

An Observation on Environmental Modification Behavior: Implications for University Apartments' Design

환경조절 행태에 대한 관찰연구: 대학 아파트 설계를 위한 시사점

김덕수 Kim, DukSu*

Abstract

본 연구는 미국 소재 T 대학교의 학생아파트를 대상으로 하여 창밖으로 보이는 외부 환경의 차이와 거주자의 환경조절 행태 사이의 관계를 분석하는 관찰연구로 진행되었다. 거주자와 거주환경 간에 발생하는 부조화는 환경 스트레스의 한 원인이 된다. 이러한 환경 스트레스에 대한 대응 전략으로 거주자는 그들의 환경을 조정하곤 한다. 본 연구는 실내에서 식물을 키우거나 거주자의 취향에 따라 커튼을 교체하는 등의 환경조절 행태를 분석의 대상으로 한다. 창문과 현관 영역에서 발생하는 환경조절 행태의 정도를 비교 관찰하기 위해 군집형과 일자형으로 되어 있는 두 개의 배치 유형을 연구의 대상으로 선정하였다. 군집형 유형(cluster type: type A)은 상대적으로 도로에 가깝고 거실 창문의 조망이 다른 건물에 가로막혀 있으며, 일자형 유형(parallel type: type B)은 가로막고 있는 건물이 없어 자연경관을 거실 창문을 통해 조망할 수 있는 배치상의 두드러진 차이점이 있다. 관찰연구를 통해 군집형 유형에서 일자형 유형보다 더 높은 빈도로 식물 화분과 개별 커튼 등을 이용한 개인적 환경조절이 이루어진 흔적이 발견되었다. 이러한 결과는 창문을 통해 보이는 외부 경관의 특성이 거주자의 환경조절 행태에 미치는 영향의 정도를 암시하고 있다. 결론적으로 관찰연구에서 나타난 거주자의 환경조절 행태를 반영하여 디자인 고려사항을 제안하였다.

Keywords environmental modification behavior; window view; design implications

키워드 환경조절행태; 창문 조망; 설계 시사점

1. Introduction

1.1 Problem Statement

University students seemingly suffer due to increased risk of mental fatigue. The university environment demands increased use of directed attention. In case of living in university-owned apartments, students should handle living in a new environment. They have considerable difficulties in meeting new rules and behavioral constraints, as well as fulfilling academic requirements (Aycock, 1989: 38-44). In addition, they encounter a continuous series of changes and conform to the changes as a base of academic year to successfully complete the college experience (Grayson, 1985: 198-204). Thus, the mental fatigue, caused by overactivated directed

attention, is obvious in the university experience. It is likely to weaken a student's ability to successfully complete academic programs.

Over 90 percent of the residents of T University owned apartments in the United States are international students. Given the fact that stress from cultural differences and environmental stressors is combined with that of student life, it can be assumed that residents' stress and mental fatigue levels are likely to be high.

Environment stress can be caused due to factors such as traffic noise, rowing and population in a urban setting (Brannon and Feist, 1977: 55-60). Given environmental stress and the inhibition of physical change (e.g., gardening) to residents environments due to university owned apartment's policies, window or door-front area decoration by plants and personalized curtains might be passive, but the best

* Hanbat National University, Department of Architecture, Assistant Professor, Ph.D

feasible environment modification strategy. Thus, the degree of window or door area decoration by plants or personalized curtains might imply the degree of perception about environment quality. Residents might reduce mental fatigue as well as stress by looking natural elements nearby (e.g., plants) or by decorating windows with personalized curtains. They also acquire a sense of control by nurturing plants and decorating windows.

Mental fatigue might result from long hours of study, or days filled with worry and concern. Restorative effects of nature can help one recover from stress and mental fatigue (Kaplan and Kaplan, 1995: 177-178). These effects might result from: (1) viewing natural scene from a window (Ulrich, 1995: 94-98); and (2) involving oneself in the natural setting (R. Kaplan, 1973: 145-152). According to evolutionary approaches to restorative effects of nature, people prefer following landscapes: (1) savanna-like environment, including large trees, a focal point, even ground cover and distant views to horizon (Ulrich, 1986: 29-44); and (2) mystical nature scenes, encouraging exploration and information gathering (Kaplan and Kaplan, 1981: 79-94).

