OUTCOMES OF ENVIRONMENTAL APPRAISAL OF DIFFERENT HOSPITAL WAITING AREAS

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ABSTRACT: This article evaluates the intuitively informed interior design changes made to a United Kingdom neurology outpatient waiting area following relocation to an alternative building. This nouveau environment is compared with the more traditional waiting area used before the relocation. The two waiting areas are compared in terms of their effects on the environmental appraisals, self-reported stress and arousal, satisfaction ratings, and pulse readings of 145 outpatients. The equivalence of the outpatient samples attending each clinic is demonstrated in terms of their common demographic characteristics and their similar health profiles. The results provide convergent evidence that the nouveau waiting area is associated with more positive environmental appraisals, improved mood, altered physiological state, and greater reported satisfaction. These findings provide support for the concept of a therapeutic hospital environment.

Keywords: hospitals; environmental appraisal; stress; arousal

SOURCES OF STRESS IN THE HOSPITAL ENVIRONMENT

For many patients and visitors, the hospital is a strange and alien environment (Carver, 1990; Veitch & Arkkelin, 1995; Zimring, Carpman, & Michelson, 1987). As Carver (1990) described it,

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Being admitted to a modern hospital can be like entering an alien spacecraft. The atmosphere can be intimidating and unfamiliar... there is often... a confusing array of doors, corridors, and color-coded signs-enveloped in a tall, intimidating structure appearing... like an oversized air conditioning unit.

(p. 86)

Veitch and Arkkelin (1995) suggested that the mere mention of the word hospital conjures up “thoughts of long sterile hallways, stainless steel utensils, banks of life-monitoring equipment, people in white uniforms rushing to and fro, specialized rooms for specialized functions, wheelchairs lined up at elevators, and the smell of rubbing alcohol and disinfectant” (pp. 291-292).

The unfamiliarity and strangeness characteristic of the hospital environment may generate strong negative emotions—often, those associated with suffering and death (Brown, 1961). At the very least, hospitals are perceived as strange, frightening, and fearful places that stimulate feelings of threat and vulnerability (Brown, 1961; Carpman, Grant, & Simmons, 1984; Leventhal, Nerenz, & Leventhal, 1982). Leventhal et al. (1982) added that the environmental sterility characteristic of the modern medical setting can contribute to the experience of patient dehumanization. As Olsen (1978) explained, hospital designs often communicate a uniform message that people are “sick and dependent and should behave in an accordingly passive manner” (p. 7). In essence, patients and visitors pick up on design cues (e.g., bedside privacy, medical equipment, location of nursing stations) that influence self-perception, help define sick-role behavior, and provide information about the hospital’s humaneness and competence as an institution (Zimring et al., 1987).

Shumaker and Reizenstein (1982) identified this negative symbolic meaning as being one of the principal ways in which the physical environment of the hospital can contribute to levels of stress. Stress, defined as an imbalance between perceived demands and perceived coping resources (Cox, 1978; Lazarus, 1966; Lazarus & Launier, 1978; Selye, 1976), offers a valuable heuristic to help explain how the physical features of any environment can influence human health and well-being (Evans, 2000; Evans & McCoy, 1998; Ulrich, 1991). Evans (2001) noted, in this respect, that the physical environment might contribute to stress in three distinct ways: (a) by acting as a stressor that directly loads or pressures the system, for example, where crowding creates excessive stimulation; (b) by damaging or ameliorating coping resources, for example, where chronic noise leads to learned helplessness (Glass & Singer, 1972); and (c) by eliciting coping strategies that, in turn, lead to poor health, for example, where noisy working conditions are associated with increased substance abuse.
What is of fundamental importance in this is the idea that the physical environment might be conceptualized either as a source of stress or as a source of coping resources. Physical and psychosocial elements have frequently been found to interact in their effect on well-being (Evans, Johansson, & Carrere, 1994; Evans & Lepore, 1992; Leather, Pyrgas, Beale, & Lawrence, 1998). This opens up the possibility that, although the physical characteristics of an environment might not be stressful in themselves, they nevertheless might act to exacerbate or attenuate the negative impact of some co-occurring psychosocial stress. Investigators (e.g. Ulrich, 1991) have applied this to the hospital setting. This article also tests this proposition, namely, that differently designed hospital outpatient waiting areas might accentuate or alleviate the stress known to accompany a visit to the hospital for a medical consultation (Ulrich, 1991).

Central to this idea is the degree of congruence or fit between individual needs and environmental resources and affordabilities. Importantly, in this respect, research identifies clear disparities between hospital user groups in the extent to which their environmental needs are recognized and prioritized. The typical hierarchy places clinical and medical needs first, inpatients second, outpatients third, and visitors last (see, for example, Zimring et al., 1987). To differing degrees, patients and visitors are all expected to adjust to an unknown environment in which much is new and alien to them (Shumaker & Reizenstein, 1982). As Leventhal et al. (1982) concluded, attending clinics for medical treatment often involves a loss of control over many aspects of daily life including control over the physical environment. Thus, the stress associated with the hospital visit is not confined solely to the worry and anxiety known to accompany physical illness (Cohen & Lazarus, 1979). In addition, it can derive both directly from the adaptation needed to actively engage with a strange and alien environment (Shumaker & Reizenstein, 1982) and indirectly from the depleted coping resources that are thereby left to deal with any physical illness or complaint.

