

AN ABSTRACT OF THE THESIS OF

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Title: Emotional Responses to a Sustainable Interior Environment and a Non-Sustainable Interior Environment

Abstract approved:

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This study focused on users' emotional responses to a sustainable and a non-sustainable interior environment. Emotional reactions toward interior environments were tested by having subjects complete a survey. The survey tested users' emotional reactions with a mixed methods approach by including both qualitative and quantitative questions. The scope of this thesis included surveys completed by subjects in the sustainable Kelley Engineering Center conference room number 1114 and in the non-sustainable Bates Hall conference room number 129, both located on the Oregon State University campus in Corvallis, Oregon.

Survey questions utilized material from Mehrabian and Russell's (1974) "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale; Mehrabian and Russell's (1974) "Verbal Measures of Approach-Avoidance" scale; and Anderson's (2006) survey involving lighting, thermal comfort, and noise level satisfaction. There were also open-

ended questions and a demographic section. Mehrabian and Russell's "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale included only questions based on pleasure and arousal, which were interpreted with Russell's (1980) circumplex model. In addition, pleasure, arousal, and dominance score results were tested with a two-sided paired t-test. The thermal comfort, lighting, and noise variables were tested using the Wilcoxon signed-rank test.

The findings of this research were mixed. The pleasure and arousal results were significant, indicating that participants rated the sustainable and non-sustainable interior environments differently. In addition to the results of the two-sided paired t-test, the differences in pleasure and arousal scoring for the two interior environments were also apparent in the circumplexes. The circumplex for the Kelley Engineering Center conference room showed that many participants rated the interior positively on the pleasure axis and on the arousal axis, indicating that users felt excited in the space. Regarding the Bates Hall conference room, scores on the circumplex were positive on the pleasure axis, but less so than in the other interior; and they were negative on the arousal axis. These results indicated that participants felt content in the Bates Hall conference room. The results for dominance were not significant. Thermal comfort and noise were also not found to be significant. The satisfaction with the lighting in the interior environments was significant, indicating that participants rated the lighting of the two conference rooms differently. Subjects rated the Kelley Engineering Center conference room lighting as more satisfying than the lighting in the Bates Hall conference room.

Lastly, qualitative responses were different for the two spaces. Some participants stated preference for the interior of the Kelley Engineering Center conference room over the Bates Hall conference room. No subjects stated preference for the Bates Hall conference room over the Kelley Engineering Center conference room.

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Emotional Responses to a Sustainable Interior Environment and a Non-Sustainable
Interior Environment

by
Reade B. Northup

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Reade B. Northup, Author

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Emotional Responses to a Sustainable Interior Environment and a Non-Sustainable Interior Environment

CHAPTER 1.

Introduction

Interior environments surround people every day. Therefore they continuously influence users' emotions. Sustainable environments are increasingly being designed and built for commercial and residential interiors. This study investigated the emotional response of users to a sustainable and a non-sustainable space.

Many publications have expressed the rationale for implementing sustainable practices to protect the environment. Some of the most influential books have been Carson's *Silent Spring* (1962), McDonough and Braungart's *Cradle to Cradle* (2002), and Gore's *Earth in the Balance* (2000); they have had a great impact on society's attitude toward implementing sustainable practices. They conveyed to the public the importance of environmental awareness and application of sustainable practices (Carson, 1962; Gore, 2000; McDonough & Braungart, 2002). Early in the 21st century, Ray Anderson, founder of the modular carpet manufacturing company Interface, Inc., challenged corporations to meet his company goal of full sustainability, meaning no reduction of resources from the Earth by the year 2020 (Anderson, 1998). These advocates stress above all the need for business and individuals to implement sustainable practices (Anderson, 1998; Carson, 1962; McDonough & Braungart, 2002). In great part because of these efforts and writings, the sustainability movement is so prevalent now that it is commonly used to sell ideas, products, and interior materials and finishes (Friedman, 1997; USGB website, 2007).

Recently, interior design projects often utilize at least some sustainable practices. For example, the housing project in Chicago by Harley Devereaux received an architectural award for excellence for its use of sustainable materials and practices (AIA website, 2007). In addition, a Windrush School was built sustainably in California (AIA website, 2007). Not only did Windrush communicate ideas about sustainability to the community, but the school itself could relay information to the students about sustainable practices.