In a residential setting, what is seen from the window of one's home is strongly related to the perception of attractiveness of one's neighborhood (Cooper-Marcus and Sarkissian, 1986: 47-48). It is thus evident that a window view and outdoor space quality are related to environmental stress. In housing adjustments theory, a mismatch between a family and its environment causes environmental stress (Wolpert, 1966: 98). Environment modification is one of the housing adjustment behaviors that reduce environmental stress.

1.2 Research Objectives

This study attempts to answer a question: Are the relationships between residents' stress, mental fatigue, and window view differences caused by two site plans such as cluster and parallel types? By answering this question, this observational study aims at identifying the effects of window view on environmental modification behavior. The purpose of this research is to investigate the possible effects of nature in a

residential setting of the university owned apartments for students. Specifically, the purpose is to explore the relationships between environmental settings and environment modification behavior as a coping strategy.

2. Literature Review

2.1 Two Theories, Explaining Positive Benefits of Nature

There are two explanations regarding influence of visual environments on stress: (1) affection theory; and (2) attention restoration theory. First, affection theory explains the positive outcomes of natural surroundings, while claiming that positive benefits of nature have a genetic basis (Appleton, 1996: 12; Kaplan & Kaplan, 1995; Ulrich et al., 1991). Ulrich proposes an affection model, explaining that the initial affective response to an environment benefits cognitive process in terms of: (1) sustained attention; (2) higher levels of positive feelings; (3) reduced negative or stress-related feelings; and (4) suppressed negative thoughts (Ulrich et al., 1991: 201-230). Experiments, showing surrogate nature (e.g., slides, videos, and posters with two scenes such as natural and urban settings), demonstrate the power of natural elements, reducing stress and promoting restoration (Ulrich, 1981: 523-556; Ulrich et al., 1991: 201-230; 2003: 38-47; Kweon et al., 2008: 355-381). Perceptual evaluations, causing stress recovery, do not require focused cognitive activity. Rather, automatically and quickly, they occur (Ulrich, 1983: 85-125; Ulrich et al., 1991: 201-230). Environments with nature are preferred to environments without nature (Browne, 1992: 75-79; Getz, Karow, & Kielbaso, 1982: 258-263; Herzog, Kaplan, & Kaplan, 1976: 43-59; Sullivan, 1994: 85-101). The findings imply that exposure to natural elements has effects to reduce stress. Affection theory emphasizes that people respond to an environment with an affective mode rather than cognitive one. Structural characteristics of visual information are related to automatic affective response (Ulrich, 1981: 523-556; Ulrich et al., 1991: 201-230). In this theory, patterns seen in a built environment are less affective than those seen in nature settings (Hartig et al., 1991: 3-26).

A second theory, attention restoration theory, emphasizes the benefits by restorative effects of nature. The theory focuses on directed attention, its fatigue, and ways to achieve restoration (R. Kaplan, 2001: 507-542). The theory explains that natural environment provides people with restoration from over-activated directed attention (Hartig et al., 1991: 3-26; R. Kaplan, 1995: 193-201, 2001: 507-542). On the other hand, urban environments containing various stimuli (e.g., neon signs and traffic noise) demands direct attention, causing mental fatigue. (Berman et al., 2008: 1207-1212). Mental fatigue means the effects of cognitive activity, caused by everyday modern life (Boksem, Meijman, & Lorist, 2005: 107). Mental fatigue causes negative consequences, including (1) difficulty in concentrating, clear thinking, and problem solving; (2) irritability and a disinclination to be helpful or even civil; (3) unsocial behavior; and (4) vulnerability to accident (Herzog, 1997: 165-170). Exposure to natural elements reduces levels of mental fatigue, and consequently causes restoration. A view of nature plays an important role to recover from mental fatigue. Recent research found fewer fixations in nature scene, while tracking eye movements when looking at two different settings such as urban and nature (Berto et al., 2008: 185-191). The results imply that nature promotes involuntary attention, because it can be viewed with less effort (S. Kaplan, 1991: 498). Restoration research points to the potential of outdoor settings including natural environments such as trees, flowers, and lawn. It reduces stress and mental fatigue. After stressful or demanding experiences, visual exposure to nature reduces stress by eliciting positive emotions, sustaining indirect attention (i.e., involuntary attention or fascination as a Kaplan's term), restricting negative thoughts, and reducing arousal or stress mobilization in bodily systems. Attention restoration theory provides an insight that nature functions as a restorative environment. It replenishes mental and emotional processes, which are exhausted in everyday life due mainly to direct attention (Hartig et al., 1995: 378-393; R. Kaplan, 1995: 193-201; Laumann et al., 2001: 31-44). Restoration results from four environmental components: (1) a scene of being away, meaning escape from stressors; (2) extent, meaning the sense of being in a whole other world;

(3) fascination, causing involuntary attention; and (4) compatibility between the space and person (Kaplan and Kaplan, 1995: 182-186).