Physical discomfort is a further mechanism by which the hospital environment can be a potential contributor to stress (Steele, 1973). Conversely, a comfortably designed environment may at least partially mitigate the stress of a hospital visit (Zimring et al., 1987) by way of design features that meet patient needs for bodily comfort (Shumaker & Reizenstein, 1982).

**THERAPEUTIC HEALTH CARE ENVIRONMENTS**

The potential for what is often termed the *therapeutic dimension* in hospital design has a long history (e.g., Kirkbride, 1854) and continues to be a focus for contemporary research (Canter & Canter, 1979; Cumming &

Moran (1990) pointed out that, as a bare minimum, “healthy environments” should “at least lack attributes which are associated with dis-ease” (p. 6). Similarly, Carver (1990) suggested that the design of hospitals needs to portray “a nurturing, non-threatening environment . . . to help put people at ease” (p. 90). Evidence does indeed suggest that people respond positively to attractive environments that connote caring intent (Campbell, 1979). For example, changes in decor, furnishings, and furniture arrangement have been found to increase social interaction and decrease anxiety in hospital settings (Bakos, Bozic, Chapin, & Neuman, 1980; Hiatt, 1981; Holahan & Saegert, 1973; Sommer & Ross, 1958). The value of an attractive environment is thought to lie in its ability to distract attention (Baum & Davis, 1976) with natural environments, in particular, allowing recovery from mental fatigue (Kaplan & Kaplan, 1989). These examples demonstrate that environmental features may facilitate or enhance patient behavior and contribute to the generation of a healthy environment (Canter & Canter, 1979; Moran, 1990).

Color (hue), for example, has been found to moderate both subjective and physiological indexes of patient well-being. Schauss (1979) attributed a tension-relieving effect to a specific shade of pink, whereas Brown (1974) reported that pulse rate changed in response to different hues thereby substantiating the claim that color can induce emotional states. Generally, cool colors (green and blue) have been found to have a relaxing effect by decreasing the pulse rate, whereas warm colors (red and some pinks) tend to induce both physiological arousal by increasing the pulse rate and a tendency for attention to be directed outwards into the environment (Birren, 1979). Birren (1979) argued against the use of the color white in hospitals, because, in combination with artificial (fluorescent) lighting, it can cause “distressing glare” sometimes linked with headaches and eye strain.

The value of a pleasantly designed healthcare environment should not be underplayed. Reizenstein (1976) found that it facilitated self-disclosure by clients to hospital social workers. Bobrow and Thomas (1990) found that doctors were keen to develop a pleasant environment as a means to increase the efficiency and quality of their work. Perhaps most impressively, Ulrich (1984) found shorter postoperative stays and decreased analgesic use in
hospitalized patients whose windows looked out on a natural scene rather than an urban view.

Such findings have important implications for patient health and the quality of care received. As Shumaker and Reizenstein (1982) stated, “Patients enter hospital settings in a vulnerable state, and any stressors they encounter that go beyond their illness can threaten them by diverting their physiological and psychological mechanisms from their own recovery” (p. 189). Removing such sources of stress in the hospital environment may, therefore, have beneficial effects on the process of recovery. However, Kasmar, Griffin and Mauritzen (1968) found that two contrasting visual-aesthetic settings (i.e., a beautiful and an ugly room) had no simple effects on either self-rated mood of patients or their perceptions of the members of hospital staff.

Certainly, evidence exists to suggest that stress can generate relapse or complications in those who are already ill (Andrews & Tennant, 1978; Sklar & Anisman, 1981). Stress may lead to feelings of anger, frustration, and helplessness (Cohen, 1980), which may also inhibit recovery (Seligman, 1975). Additionally, a reduction in information-processing capacity can occur following stressful experiences (Cohen, Evans, Stokols, & Krantz, 1986).

A fundamental question being asked in attempts to identify healthy healthcare environments is whether different everyday environments have different stress-recovery capabilities (Ulrich & Simons, 1986; Ulrich et al., 1991). That is, does exposure to some environments have restorative effects, whereas exposure to others has either no effect or, worse still, a negative effect? Although Ulrich’s demonstration of the value of natural environments is particularly important in this respect (Ulrich, 1981, 1984; Ulrich & Simons, 1986; Ulrich et al., 1991), there is a need to continue this work in real-world contexts outside the laboratory.

What Ulrich’s work offers is a clear set of criteria against which the recovery or restorative potential of an environment can be judged. Put simply, “Restoration or recovery from stress involves numerous changes in psychological states, in levels of activity in physiological systems, and often in behaviors or functioning” (Ulrich et al., 1991, p. 202). Ulrich et al. (1991) emphasized that “recovery effects should be evident in emotional states and physiological indicators”, the key point being that “general synchrony between data obtained from different modes (e.g., psychological and physiological) would suggest true convergent validity, and justify greater confidence in the findings” (p. 202-203).