Interior environments clearly communicate messages to the users of the space (Russell, 1980; Russell, 2003). One way people interpret messages that are communicated to them is by means of emotional responses. Emotional responses are triggered by stimuli, which can be objects, places, and/or events (Khalid, 2006). Previous research has explored the meanings of spaces to people through the use of emotional response scales (Mehrabian & Russell, 1974; Russell, 1980). Emotions or emotional responses can be defined as an indication about the stimuli that users encounter in an interior environment (Mehrabian & Russell 1974; Morris, 1989; Russell 1980; Russell & Lanius, 1984). Therefore, the emotional responses of users in a space may give more information about that space (Damasio, 2000).

This study looked at two conference rooms that share similar contemporary styles. The two conference rooms differ because the Kelley Engineering Center conference room is in a LEED gold-certified building and the Bates Hall conference room is not. In order to test how participants reported that they felt in these two interiors, a mixed method survey gathering the impressions of the users in the spaces was employed. The manner in which participants responded emotionally on the survey to the interiors provided some insight into the meanings and interpretations participants associated with the two spaces. Gathering information on the emotional reactions of users in two conference rooms, one sustainable and the other non-sustainable, provided some insight regarding the meanings of these types of places to the participants.

Model

The Stimulus-Organism-Response model is a theoretical model for studying the impact of the physical environment on human behavior. The main application of the model is the effect of the physical environment on a person's emotional response (Mehrabian & Russell, 1974). Details of the scales developed by Mehrabian and Russell (1974) are discussed and previous uses of these methods are described. In addition, Russell's (1980) circumplex model will be discussed as it was used for part of the analysis of one of the scales is described. The questionnaire developed by Anderson (2006) is introduced as well.

A Combination of Models

In this study, two emotional response scales were combined in order to test the feelings of users in a sustainable interior and a non-sustainable interior. The two primary methods combined to test emotional responses were Mehrabian and Russell's (1974) "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale and Mehrabian and Russell's (1974) "Verbal Measures of Approach-Avoidance" scale. In previous studies, both of these scales have been used to test subjects' reactions to interior environments (Mehrabian & Russell, 1974; Russell & Pratt, 1980). In addition, one of the scales, the "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale, was adapted from Russell's (1980) circumplex, which tests emotional responses by contrasting arousal/sleepiness and pleasure/misery on a graph (Patrick & Lovoro, 1997; Russell, 1980). The "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale could be and was evaluated using Russell's (1980) scale by removing the dominance section. In Russell's circumplex, the degrees and points were associated with words describing feelings. Viewing the circumplex clockwise, pleasure is at zero degrees, excitement is at 45 degrees, arousal is at 90 degrees, distress is at 135 degrees, misery is at 180 degrees, depression is at 135 degrees, sleepiness is at 270 degrees, and contentment is at 315 degrees (Russell, 1980). Neutral responses fall in the center of the circumplex near the origin (Russell, 1980; Russell & Lanius, 1984). This placement of emotional responses along the axial structure of the circumplex has previously helped to show that feelings such as arousal and pleasure are not independent of each other (Russell, 1980). By using Russell's (1980) model, the

emotional responses of users to different environments could be collected and interpreted (Bell, Greene, Fisher, & Baum, 2001).

The second scale used in this study was the “Verbal Measures of Approach-Avoidance” scale. It was not evaluated using the Russell (1980) circumplex because it included dominance, and the Russell (1980) circumplex model did not. While creating both of the emotional responses scales used in this study, Mehrabian and Russell (1974) asserted that dominance could be measured using a semantic differential scale, but that it was a separate measure from pleasure and arousal (Mehrabian & Russell, 1974). In a previous study, Russell and Pratt (1980) took dominance out of their scale because they believed that dominance only accounted for a small portion of the emotional responses related to environments (Russell, 1980, Russell and Pratt, 1980). For this reason, dominance was used only in one part of the study so that it was accounted for, but not forced into the incompatible circumplex model as created by Russell in 1980. By including dominance in the second part of the survey, the dimension was considered in this study without ignoring it. Based on previous research, emotional responses that fall outside of these emotional scales were considered minor in proportion and were not considered (Russell & Pratt, 1980). For example, Russell and Pratt (1980) have argued that all other dimensions beyond pleasure and arousal were not based on emotional responses but were purely cognitive in nature. Consequently, to measure emotional responses, only the dimensions of arousal, pleasure, and dominance were used.