2.2 Theoretical Implications of Natural Scenery on Design

People prefer to environments surrounded by natural objects such as trees, water, or mountains. When natural environments are not available, people show tendency, incorporating natural elements (e.g., plants, flower vases, and posters having natural scenes) into indoor environments. Research has shown that people may acquire following benefits from such efforts to incorporate nature, including (1) well-being (Tarrant, 1996: 1-17); (2) energy (Ryan et al., 2010: 159-168; Stilgoe, 2001: 243-244); (3) physical health (Kaplan, 1995: 169-182; Leather et al., 1998: 739-763; Ulrich, 1984: 420-421); (4) relaxation (Plante, et al., 2006: 108-117); and (5) stress reduction (Ulrich et al., 1991: 201-230)

Existing research discusses that people prefer scenes with nature, showing increased preference with the amount of nature in case of urban scenes (Kaplan and Kaplan, 1995: 67-69; Kaplan, Kaplan, and Wendt, 1972: 354-356; Nasar, 1998). Nearby nature and gardening activities produce positive psychological effects to human beings in terms of emotional and social benefits (Kuo and Sullivan, 1998: 823-851). Natural scenery is preferred to urban scenery. In case of urban settings, urban scenery with vegetation is preferred to scenery without vegetation. Exposure to natural elements contributes to stress reduction. Research shows that exposure to nature (e.g., trees and flowers) can effectively reduce stress (Ulrich, 1979: 17-23, 1981: 523-556; Ulrich, Simons, and Miles, 2003: 45). A view of natural elements produces positive psychological effects and increases healing (Pitt and Zube, 1987: 1010-1036; Ulrich, et al., 1991: 201-230). People in a room with views of natural elements such as trees experience less stress than people in a viewless room (Hartig et al., 2003: 109-123).

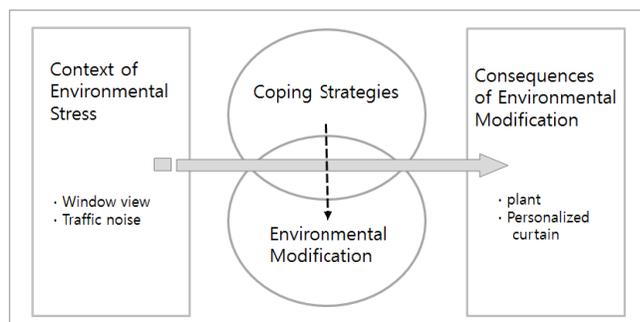
It is proposed that effective urban planning should incorporate natural elements (e.g., Galindo and Rodriguez, 2000: 13-27; Parsons et al., 1998: 113-140). Lynch mentioned that "The hunger for trees is

outspoken and seemingly universal.... Landscaping should be as essential a part of the basic infrastructure of a settlement as electricity, water, sewer, and paving” (Lynch, 1977: 56-57). Designs, incorporating natural elements, may influence life aspirations and the sense of community, generating stronger community identity and well-being of residents (Weinstein, et al., 2009: 1315-1329).

The nature content in the view from home contributes to satisfaction and well-being of residents. Tennesen and Climprich (1995: 77-85) explored the content of the window view in the residential context of university housing. They found that students who have natural views show greater attentional capacity, because they had means of restoration unlike those without a natural view. Considering the fact that natural views from windows are positively related to residents’ capacity to direct attention, the content of the window view should be considered in the housing design, including university owned apartments (Tennesen and Cimprich, 1995: 84). Previous research (R. Kaplan, 1983: 127-162; Talbot and Kaplan, 1991: 119-130) showed that satisfaction with the neighborhood is related to natural than built settings. A window with nature can provide many moments of fascination, reducing the effects of mental fatigue. Residents’ satisfaction increases with nature, the availability of gardens, and landscaping. Cooper-Marcus and Sarkissian (1986: 47-48) pointed out that the judgments of the attractiveness of one’s neighborhood are related to a window view from one’s home.