Despite the obvious value of systematic research on the impact of hospital design choices, studies have characteristically lacked theoretical and empirical content (Bell, Fisher, Baum, & Greene, 1990; Veitch & Arkkelin, 1995). Furthermore, most studies have considered only inpatients in acute care and
psychiatric settings. Research on a wider range of hospital settings is now needed (Zimring et al., 1987).

AFFECTIVE APPRAISAL IN WAITING AREAS

Waiting areas may play an important role in healthcare settings in reassuring or further distressing patients. Ingham and Spencer (1997) found that the “softening” of a dental clinic waiting area reduced worry and anxiety experienced by patients prior to examination or treatment. Zimring et al. (1987) pointed out that the decor and furnishings in hospital waiting areas “speak” to visitors about the value the hospital places on their comfort. Waiting areas designed without consideration of user needs may communicate a negative message such as the patient having a low priority within the overall hospital system.

This article reports the results of a comparative evaluation of two waiting areas used by outpatients at neurology clinics in a large city hospital in the west of England. The two waiting areas, hereafter referred to as traditional and nouveau, differed in terms of a number of aesthetic and functional attributes. Essentially, the label traditional describes the typical design of outpatient clinics found in U.K. hospitals, whereas nouveau refers to a deliberate attempt to create an alternative image (refer to Table 1 in Method). Based on Russell and Snodgrass (1987), it is contended here that the person-environment relationship is largely emotional in nature with the affective quality of a place accounting for the cumulative influence of the environment on mood, health, and subjective well-being.

In simple terms, the impact of the physical environment derives from the individual’s appraisal of the environment itself. Appraisal, in this sense, is the individual’s subjective evaluation of the environment in terms of both the quality of features present and how the environment fits the person’s needs. This conceptualization is in line with an appraisal model of emotion (Lazarus, Averill, & Opton, 1970) where emotions are defined as “valenced reactions to events, agents, or objects, with their particular nature being determined by the way in which the eliciting situation is construed” (Ortony, Clore, & Collins, 1988, p. 13). In this way, an important distinction is drawn between the resulting mood or emotion and the appraisal or evaluation of the situation. With respect to person-environment relationships, Russell and Snodgrass (1987) made a similar distinction between an individual’s internal emotional state and the affective appraisal of the environment that gives rise to it.

Following Russell and Snodgrass (1987), affective appraisal is operationally defined as an individual’s rating of a setting on a series of adjectives
highly saturated in affective meaning—for example, boring versus stimulating, dull versus bright, and tense versus relaxed—but with little or no reference to objective, perceptible properties of the place described. This is to differentiate affective appraisal from environmental evaluation, which refers to judgments of specific and identifiable features within the environment, for example, the furniture or furnishings present. For the purpose of this research, the patients’ emotional state that resulted from appraisal of the different waiting areas was operationally defined as their self-reported stress and arousal. However, an additional measure of physiological arousal was used to strengthen the validity of any findings (Ulrich et al., 1991).

Accordingly, the two waiting areas were compared in terms of patients’ (a) affective appraisal of the environment, (b) emotional reactions contingent upon that appraisal, (c) pulse rate as a base, physiological indicator, and (d) more detailed evaluation of specific environmental features. It was hypothesized that the nouveau design would be associated with (a) more positive affective appraisals of the waiting area, (b) more positive emotional reactions experienced by the waiting area occupants, and (c) more positive evaluations of particular design features compared to the traditional design.

METHOD

RESEARCH DESIGN

The study utilized a two-sample comparative design with data being gathered from patients prerelocated and postrelocated to a neurology outpatient clinic. The equivalence of the two samples was determined by comparing the age and gender composition and the health profiles. The differently designed waiting areas constituted the independent variable in this field experiment, the dependent variables being patients’ appraisals and evaluations of those environments together with their mood and physiological arousal.

SETTING

The impetus for this study was the rehousing of the neurology clinic from a shared, medical outpatient department to a nearby building within the same hospital complex, which was to serve exclusively as a neurology clinic. Relocation to the new site afforded a senior consultant the opportunity to design the interior waiting area in a manner believed to be less “clinical and intimidating” and more “supportive” for patients (personal communication).
However, no structural changes were made to the building to accommodate the neurology clinic. The major design attributes of the two waiting area environments—traditional and nouveau—are outlined in Table 1. Ease of access to the two waiting areas was similar in terms of distance from parking lots and pedestrian entrances and situation within their respective buildings.