Previous Research Using Mehrabian and Russell

Russell's (1980) research on emotion and place has become a paradigm for studies about emotional responses. Russell's (1980) theory about emotions was used to evaluate spaces in his later work (Russell & Pratt, 1980; Russell & Lanius, 1980). The distribution of semantics relating to feelings, including the Russell (1980) circumplex, both on the axes and in between them, reflect the feelings of users (Russell, 1980). By using Russell's (1980) circumplex method, Russell and Pratt (1980) found that the emotional reactions of users, if present and not neutral, did not cluster in the center of the graph, but rather fell around the outer perimeter of the circumplex (Russell & Pratt, 1980; Russell & Lanius, 1984).

The term "pleasure" refers to feelings of joy, happiness, satisfaction, and contentment, versus "misery," which refers to feelings of melancholy, dissatisfaction, and unhappiness (Mehrabian, 1976). "Arousal" refers to activation, stimulation, excitement, and a level of frenzy versus its opposite sleepiness, meaning inactive or under-stimulated (Mehrabian, 1976). In other words, arousal refers to the general amount of stimulation felt by the user. The use of Russell's (1980) model of interpretation allowed actual emotional responses to be tested for and reflected on the circumplex itself (Yik & Russell, 2004). Furthermore, due to quadrant and axes meanings, in the Russell model (1980), words that are similar in intensity when explaining emotional responses fall near each other on the circumplex (Russell, 1980). Therefore, this means that people who felt similarly fall into similar places on the circumplex.

It should also be noted that Russell has completed additional research on user responses. This research focused on what is defined in this discussion as mood (Russell &

Barrett, 1999; Russell, 2003). For example, in 2003, Russell developed another method for testing responses in people. This newer method focused mostly on mood, or what he called “core affect” (Russell, 2003). The mood-oriented model had a circumplex, but it was not created with the intention of testing emotional responses (Russell, 2003). This “core affect” circumplex has dimensions of “pleasure/displeasure” and “activation/deactivation” (Russell, 2003). As Russell (2003) stated, the core affect circumplex does not include dimensions for emotion as his 1980 model did. In summary, “whereas core affect [mood] is not object directed, perception of affective quality is.

Phenomenologically, core affect [mood] is a feeling inside oneself, whereas an affective quality [emotional response] is a property of the thing perceived” (Russell, 2003, p. 175).

In previous studies, terms used to describe emotional responses have varied in interpretation, although many still use a circumplex structure including pleasure and arousal (Russell, 1980; Russell & Pratt, 1980). Recently there has been disagreement as to the most relevant rotation of the axes as talked about by Yik and Russell (2001). Previous research, however, has shown that the basic structure of the axes has been extremely reliable and relevant (Yik & Russell, 2001). Although, in Yik and Russell’s (2001) study, Yik and Russell stated that the possible faulty aspect of the circumplex (due to the degree of the relationships in emotional response) may be less apparent when testing something in addition to emotional response. The present study explored emotional reactions to two interior environments, one sustainable and one non-sustainable, so the possibility of “fault” in the model may be mitigated. Furthermore, Yik and Russell’s (2001) study ultimately found that no one rotation of the axes was better than the other (Yik & Russell, 2001).

A second possible objection to the use of Russell's (1980) model to interpret emotional responses was that when comparing across the circumplex, a high level of one dimension may be associated with lower levels of another. For instance, anger is very unpleasant yet very aroused (Parkinson, Totterdell, Briner, & Reynolds, 1996). However, these discussions have not shown that the axial structure of the circumplex was not invalid for testing of emotional responses of subjects. Instead, these types of emotional response relationships support the structure of the circumplex, showing that feelings can be in combination (or circle around) the two dimensions of pleasure and arousal. In summation "tradition and common sense have assumed bipolarity in affect. Pleasure and pain, happy and sad, tension and relaxation, depression and elation- such pairs seem to express opposites. Bipolarity appears strongly in the semantics of emotion" (Barrett & Russell, 1998, p. 967). For the purposes of the present study, using the Russell (1980) model to interpret emotions in regard to interior environments was valid because the axial structure allowed detailed interpretation of users' responses.

Satisfaction Theory

Previous research has explored satisfaction as a factor in the evaluation of a place. For example, Ghozlane, Felonneau, and Marchand (2008) linked satisfaction to residential spaces with the physical and social aspects perceived by users. In addition, previous research has shown that positive satisfaction can increase profits for a place of business (Pohtas, A. DeWet, & J. DeWet, 2001). In 2006, Anderson used a satisfaction survey to explore how participants felt inside an interior space. She included questions about

thermal comfort, noise, and lighting. Several questions developed by Anderson (2006) were about thermal comfort, lighting and noise were adapted for the present study.