2.3 Research Model

The following Figure 1 illustrates relationships between the context of environmental stress and the consequences of environmental modification.



[Figure 1] Research model

3. Method

3.1 Observation Setting

The T university owned apartments are categorized as two types: (1) cluster; and (2) parallel types (Figure 2).



[Figure 2] University Owned Apartments

These cluster and parallel type units are exposed to traffic noise from College Avenue and University Drive, respectively. Peak hour traffic volume at the evening rush hour was counted as 194 vehicles per 10 minutes and 720 vehicles per 10 minutes, respectively. The distance from units to driveways was measured as 14.7 meter and 39 meter, respectively.

The cluster type units have a variety of orientation. To acquire homogeneous observation samples among cluster type units, only 24 units paralleled with College Avenue (hereafter referred as Type A) (Figure 3) and all 42 parallel type units along University Drive (hereafter referred as Type B) (Figure 4) were selected for two reasons. First, the selected units are exposed to a somehow similar environmental stressor such as traffic noise. Second, these selected units are one bedroom. One bedroom units consist of one living room and one bedroom.



[Figure 3] Views to and from Type A



View to Type B



Front view from Type B

[Figure 4] Views to and from Type B

Observation was limited to ground floor units, because the ground and second floor units have different view as well as privacy concerns. By these differences, residents might adapt different stress and mental fatigue reduction strategies. In summary, these settings were observed: (1) one bedroom units; (2) ground floor units; and (3) units paralleled to a driveway.

3.2 Research Method

The observational study utilizes two methods: (1) participatory observation; and (2) trace measures. The observer had lived in a Type A units for 4 months. Thus, the problem of the environmental setting in question is well recognized. The recognition will serve to reduce the observer's bias by short-time and causal observations. It was quite annoying experience to live in the Type A unit, closed to College Avenue, due to traffic noise and a living room window view blocked by an opposed apartment.

Personalized traces can be founded in such settings as windows, window ledges and doorways (Zeisel, 2006: 159-190). In this study, the personalized traces of window and entrance area of each unit were observed to identify resident's environment modification behavior because residents might have relaxing elements in their units such as window and door-front plants, and personalized curtains (mostly semi-transparent).

With these concerns, the observation study focused on how surrounding landscapes were related to environment modification in a residential setting. The major assumption was that the level of residents' environment modification was negatively related to the visual quality of outdoor space and the change of involvement with nature (e.g., visual and physical proximity to natural elements).

3.3 Procedure

The five steps of this observational study consists of: (1) construction of inclusion and exclusion criteria, such as ground level units, one-bed room units, and units parallel to a driveway; (2) systematic observation by observation categories including: plants on nearby window or door area, and personalized curtains; (3) traces measures by nominal scales; (4) analysis; and (5) design implications.

4. Results and Discussion

If a window view lacks natural elements or is blocked by opposing buildings, it would hinder relaxation by the positive distraction, which can significantly reduce stress and mental fatigue. Rather these situations might increase stress. A certain unit's existing surroundings can be a clue to understanding what are the sources of stress and mental fatigue (Figures 5 and 6). They also can be behavioral outcomes (Figures 7 and 8). Type A and B units show the different degree of environment modification activities to acquire the sense of control to their environments (Ulrich, 1995: 91-93), including window and window-front plants, personalized curtains, and gardening activities.



[Figure 5] Opposed view of Type A



[Figure 6] Opposed view of Type B



[Figure 7] Door-front plants of Type A



[Figure 8] Door-front plants of Type B

4.1 Plants

Residents who live in the Type A unites are

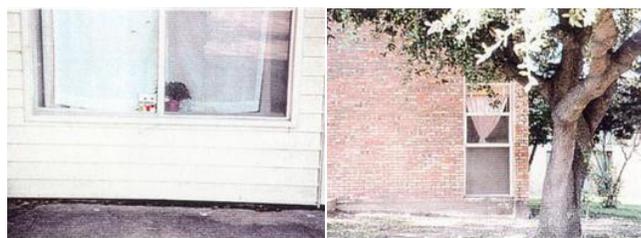
significantly more involved in environment modification activities by plants than the ones in the Type B units. The ratio is 54% and 10% of observation samples, respectively. The Type B units are founded to have better landscape than the Type A units. At the type B units, residents have a wide vision towards savana-like landscape. They can see calm backyard landscape as well as distance view to campus as a front yard view. By contrast, the Type A units' front yard view is blocked by surrounding apartments(The minimum distance from Type A units to their opposed buildings is 5.4 meter.), while the backyard view is open to landscape across College Avenue. However, the short distance from Type A units to College Avenue (i.e., 14.7 meter) generates more negative effectives by traffic noise rather than positive effects by visual access to natural elements. Even worse, the outdoor space maintenance is worse than Type B. The poor maintenance in Type A is confirmed by relatively more trace measures such as broken pavement, leaking water on the ground, and lawn erosion. Consequently, residents in Type A tend to be more involved in environmental modification by the means of installing plants at its surrounding units (Table 1).