### TABLE 1

<table>
<thead>
<tr>
<th>Design Feature</th>
<th>Traditional</th>
<th>Nouveau</th>
</tr>
</thead>
<tbody>
<tr>
<td>General layout</td>
<td>Square plan; enclosed reception area; files and paperwork visible from waiting area</td>
<td>L-shaped plan; open-plan reception area; no files or paperwork visible</td>
</tr>
<tr>
<td>Color scheme</td>
<td>Magnolia &amp; dark brown; no color coordination</td>
<td>Grey and pink tones; color coordination</td>
</tr>
<tr>
<td>Floor covering</td>
<td>Red, patterned, flat carpet</td>
<td>Lilac, pile carpet</td>
</tr>
<tr>
<td>Curtains</td>
<td>Flimsy, window-length</td>
<td>Heavy, full-length</td>
</tr>
<tr>
<td>Furniture</td>
<td>Plastic-covered, blue-grey benches and armless chairs</td>
<td>Fabric-upholstered, deep blue, armless, wooden chairs</td>
</tr>
<tr>
<td>Lighting</td>
<td>Fluorescent strip lighting</td>
<td>Wall-mounted fixtures</td>
</tr>
<tr>
<td>Walls &amp; pictures</td>
<td>Cork notice-boards</td>
<td>Wall-mounted nature photography; wooden paneling</td>
</tr>
<tr>
<td>Plants &amp; flowers</td>
<td>Small, wall-mounted, dried flower arrangements</td>
<td>Free-standing, ceramic-potted indoor plants</td>
</tr>
<tr>
<td>Reading material</td>
<td>Large piles of easy-reading magazines (e.g., Woman's Own)</td>
<td>Selection of glossy magazines (e.g., Homes &amp; Gardens)</td>
</tr>
<tr>
<td>Medical information displays</td>
<td>Leaflet carousels &amp; information boards</td>
<td>None</td>
</tr>
<tr>
<td>Windows</td>
<td>Metal-framed, clear glass; view onto adjacent hospital buildings</td>
<td>Metal-framed, clear glass; view onto adjacent hospital buildings</td>
</tr>
<tr>
<td>Noise</td>
<td>No music or television; noise from waiting patients, staff, and telephones</td>
<td>No paging system or television; noise from waiting patients, staff, and telephones</td>
</tr>
</tbody>
</table>

The sample comprised 145 neurology outpatients interviewed in two groups: 81 patients were interviewed in a traditional waiting area and 64 in a
newly refurbished (nouveau) waiting area. Seventy subjects (48%) were male and 73 (50%) were female (2 respondents did not indicate gender). Chi-square analysis revealed no significant difference between the two patient groups in terms of gender, $\chi^2(1, 145) = .38, ns$. The age of subjects ranged from 15 to 78 years with a mean age of 48 years and a standard deviation of 15.8 years. An independent samples $t$ test revealed no significant difference in age between the two groups, $t(143) = .57, ns$.

Of the patients sampled in the traditional waiting area, 39% were making their first visit to the neurology outpatient clinic. In the nouveau waiting area, this figure was 30%. Chi-square analysis revealed no significant difference between the two patient groups in terms of their status as new or returning patients, $\chi^2(1, 145) = .80, ns$. However, for the returning patients in the traditional waiting area, the group median for the number of previous visits was 4 (57% having attended for at least 4 previous visits). For returning patients in the nouveau waiting area, by contrast, the group median for the number of previous visits was 1 (84% returning for only their first time). Not surprisingly, the chi-square test revealed a significant difference in the number of previous visits made to the different waiting areas, $\chi^2(1, 145) = 33.2, p < .001$.

Diagnoses for patients were similar in both groups with multiple sclerosis, Parkinson’s disease, and epilepsy together accounting for approximately two thirds of patients. When possible, every patient attending during data collection was included in the study. However, on the advice of a senior medical consultant, a few patients were excluded because of the disabling nature of their medical condition, such as advanced motor neuron disease. To determine the equivalence of the two samples, both self-reported and medically judged ratings of the pain, anxiety, and disability currently experienced were gathered. Each of these six measures was a single item based on a 7-point Likert-type scale, ranging from 1 (none at all) to 7 (a great deal). For each patient, doctors also provided details of medical condition and treatment. Multivariate analysis of variance showed the two patient samples to be similar in terms of self-reported and medically judged ratings of pain, anxiety, and disability, multivariate $F(7, 123) = 1.67, ns$. Table 2 provides the descriptive and univariate statistics for each of these six ratings where lower scores indicate greater severity. These figures clearly demonstrate the equivalence of the two patient groups with respect to both their demographic characteristics and their health status.

**INSTRUMENTS**

Information was gathered from patients using a structured interview methodology appropriate for the medical condition of many of the subjects.
The schedule for the interview consisted of five sections. Sections 1 and 2 were completed at Time 1. Sections 3, 4, and 5, were completed approximately 7 minutes later at Time 2.

Section 1 included biographical information (i.e., age, gender, and number of visits made to the clinic) together with 7-point rating scales measuring self-reported pain, anxiety, and disability.

