance. The overall pattern of physiological findings further suggested the possibility that there was a major parasympathetic nervous system component to responses to the natural but not built settings. Parasympathetic responding is associated with restoration or maintenance of energy or bodily resources. Another finding warranting attention was the quickness with which restoration occurred during the nature exposures. After less than five minutes of exposure to the setting dominated by vegetation, significant recovery was evident in physiological recordings.

Hartig (1993) also studied restoration through physiological recordings, including blood pressure measured by monitors worn by participants, and obtained generally similar findings. Hartig's work further suggests that the potential benefits of viewing vegetation may often be greatest for people experiencing stress, but that unstressed persons also derive enhanced psychological and physiological well-being.

As was noted earlier, laboratory research shows that even fairly short exposures to vegetation scenes (about five minutes) can be effective in promoting recovery from stress (Ulrich et al., 1991). This finding has also emerged from research where acutely stressed patients in healthcare facilities were exposed for comparatively short periods to views of nature. Coss (1990) reported that patients exposed to "serene" pictures of nature, including settings with prominent vegetation, had lower blood pressure than patients exposed either to "stimulating" scenes (e.g., nearby wild animals) or to a control condition of no picture.

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HEALTH RELATED INFLUENCES

If short exposures to plants and other nature can have stress reducing influences, it seems possible that long duration exposures might have persistent positive effects on psychological and physiological components of stress and perhaps on behaviours - which in turn might be reflected in improvements in health-related indicators. This notion has received support from a few studies which have examined whether window views of vegetation and other nature can have health-related benefits for hospital patients and individuals confined in prisons.

In a prison study Moore (1982) reported that inmates whose cells had a natural view were less likely to report for sick call than those whose windows looked out on the prison complex. A study of hospital patients by the present author (Ulrich, 1984) examined whether a bedside window view of nature might have beneficial influences. Recovery data were compared for pairs of surgery patients who were matched for characteristics that might affect recovery such as age, weight, tobacco use, and previous health status. The patients were assigned in an essentially random manner to rooms that were identical except for window view: one member of each pair looked out onto trees, whereas the other had a view of a brick wall. Patients with the vegetation view had shorter postoperative hospital stays, had far fewer negative evaluative comments in their records ("patient needs much encouragement," "is upset"), and tended to have fewer minor postsurgical complications such as persistent headache or nausea. Further, the wall-view patients required more injections of strong narcotic pain drugs, whereas those with the vegetation view more frequently received weak pain drugs such as acetaminophen.

In an extension of this research direction, Ulrich, Lundén, and Eltinge (1993) investigated whether exposure to simulated nature views had positive influences on the postoperative courses of heart surgery patients. At Uppsala University Hospital in Sweden, 160 patients who had undergone heart surgery were assigned according to a modified random procedure to a visual condition consisting either of nature picture (trees, water/vegetation), an abstract picture dominated by either rectilinear or curving forms, or a control condition (either a white panel or no picture). Findings suggested that individuals exposed to the water/vegetation view experienced less postoperative anxiety than the control groups and those exposed to the other types of pictures. Moreover, those patients with the water/vegetation view shifted more quickly than other groups from strong pain drugs to moderate strength pain drugs. The rectilinear abstract picture, by contrast, may have elicited higher anxiety than having no picture at all.

Such studies as these on health-related influences suggest the possibility that views

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of vegetation can be credibly linked to monetary savings in healthcare costs. For instance,

because patients in hospital window view study required fewer doses of the more costly strong pain injections (Ulrich, 1984), and prisoners with cell views of nature needed fewer health services (Moore, 1982), it appears that certain monetary savings could justifiably be attributed to the views of vegetation and other nature.

CONCLUSIONS

The number of scientific studies in this area is limited, but findings already suggest strongly that views of plants and other nature can reduce stress and in certain situations may have beneficial health-related influences. Different investigators have found that viewing vegetation can produce significant restoration from stress within five minutes or less, as indicated by changes in such physiological indicators as blood pressure. The apparent quickness of restoration raises the possibility that even fairly brief visual contacts with plants in work places, homes, and other built settings might be important for promoting restoration from the detrimental effects of commuting, work pressures, and other stressors that most urbanites encounter daily.

Stress recovery derived from viewing vegetation apparently is manifested in a combination of beneficial effects, including: increases in positive feelings; declines in negative or stress-related feelings such as fear, anger, or sadness; positive changes in different bodily systems, including reduction of deleterious sympathetic nervous system mobilization; and often sustained attention/interest directed at the scene that might temporarily reduce worries or block stress-related thoughts (Ulrich et al., 1991). This combination of beneficial stress-reducing influences, which can be derived from exposures lasting only a few minutes, may underlie health-related benefits reported in a few studies where stressed individuals in hospitals and prisons were exposed for longer periods to vegetation views (Ulrich and Parsons, 1992).

To date most research findings pertain to larger-sized vegetation such as mixed vegetation with prominent shrubs and trees, rather than small plants and flowers. The neglect of research on flowers can be attributed to the comparative lack of funding to support studies. If this obstacle were removed, then nearly all the research methods used to study large vegetation - for instance, physiological assessment of restoration - could be directly applied to small plants or flowers (Parsons, Ulrich, Tassinary, 1994). Scientific research on physiological and health-related influences of viewing flowers or small plants would likely contribute credible, convincing evidence of benefits that could prove effective in achieving greater importance or priority for plants.