Satisfaction theory provides a framework to study the extent to which a space satisfies users (Anderson, 2006). In this study, satisfaction theory provided a framework for exploring participants' responses to additional aspects of the two conference rooms besides the emotional responses.

Statement of the Problem

Although sustainability has been a popular topic in interior design practice, research in the field is relatively new. Previous research involving sustainability has focused mainly on product design (Chen & Burns, 2006). Furthermore, there is a lack of research on user responses to sustainable interior environments compared to non-sustainable environments. Due to this gap in knowledge about sustainably designed interior environments, little is understood about the impact of such spaces on human emotion. Previous research has employed emotional response scales to measure the psychological impact of interior spaces on people (Mehrabian & Russell, 1974; Russell, 1980). However, no research using these emotional scales has been found focusing on the emotional impact of sustainable interior environments versus non-sustainable environments.

Statement of Purpose and Objectives

The purpose of this study was to investigate the emotional responses of users to two different interior environments on the Oregon State University campus. The first space was a conference room in the Kelley Engineering Center, awarded Leadership in Energy and Environmental Design (LEED) “Gold” designation in 2006. The second interior examined in this study was a conference room in Bates Hall, completed in 1992 and not sustainably designed. Both buildings may be described as contemporary in design. This study explores emotional responses of users to a sustainable conference room and a non-sustainable conference room. Responses from the same participants to the two spaces

will be compared. Similarities and differences in responses to the two spaces will be examined.

Null hypotheses of the study:

1. H_0 : There will be no difference reported in the emotions of users between the sustainable and non-sustainable environments.
2. H_0 : The responses of users to the sustainable and non-sustainable interiors will be neutral on the pleasure and arousal scale, therefore falling in the center of the circumplex.
3. H_0 : Based on the dominance scale, there will be no difference in responses to the sustainable environment and the non-sustainable environment.
4. H_0 : There will be no difference in satisfaction with the thermal comfort, noise, or lighting between the sustainable interior environment and the non-sustainable interior environment.

Operational Definitions

Affect- A response from a user to external stimuli, such as an interior environment (Mehrabian & Russell, 1974).

Arousal- A measure of emotional response (Mehrabian & Russell, 1974)

Cognition- Cognition involves reasoning and analysis. Therefore cognition differs from an emotional response (Castillo, 1997).

Dominance- An individual's sense of control within a space (Mehrabian & Russell, 1974).

Emotion/Emotional Response- a person's feeling towards an external stimulus (Castillo, 1997).

Gold, LEED- LEED A rating achieved by certified LEED projects. LEED has multiple levels of ratings including Silver, Gold and Platinum (USGBC website, 2007).

Leadership in Energy and Environmental Design (LEED)- A rating system developed by the United States Green Building Council for the purpose of rating the sustainability of buildings (USGBC website, 2007).

Mood- The feeling state that facilitates emotional response (Rottenberg, 2005).

Non-Sustainable Interior- An interior that has not been built sustainably to a standard such as LEED.

Pleasure- A measure of emotional response (Mehrabian & Russell, 1974).

Satisfaction- A measure used to test how fulfilled people feel in spaces. The term is a way to measure the level of acceptance people have with the aspects of their surroundings.

Sustainability- Processes or materials that harm the environment as little as possible. For example, sustainable practices are choosing specific materials, and construction techniques which are friendly towards the environment (McDonough & Braungart, 2002).

Sustainable Interior- An interior is one that has been built using environmentally friendly materials and processes. The United States Green Building Council has set standards for sustainable building by creating LEED (USGBC website, 2007).

CHAPTER 2.

Review of Literature

This chapter reviews the literature about emotional responses to the near environment. The terms “cognition,” “mood,” “feelings,” and “affect” are discussed. In addition, emotions and changing emotional responses are investigated. Users and sustainable design are discussed and clarified. The aesthetics of sustainable design are clarified and discussed, particularly by comparing sustainably designed interior environments to non-sustainably designed interior environments.

Differentiating Terms

Cognition, Mood, Feelings and Affect

The broad terms that are associated with emotional response are “mood,” “emotion,” “affect,” “feeling,” and “cognition.” As implied, defining the terms “mood,” “emotion,” “affect,” “feeling,” and “cognition” can be difficult because the words have been used and described in reference to the same, similar, or different human responses. There are multiple meanings or suggested meanings to even the word “emotion” (Russell & Barrett, 1999). By delineating the differences among the meanings of these words, it should help to clarify the terms as they are used in this discussion.