Section 2 consisted of an abbreviated version of Cox and Mackay’s (1985) Stress Arousal Checklist (SACL). The SACL comprises a set of unipolar mood-adjectives rated on 4-point scales (do not feel to definitely feel) derived from a series of factor analytic studies to measure two fundamental aspects of mood: self-reported stress and self-reported arousal. As reported by the authors of the scale (Cox & Mackay, 1985), the SACL demonstrates good reliability and validity with respect to the measurement of transient emotional states. Stress relates to feelings of tension and hedonic tone, whereas arousal relates to the person’s energy level and has to do with the physiological and behavioral states of attentiveness and wakefulness (Gotts & Cox, 1988). Only the 20 highest loading items of the original instrument were used to facilitate more rapid assessment of mood given the restricted time available for interviews. Twelve items pertained to the stress factor (e.g., nervous, distressed, peaceful, relaxed) and 8 to arousal (e.g., lively, alert, tired, drowsy). Scoring followed the procedure set out in the user’s manual (Gotts & Cox, 1988), so that each item was scored 0 or 1 according to the presence or absence of feelings associated with stress or arousal (with reverse scoring.
where appropriate) and the item scores summed. The maximum possible score for stress was 12 and for arousal was 8. The shortened version of the SACL demonstrated adequate alpha reliability coefficients at both data collection points, Time 1 (\(\alpha = .91\) for stress, \(\alpha = .72\) for arousal) and Time 2 (\(\alpha = .91\) for stress, \(\alpha = .79\) for arousal).

Section 3 comprised Fisher’s (1974) Perceived Environmental Quality Index (PEQI) as a measure of affective appraisal. The PEQI consists of fourteen 7-point scales anchored by bipolar adjectives connoting at one end positive and at the other end negative perceptions of the environment (refer to Table 3). A negative response was scored 1; a positive response was scored 7.

Section 4 included ten 7-point rating scales each requesting evaluation of whether a specific design feature (e.g., general layout, furnishings, and lighting) added to or detracted from the overall pleasantness of the room (refer to Table 4 for complete details). An additional 7-point scale, ranging from 1 (not at all satisfied) to 7 (completely satisfied), measured overall satisfaction with the environment as a hospital waiting area. This single-item measure was included to ascertain the extent to which subjects felt the environment fulfilled the function for which it was built. On all these items, a high score indicated a positive evaluation.

Section 5 included an alternative version of the adapted SACL including the same items as in Section 2 but in a different order to minimize any memory effects from completing the SACL previously at Time 1.

The physiological arousal (pulse rate) of subjects was recorded using a digital exercise pulse monitor (Elexis Pulse Coach 3). Pulse rate was measured via a clip that fitted comfortably onto the earlobe. To ensure consistency, the pulse rate reading was always recorded after the clip had been attached to the earlobe for 15 seconds. Pulse rate readings were recorded as beats per minute.

PROCEDURE

Data collection was undertaken in the traditional waiting area some weeks before the clinic relocated. In the nouveau waiting area, it commenced 4 weeks after relocation to allow time for staff to get used to their new working environment.

Having registered with the receptionist on arrival and after finding a seat, patients were approached by the researcher and informed of the nature and purpose of the study. Voluntary participation was then sought and absolute anonymity assured. Patients’ hospital reference numbers (as indicated on the clinic attendance list) were used to link questionnaires to information supplied by the medical staff.
Initial measures were taken at Time 1, which coincided with the subjects having been in the environment for approximately 3 minutes. The first measure obtained was pulse rate, then Sections 1 and 2 of the questionnaire were completed. Subjects were then informed that the researcher would return in approximately 7 minutes during which time the patient was left to take in the environment. When the researcher returned at Time 2, the pulse rate was again taken, and Sections 3, 4, and 5 of the interview schedule were then completed.

The entire procedure for each subject took approximately 12 minutes. Following the medical consultation, the doctors provided the requested information on each patient’s health status by means of a single-page questionnaire. In addition to the pain, anxiety, and disability rating scales, this questionnaire requested a diagnosis for the patient’s condition.

DATA ANALYSIS

All data were analyzed using the Statistical Package for the Social Sciences, Version X (SPSSX)(Nie, Hull & Bent, 1986). Prior to the use of parametric statistical techniques, all data were checked for normality. Variables with excessive skew or kurtosis were transformed using a square root transformation. To assist in interpretation, however, descriptive statistics are reported here in their raw form.

RESULTS

ENVIRONMENTAL APPRAISAL

Differences in appraisals of the two waiting area environments were analyzed by the comparison of scores on the 14 PEQI items. A between-subjects multivariate analysis of variance, using scores on the PEQI items as dependent variables, revealed a significant multivariate effect for waiting area, $F(14, 116) = 10.644, p = .000$. Table 3 reports the univariate statistics for each of the 14 ratings and shows that the two waiting areas were perceived in markedly different ways. Specifically, the nouveau environment was rated as being significantly more colorful, positive, stimulating, attractive, relaxed, comfortable, cheerful, good, lively, bright, motivating, pleasant, and open. Figure 3 represents these differences in profile form where the sample means for each waiting area are plotted along the horizontal dimension.
The impact of the two waiting area environments on self-reported mood and pulse rate was examined by means of separate mixed analyses of variance. Waiting area was the between-subjects factor in these analyses, whereas self-reported stress, arousal, and the pulse readings at Times 1 and 2 constituted the within-subjects factors.

Although no significant effects were found on self-reported arousal, a significant Waiting Area $\times$ Time interaction was found on self-reported stress, $F(1, 132) = 5.88$, $p = .017$. Figure 1 depicts this interaction and shows that, although self-reported stress increased over time in the traditional waiting area, it decreased across time in the nouveau waiting area. A separate independent samples $t$ test was conducted to examine whether levels of self-reported stress differed between clinics at Time 1. The result was not significant, $t(143) = .538$, ns.