[Table 1] Presence of plants as an environment modification behavior

Type	Units(#)	Plants (#)	Percentage (%)
A	24	13	54.17%
B	42	4	9.52%

4.2 Personalized Curtains

Residents in the Type A units seemingly prefer to changing originally installed curtains into their preferred curtain style and fabric type (e.g., mostly from originally opaque fabric to semi-transparent fabric) than ones in the Type B units (Figures 9 and 10).



[Figure 9] Personalized curtain of Type A

[Figure 10] Personalized curtain of Type B

The change ratio is 21% and 12% of observation samples, respectively. Seemingly, the degree of changing curtains is related to the degree of visual access to open space, while retaining privacy (Table 2).

[Table 2] Presence of personalized curtain as an environment modification behavior

Type	Units(#)	Personalization (#)	Percentage (%)
A	24	5	20.83%
B	42	5	11.90%

In conclusion, the Type B landscape provides more restorative effects than that of the Type A. The Type B units preserve better visual quality than the Type A units. Even though both units are exposed to traffic noise as an environmental stressor, a restorative window view might make residents less involved in environment modification as a way to reduce stress and mental fatigue. Given the fact that restorative effects by nature positively reduce stress, the existence of plants can be explained as restorative resources for reducing stress and mental fatigue (Table 3).

[Table 3] Comparison of environment modification found in Types A and B

	Type A	Type B	Sum of # (%)
Units(#)	24 (36.36%)	42 (63.64%)	66 (100%)
Plants	13 (76.47%)	4 (23.53%)	17 (100%)
Personalization	5 (50.00%)	5 (50.00%)	0 (100%)
Distance to opposite bldgs	5.4 meter	open	-
Distance to a drive way	14.7 meter	39 meter	-
Traffic volume	194vehicles/10min	720vehicles/10min	-

5. Conclusions

Without knowledge about how people and environment interact, design to improve the built environment will be failed due to the lack of reliable outcomes (Rapoport, 2008: 227). Since design activities are involved in a variety of concerns, including psychological, aesthetic and economic, it will be impossible to generate optimal solutions in a

practical sense. Thus, the following recommendations were generated to improve in existing the university owned apartments environment, with concerns of restorative effects by natural elements on residents. When considering stress and mental fatigue reduction effects by nature, it is evident that design consideration to buffer traffic noise and to maximize visual access to a preferred natural scene will contribute to the well-being of university owned apartments residents. Overall, the site plan has a problem in terms of axis and orientation. The apartments are parallel with a high traffic driveway (University Drive) or too close to a moderate traffic driveway (College Avenue). By the site plan, traffic noise is penetrated to each unit, while generating environmental stress. More critically, the Type A units have a more significant problem. At most units, the window view in the living room is blocked by the opposed apartments. Thus, it is oriented to narrow corridor-like pedestrian connected with paved parking space.

For more improved residential environments, the following suggestions were generated.

(1) Do not make window view blocked by other buildings, or provide appropriate distance between buildings.

(2) Make a bank of trees or dense shrubbery to the College Avenue side for Type A units residents. this will buffer the traffic noise and protect privacy from the driveway.

(3) Provide a front yard for residents with a chance to be involved in gardening activities. This front yard might be located next to a window area. By this layout, the window view will provide visual access to natural elements as well as the sense of control.

(4) If the university builds additional apartments or rebuild Type A apartments, perpendicular site plan to a driveway is preferred in order to reduce environmental stress by traffic noise.

Methodological limitations exist. Even though the two observed residential settings show very distinctive differences regarding environmental modification, the environmental modification behavior may be affected by other variables such as personality. Further empirical studies, including environmental and non-environmental stressors, could enrich our understanding related to environmental modification.

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