Cognition

In previous research, cognition has been differentiated from emotional response (Forgas, 2001; Norman, 2002). “Cognition” has been a term used by researchers to describe a response that was created by a process of reasoning (Khalid, 2006). Cognitive control and emotional responses have been described as different players who are on the same team (Gray, 2004). For the above reasons, this study will focus on emotional response rather than cognition.

Mood

Previous research has differentiated the mood of users from emotional response. As with cognition, in this discussion, the definitions of “mood” and “emotion” have been separated. There are researchers who have defined “mood” as the aspect in humans that guides the emotions (Morris, 1989). By this definition, mood is the feeling state that facilitates the emotional response or reaction (Rottenberg, 2005). This means that emotion gets induced by stimuli contrary to mood, which is not object-based (Martin & Clore, 2001). Therefore, mood has been defined as a more global and abstract concept influencing behavior as compared to emotional response.

Feelings and Affect

Some researchers have used the term “affect” interchangeably with the term “mood,” but in this paper it was used to describe the same human response as emotion. In addition, the term “feeling” refers to the same thing as emotional response. The term “affect” (or “feeling”) describes the reaction of a user that comes directly from stimuli

such as an interior environment (Kandel, Schwartz, & Jessell, 2000). In summation, the terms “emotional response,” “emotion,” “feeling,” or “affect” are human responses that have been spurred by stimuli.

Emotion

The last term to clarify is “emotion” (or “emotional response”), which was most commonly used during this discussion. Previous research has described emotion as a subcategory of mood, wherein a state of feeling has intensified, or spiked (Parkinson et al., 1996). In addition, emotions have been called responses that are event, action and object focused (Martin & Clore, 2001). In summation, stimuli such as different places, events, and situations can cause different levels of emotional response in a user, even when that person seems to be in the same mood (Castillo, 1997).

Changing Emotional Responses

An emotional response can change the manner in which a person sees an environment (Morris, 1989). The built environment can not only create an emotional response in a user, but that feeling can then alter that person’s idea of the space. Previous research has shown that people who have a positive emotional response in a space may see that environment in a positive way (Isen & Reeve, 2005). Importantly, it should be noted that previous research has also found that people who are already experiencing positive emotions before interacting with the tested stimuli are not bound to those feelings but can change responses quickly (Isen & Reeve, 2005). This existing research helped mediate concerns for this study about bias towards an existing feeling.

Users

A user of a space is a person who spends time in a place and may therefore be influenced by it because of that time spent in the said environment. Previous research has shown that the design of an interior indicates meaning about the space to users. Knowledge about an interior can be gained from testing the users of a space (Hill, 1999). Hill (1999) argued this point about the value of users to show that it is the users who interact with architecture and who therefore must be understood. Working from Hill's idea, the design can provide information about an interior, but it cannot interpret the entire impact of a space without user feedback. In this study, to understand two interior spaces, users' emotional reactions to the interior environments were tested.

Meanings of Spaces to Users

Immanuel Kant, the 18th century philosopher, had a theory about the relationship of external stimuli to the mind. In his view, the mind is "used as a receptacle for external stimuli," which makes sense or arranges those stimuli into meaning (Downing, 2000, p. 59). The users of a space can define the stimuli from an interior, as they see, feel, interpret, and create meanings (Vilnai-Yavetz, Rafaeli, & Yaacov, 2005). Inherent symbolism can eventually become the meaning of a built interior to some or all of the greater population. This inherent meaning created by symbolism and caused by the response from stimuli is common with built structures such as churches or other sanctuaries (Vilnai et al., 2005). Another example of inherent meaning has been previously shown with the workplace environment to its employees (Fischer et al., 2004).

Different interiors can stimulate various emotional responses in users, giving them impressions as to the inherent meaning of the place (Cold, Dovey, Lawrence, Noschis, & Uzzell, 2001). Ultimately, contact with a space is what creates responses in users, which can then create meaning (S. Kaplan & R. Kaplan, 2003). In summation, the relationship between users' emotional responses and the actual structure forms meaning (Cold et al., 2001).