A similar Waiting Area $\times$ Time interaction was found with respect to pulse, $F(1, 136) = 5.83$, $p = .017$. As Figure 2 shows, the tendency here is for pulse rate to increase over time in the nouveau waiting area while decreasing in the traditional waiting area. It should be noted, however, that separate,
independent samples $t$ tests revealed pulse levels in the nouveau waiting area to be significantly higher than those in the traditional waiting area at both Time 1—$t(143) = 2.311, p < .05$— and Time 2—$t(143) = 4.332, p = .001$. 

**Figure 1: Interaction of Waiting Area × Time on Self-Reported Stress Score**

**Figure 2: Interaction of Waiting Area × Time on Pulse Rate**
Thus, self-reported stress and pulse readings yielded discordant results—a point that will be returned to in the discussion.

ENVIRONMENTAL EVALUATION

Satisfaction ratings for the two waiting areas, whether for the two environments as a whole or for specific features therein, were compared using a between-subjects multivariate analysis of variance. A significant multivariate effect for waiting area was revealed, $F(11, 114) = 13.663, p = .000$. Table 4 reports the descriptive and univariate statistics for each of the 11 ratings given and shows that the nouveau waiting area was rated more favorably in
terms of its layout, color scheme, floor covering, curtains, furniture, lighting, pictures, and plants. It also received a greater overall satisfaction rating. No significant differences were perceived in temperature or provision of information. Figure 4 represents these results in profile form where the sample means for each waiting area are plotted along the horizontal dimension.

CONTROLLING FOR INTERVENING VARIABLES

Controlling for the number of visits made to each waiting area through analyses of covariance made no difference to the pattern of results reported here. This fact together with the equivalence of the two samples on self-reported and doctors’ health-profile ratings strengthen the probability that all of these reported differences between the two waiting area environments in appraisal, mood, satisfaction, and physiology reflect real differences rather than spurious ones.

LINKING APPRAISAL TO MOOD, PHYSIOLOGICAL STATE, AND SATISFACTION

To identify exactly how environmental appraisal might be related to self-reported mood, physiological state, and satisfaction, PEQI items were factor analyzed for the entire sample to reveal the existence of any underlying dimensions. These factor scores were then correlated with self-reported
mood, pulse, and satisfaction to assess both the degree of association between them and their suitability for use in a series of multiple, linear regression analyses. Table 5 reports the results of the principal components analysis for the PEQI. Oblimin rotation was used, as it was not assumed that any factors would be orthogonal. Factor 1 is essentially concerned with a sense of *goodness* and is therefore termed Agreeableness. Factor 2, on the other hand, is essentially to do with the arousing nature of the environment and is accordingly labeled Arousing Potential. Factor 3 contained the single item, *large*.

As would be expected from the comparison of individual items (see Table 3), the one-way, between-subjects multivariate analysis of variance with multiple dependent measures (i.e., the three factor scores) revealed a significant multivariate effect for waiting area, $F(3, 126) = 33.00$, $p < .001$.  

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### Table 5: Results of Principal Components Analysis for the PEQI

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>Factor Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>Agreeableness</td>
<td>7.30</td>
</tr>
<tr>
<td>Factor 2</td>
<td>Arousing Potential</td>
<td>5.90</td>
</tr>
<tr>
<td>Factor 3</td>
<td><em>large</em></td>
<td>4.20</td>
</tr>
</tbody>
</table>

---

Figure 4: Traditional and Nouveau Waiting Area Profiles on the Satisfaction Ratings
Examination of the univariate statistics showed this effect to be common to both the Agreeableness factor, \(F(1, 128) = 78.68, p < .001\), and the Arousing Potential factor, \(F(1, 128) = 57.68, p < .001\), but not to the single-item large factor, \(F(1, 128) = .56, ns\). Because of the possible unreliability of a single-item, self-report predictor measure and, in an effort to maximize the ratio of predictor variables to number of subjects, this last factor was dropped for the subsequent correlation and regression analyses.

Table 6 details the intercorrelations between the two remaining factor scores (Agreeableness and Arousing Potential), self-reported mood, pulse, and satisfaction. From Table 6, it can be seen that greater Agreeableness is associated with lower self-reported stress, higher self-reported arousal, and higher pulse readings. Arousing Potential is similarly associated with self-reported stress and self-reported arousal but shows no significant association with pulse. The existence of these various correlational relationships justifies the use of multiple linear regression analyses to determine the predictive power of the affective appraisal variables. In each regression analysis,

#### Table 5

<table>
<thead>
<tr>
<th>Items</th>
<th>Agreeableness</th>
<th>Arousing Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>.896</td>
<td>.949</td>
</tr>
<tr>
<td>Comfortable</td>
<td>.779</td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>.768</td>
<td></td>
</tr>
<tr>
<td>Pleasant</td>
<td>.755</td>
<td></td>
</tr>
<tr>
<td>Attractive</td>
<td>.737</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>.664</td>
<td></td>
</tr>
<tr>
<td>Lively</td>
<td></td>
<td>.902</td>
</tr>
<tr>
<td>Motivating</td>
<td>.827</td>
<td></td>
</tr>
<tr>
<td>Stimulating</td>
<td>.561</td>
<td></td>
</tr>
<tr>
<td>Cheerful</td>
<td>.464</td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td></td>
<td>.949</td>
</tr>
</tbody>
</table>

Eigen value: 5.317, 1.063, 1.033

% variance accounted for: 48.3, 9.7, 9.4

NOTE: Kaiser-Meyer-Olkin measure of sampling adequacy = .881; Bartlett’s test of sphericity = 682.685, N = 132, p < .001; subject:variable ratio = 12:1; rotation: Oblimin; extraction rule: Kaiser 1; criterion for item-factor loading: to exceed .4; items discarded due to low communality (< .03), low anti-image correlation (< .05), or crossloading: colorful, bright and open.
Factors 1 (Agreeableness) and 2 (Arousing Potential) were entered simultaneously in a single block.

The regression of self-reported arousal onto the two environmental appraisal factors revealed that only the Arousing Potential of the environment made a significant, independent prediction as shown in Table 7. Self-reported arousal scores increased as the perceived Arousing Potential of the environment increased ($\beta = .275, t = 2.505, p = .05$).

For self-reported stress, it was the Agreeableness factor that made a significant independent prediction as shown in Table 7. Self-reported stress scores decreased as the agreeableness of the environment became more positive ($\beta = -.411, t = -3.86, p = .001$).

Neither appraisal factor made a significant, independent prediction of pulse rate as can be seen in Table 7. Cumulatively, however, they did show a weak association ($R^2 = .039, F = 2.584, p < .1$) with the Agreeableness factor manifesting the stronger relationship ($\beta = .185$).

Finally, the overall satisfaction rating given for the waiting area was regressed onto the two appraisal factors. As shown in Table 7, both factors were found to make a significant, independent prediction ($\text{Agreeableness } \beta = .457$, Arousing Potential $\beta = .219$) with 38% of the variance in satisfaction ratings being accounted for by their cumulative impact.

---

**TABLE 6**

Inter correlation of Study Variables Considered for Use in Regression Analyses

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variable 2</th>
<th>Variable 3</th>
<th>Variable 4</th>
<th>Variable 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreeableness</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousing Potential</td>
<td>.669**</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-reported stress at Time 2</td>
<td>$-.358**$</td>
<td>$-.179^*$</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Self-reported arousal at Time 2</td>
<td>$.178^*$</td>
<td>$.229**</td>
<td>$-.186^*$</td>
<td>1.000</td>
</tr>
<tr>
<td>Pulse at Time 2</td>
<td>$.196^*$</td>
<td>$.122</td>
<td>$.031</td>
<td>$.032</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>$.593**</td>
<td>$.534**</td>
<td>$-.265**$</td>
<td>$.086</td>
</tr>
</tbody>
</table>

$^*p < .05. \quad ^{**}p < .01.$

---
DISCUSSION

Set within the general proposition that a softening of hospital design might help to buffer the stress known to accompany attendance at hospitals and other health care facilities (Ingham & Spencer, 1997; Ulrich, 1991), three specific hypotheses were tested in this article. These were that the design of the so-called nouveau waiting area would be associated with (a) more positive affective appraisals of the waiting area, (b) more positive moods, and (c) more positive evaluations of specific and identifiable design features. The data presented in this article offer strong and consistent support for all three hypotheses.

With respect to affective appraisal, the difference between the ratings given for each waiting area was statistically significant on all but 1 of the 14 dimensions used with the nouveau waiting area being perceived more positively each time. In terms of the results of the principal components analysis, the nouveau waiting area was appraised as being generally more agreeable than the traditional waiting area and as having a more positive arousing potential. That this more positive image of the nouveau waiting area is...
associated with a more positive emotional response is evidenced by the decrease in self-reported stress over the waiting time in the nouveau waiting area compared to the increase in self-reported stress in the traditional waiting area. Importantly, however, the therapeutic impact of the nouveau environment is demonstrated not only by its relationship with decreasing self-reported stress but also by its association with increasing pulse rate. This increase in pulse rate observed in the nouveau waiting area is entirely in accord with the appraisal of that environment as having a greater arousing potential.

It is important to remember in this context that the restorative aspect of environmental design is not limited to recovery from states characterized by excessive psychological and physiological arousal (Ulrich et al., 1991). Rather, restoration also applies to recuperation from understimulation or excessively low arousal (Ulrich, 1981, 1983; Ulrich et al., 1991). As Olsen (1978) and Leventhal et al. (1982) pointed out, in this respect, the commonly communicated message of many traditional hospital designs is one of sterility and passivity. In marked contrast to this, the image communicated by the nouveau waiting area was evidently one of lively stimulation. Attention to interesting and enjoyable mental stimuli has been linked to physiological mobilization (Lundberg, Melin, Holmberg, & Evans, 1990) with mental problem solving and information manipulation, in particular, having been shown to produce an increase in heart rate (Lacey & Lacey, 1970).