Sustainable Design

After publishing his book *Earth in Balance* in 2000, Al Gore gave many influential speeches about the importance of sustainable practices. In 2007, Gore received the Nobel Peace Prize for his efforts to spread knowledge about the impacts of human beings on the environment (Nobel website, 2007). Environmental issues have been addressed by many other advocates, notably McDonough and Braungart (2002), Anderson (1998), and Carson (1964). Since sustainability has become an important issue in popular culture, professionals have begun to incorporate it into their practice. Professionals in the interior design field have attempted to utilize sustainable practices when designing interior environments.

Supply and Demand

In basic economics, the push and pull of supply and demand implies that without demand for a product, no supply would be necessary. This system implies that a company that cannot see a future demand for what they sell will expand into a different niche where demand can be found (Nuckolls, 1983). Hawken (1993) stated that businesses reflect people in that the desires of people become the offerings (or supply) of businesses (Hawken, 1993). In relation to sustainable design, it could be presumed that without demand for the method, there would not be a given supply. Therefore, in order for sustainable practices to continue into the future, more must be known about the reasons that people demand environmentally friendly interior spaces.

Environmental Psychology

Environmental psychology examines how people are affected emotionally by the interior environments they occupy (Krasner, 1980). The study of environmental psychology has been defined as the study of the “person- environment interface” (Krasner, 1980, p. 67). Designers have used this method of study to examine the effect of various design approaches in interior environments to see how people move, act, and feel (Aspelund, 2006). Previous studies involving environmental psychology have tested designs focusing on everything from open and closed floor plans, to color use, ergonomic considerations, the amount of daylight provided in a space, and more. For example, previous research has shown that hue has an impact on the emotional responses of users by calming, exciting, or annoying them (Demirbilek & Sener, 2003). Although environmental psychology has focused on many aspects of design and the effect on users,

there is a lack of research on users' emotions with sustainably designed and non-sustainably designed interiors.

Defining Sustainable Design

One theoretical point of view about sustainable design maintains that it is made up of three main aspects that intersect and are dependent: economy, environment, and community (Williams, 2007). From this theoretical perspective, community defines the group or people for whom the design was made. The economy refers to the goods and services that were used by the community or group to produce the design. Lastly, the environment is the physical space that the design occupies, such as an interior environment (Williams, 2007). Therefore, based on this definition, no matter how varied sustainable designs are, they all include economy, community, and environment.

When creating a new space, designers can work through the building process in a way that makes an interior sustainable. Leadership in Energy and Environmental Design (LEED) encourages and promotes sustainable building practices through its rating system (USGBC website, 2007). LEED certification is not the only way in which to demonstrate that a structure is sustainable, but it is one of the most commonly used methods in the United States because it is a standardized system. LEED certification takes into consideration a number of aspects, including user health, energy efficiency, design of the space, construction materials, maintenance of the building, and the life cycle of the structure (Anderson, 2006; USGBC website, 2007). LEED has six basic categories that a building must fulfill a number of points in to ultimately achieve certification. The six categories of LEED are Sustainable Sites, Water Efficiency, Energy and Atmosphere,

Materials and Resources, Indoor Environment Quality, and Innovation and Design Process. The levels of certification based on the points achieved (see Appendix A) by a building in these six categories of LEED are Certified (26-32 points), Silver (33-38 points), Gold (39-51 points), and lastly Platinum (52-69 points) (McGowan & Kruse, 2004; USGBC website, 2007). LEED has a standard for new construction as well for other categories. For instance, LEED standards and guidelines for existing buildings helps those who are fixing up a structure to do so while minimizing negative effects on the environment by using sustainable materials and processes (USGBC website, 2007). LEED certification for any category is not easy to achieve. Buildings may utilize sustainable materials or systems and still not achieve the LEED stamp of approval. In other words, even if a built structure utilizes the necessary materials and the designers and builders did use the processes for LEED certification, the certification process is time consuming and requires large amounts of paperwork.

Aesthetics and Sustainable Design

“Aesthetics comes from the Greek word aesthesis, referring to sensory perception and understanding, [which could also be called] sensuous knowledge” (Hekkert, 2006, p. 2). Previous research has shown that people make decisions based on aesthetic perception. This link between aesthetic interpretation and ultimate user opinion has been shown in previous research concerning consumer choices (Bloch, Brunel, & Arnold, 2003). Users of interior environments make aesthetic judgments about spaces, which can lead to opinions and/or feelings about the space (Bloch et al., 2003).