Notwithstanding the anxiety and mental strain known to accompany any medical consultation (Ingham & Spencer, 1997), the characteristic response to the nouveau environment can therefore be summarized as one of pleasant surprise, that is, a positively toned emotional reaction coupled with a very mild startle response. The likelihood is, then, that the nouveau environment was more engaging than the traditional waiting area thereby providing more of a distraction to those waiting there. The beneficial effect of the nouveau environment is accordingly evident in the convergence of a positively toned emotional response and a rising level of physiological activity.

This line of reasoning also accounts for the significant difference in pulse rates between the two samples at the time of their first reading. Given that, at this point in time, the subjects had already been exposed to their respective waiting areas for approximately 3 minutes, the novelty aspect of the nouveau waiting area may already have been operative. Furthermore, this interpretation of the pulse rate data is in accord with empirical research into the specificity of physiological responses to stress (e.g., Mason, 1971, 1974). This demonstrates that the notion of an increased level of arousal being a generalized and inevitable concomitant of stress (Selye, 1976) is an oversimplification (Bartlett, 1998) that does not fit much of the available data (Cox, 1978;
Cox & Ferguson, 1991). Rather, the exact nature of any physiological response to stress is deemed to be the product of both individual differences and the precise characteristics and meaning of any particular stressor (Bartlett, 1998). Thus, stress might be associated with either increased or decreased levels of arousal depending on the precise circumstances.

However, the possibility cannot be ruled out that subjects in the nouveau clinic actually had higher baseline pulse rates to begin with. This could only be determined by measuring baseline pulse rate prior to entry into the clinic. Unfortunately, this was not pragmatically possible in the current study.

This Waiting Area × Time interaction with respect to both self-reported stress and pulse rate supports Zimring et al.'s (1987) claim that the stress of a hospital visit can be at least partially mitigated by a comfortably designed environment. It is also in line with Olsen's (1978) results of a comparison between a traditional surgical floor and a progressive care floor. Occupants of the progressive care floor rated the environment to be more pleasant and cheerful and also perceived a more positive relationship between their setting and their mood.

More broadly, the Waiting Area × Time interaction demonstrates the importance in environmental research of considering the possible interactions between physical and psychosocial elements—particularly, the possibility that one might buffer the impact or effect of the other (Evans et al., 1994; Evans & Lepore, 1992; Leather et al., 1998). Here, there is evidence that the physical design of the waiting area did indeed buffer the negative impact of the stress known to build in the waiting room (Ingham & Spencer, 1997).

Consistent with its overwhelmingly more positive environmental appraisal, the nouveau waiting area received a significantly better evaluation on 8 out of the 10 design elements rated. Similarly, respondents reported significantly greater overall satisfaction with the nouveau waiting area. The consistency in the data between appraisal, emotion, and evaluation provides a degree of validation for a cognitively mediated model of emotion (Lazarus, 1991; Ortony et al., 1988). In short, the emotions that are found to characterize the waiting experience in the two environments are a valenced reaction to the way in which those environments are construed. Put simply, differences in these affective appraisals may generate different emotions and result in different occupancy evaluations.

In conclusion, the data reported here provide comparative and correlational support for the view that the physical design of the hospital environment is an important and integral part of the therapeutic milieu (Reizenstein, 1982). The negative imagery of the hospital that derives from a design ethic emphasizing the functional delivery of health care “often produces facilities
that are functionally effective but psychologically ‘hard’ ” (Ulrich, 1991, p. 97).

This conclusion is inevitably strengthened by (a) the demonstrated equivalence of the two patient samples in terms of their demographic characteristics, experienced pain, anxiety and disability, and medical diagnoses and judgments; and (b) the inclusion of both psychological and physiological measures. There are limitations in the data, for example, the restriction of range in the number of visits that could have been made to the nouveau waiting area prevented a firmer test of any adaptation or halo effects. Nevertheless, in systematically and rigorously evaluating the impact of the traditional and nouveau waiting areas, the study offers preliminary empirical evidence in place of the usual anecdote and often-unsubstantiated opinion (Reizenstein, 1982).

The implications of the study are clear. First, it is possible to create a more positive hospital image. Second, the creation of this image does not necessarily entail any structural changes being made to existing buildings. Rather, it can be achieved relatively quickly and simply by making changes to such interior design features as lighting, color scheme, and furnishings. However, it must be acknowledged that the focus of this article on the overall image of the waiting area does not allow precise identification of the relative importance of individual design elements. The manipulation of individual elements needed to achieve this was not possible in the current study. Third, the waiting area is a particularly important site to consider for refurbishment, not least, because it is here where anxiety and worry about the consultation and possible treatment regimes are likely to build. It is here, too, where first impressions are formed (Ingham & Spencer, 1997). Finally, the results of any softening of the traditional hospital image are not confined to subjective outcomes such as mood and satisfaction but are also likely to embrace physiological indexes. Other nonclinical factors, such as waiting times and staff attitudes and behavior, will undoubtedly play their part in determining the overall impact of the hospital on the patient, but the role of the physical environment should not be underestimated.

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