Aesthetics are a concern to designers of sustainable interior environments and non-sustainable interior environments because visual stylistic elements communicate feelings to users (Graham, 2005). Sustainable interior environments can be hard to identify visually compared to non-sustainable environments due to the chameleon-like quality of sustainable building materials. Like non-sustainable design, sustainable design can embody a variety of styles. Some argue that sustainable interior environments differ aesthetically from non-sustainable interior environments because “sustainable interior environments exist aesthetically at the level of connotation, as signs and symbols attached to various interior features” (Willis, 2000, p. 2). As in all types of design, if specific aesthetic qualities in a sustainable interior environment have an effect on a user, he or she may ultimately feel a connection to that space. Jacobsen (2006) argued that aesthetic processing of a user’s experience can be accomplished through a multitude of processes, including emotions. There has been previous research demonstrating that emotions change a user’s perception, and, therefore, emotions can affect opinions (Malnar & Vodvarka, 2004).

Although people vary in overall interpretations of built environments, associations made with stylistic content such as materials, furniture, and finishes can be similar. As previously mentioned, sustainable materials and finishes can adapt to any design style. Flooring, paint, furniture, textiles, and lighting fixtures can come in many styles yet may all be sustainable or non-sustainable.

The Interior Environments in the Current Study

The two interior environments used in this study were similar aesthetically because of the visual style embodied by the spaces. Commercial interior spaces such as the conference room in the Kelley Engineering Center and the Bates Hall conference room can be mislabeled as “Modern.” The Modern design movement occurred from around 1925 to 1945. Modernism was a reaction to Art Deco, which used intricate motifs and luxurious fabrics (Miller, 2005). Modernism intended to be in essence what it was. Modern interiors used materials without covering them in faux finishes or other embellishments. Interior environments created in the Modern movement have been described as stripped-back, exposed, and reduced when compared to previous historical interior design styles (Miller, 2005). The interiors used in this study had a Modern aesthetic, but could not be deemed Modern because both were constructed and finished in the last 10 to 20 years. After Modernism came Post-Modernism, which was a reaction to Modernism and again a movement in which these two interior environments did not fit. Miller (2005) believed that after Post-Modernism, the aesthetic style deemed “Contemporary” is reached. The Contemporary design movement is the current style. Contemporary interiors can look high tech, rectilinear, and simple, similar to the movement of Modernism. Overall, Contemporary interiors tend to look clean and simplified when compared to other aesthetic styles throughout the history of interior design, such as the Victorian style (Whiton & Abercrombie, 2002). Both of the interior environments that were used in this study could be deemed Contemporary because of the simple, rectilinear aesthetics. In summation, the conference room in the Kelley Engineering Center and the conference room in Bates Hall had similar aesthetic styles.

The two interior environments differed in that the Kelley Engineering Center conference room was built sustainably, while the Bates Hall conference room was not built sustainably.

CHAPTER 3

Methods

The main objective of this study was to compare emotional responses in the sustainably constructed Kelley Engineering Center conference room and the non-sustainable Bates Hall conference room. In order to test this objective, a survey was administered to a convenience sample of participants in the two interior environments. The following chapter discusses the sample, environments tested, pilot study, survey development, analysis, and possible bias.

Sample

The participants for this study were predominantly Design and Human Environment majors from Oregon State University. There were some participants who listed “other” for their majors in the demographic portion of the survey (See Chapter 4), but all of the subjects were enrolled in a Design and Human Environment class. The students involved were at least 18 years of age and willing to participate in the study. Some of the students who participated in the study were given motivation for participation such as extra credit in a current class. The amount of credit, if offered, was determined by the class instructor. A number of instructors in the Design and Human Environment department were asked to allow students to take part in this research. The Design and Human Environment instructors were asked over the summer of 2008 for student participation during the fall 2008 term. In hopes of obtaining 60 subjects, the Design and

Human Environment instructors of classes DHE 180, DHE 187, DHE 270, DHE 240, and DHE 245 were asked if their students could participate in this research process.

Each participant received an identification number in order to compare the answers given by him or her on the two surveys without releasing his or her identity. Subjects completed the surveys in each interior with no set order. Randomization of completion of each survey ensured that bias in the results would stay to a minimum. For instance, familiarity with the survey instrument itself due to randomization cannot be a bias in the results. In addition, the day and time in which subjects completed the surveys was random. Multiple open times for subjects to complete the surveys were set up for each interior. Subjects could then complete each survey at his or her convenience. In total, there were 32 ½ hours open for subjects to complete the surveys (each survey only took 15 minutes to complete). Subjects had 15 ½ hours to complete the survey in Bates Hall and 17 hours to complete the survey in the Kelley Engineering Center. Open times were not exactly the same for each interior space due to availability of each interior environment. Completion of the surveys was done over the course of six weeks during the fall of 2008 at varied times throughout weekdays, including both mornings and evenings.

Out of 69 total participants, 56 subjects completed a survey in the Bates Hall conference room and 52 filled out surveys in the Kelley Engineering Center conference room. These two groups were labeled “Bates all” and “Kelley all.” Figures 1 and 2 show two ways of visually depicting these “all” groups.

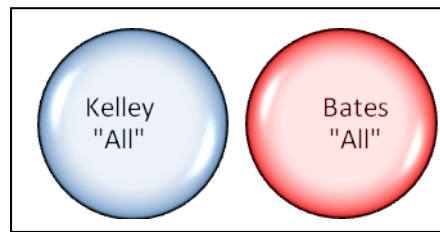


Figure 1. Visual depiction of the all group formation.

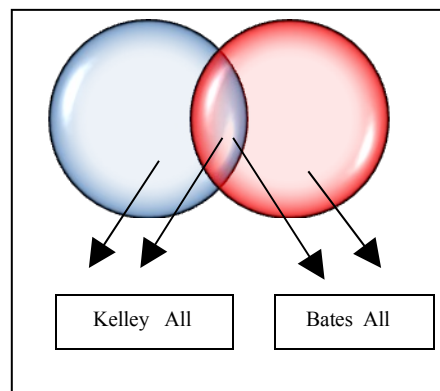


Figure 2. Another visual depiction of the all group formation.

Of the 56 subjects who filled out surveys in the Bates Hall conference room and the 52 who completed surveys in the Kelley Engineering Center conference room, 39 of the subjects filled out a survey in both interior environments. This group has been labeled “between.” Therefore, the between group members completed a survey in both of the two interior environments. Figure 3 shows a diagram of the between group.

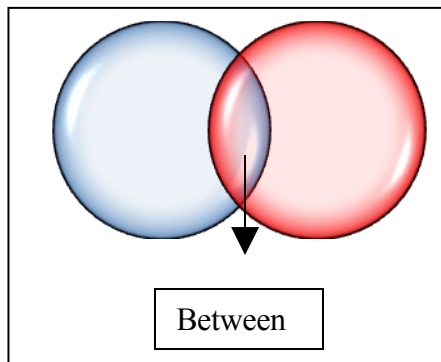


Figure 3. Visual depiction of the between group formation.

The Environments Tested

There were two interior environments tested in this study. The spaces were similar in interior design style and function. The first was a non-sustainable conference room in Bates Hall, and the second was a sustainable interior environment in the Kelley Engineering Center. For depictions and visual images of the interior environments, please see Appendices D and E and Figures 4 through 7. When looking at the details of each physical space, one can see similarities as well as differences. The paint used on the walls for each interior was similar. Each interior used light yellow/crème color paint. In addition, the paint used in each space had a semi-matte finish. The conference room tables were similar. Each was large and made of a light tone of wood. The lamps used in the two interiors were similar. Both spaces use T12 lamps. T12 lamps are fluorescent bulbs that were developed during the 1970s energy crisis. Today, T12s are used in commercial locations. The specific T12 used was “F40CW/RS/EW/Alto.” This coding signifies that the T12 bulb is a rapid start fluorescent lamp with a wattage of 34, a length of 48 inches, a

tubular bulb style, a medium bi-pin base style, a color rendering index of 62 out of 100, and lastly a color of cool white. The square footages of the conference rooms are similar but not identical. In addition, the shape of each room varies slightly (see Appendices D and E). The chair color varied between the two interiors: while the Kelley Engineering Center used red fabric, the Bates Hall conference room used blue fabric. Furthermore, the windows varied between the two interiors. The Bates Hall conference room had windows that gave an exterior view. The Kelley Engineering Center conference room had frosted windows that did not have an exterior view. The windows in the Kelley Engineering Center conference room allowed light into the space because of the hallway on the opposite side of the windows. In summation, the two spaces were very similar, but not identical.

The Kelley Engineering Center is sustainable because it was built up to Leadership in Energy and Environmental Design standards. The Kelley Engineering Center is Gold certified, meaning that it has achieved the second level of sustainability of the three offered by LEED. To achieve this level of certification, Kelley has qualifying sustainable aspects, including a natural ventilation system, an energy efficient heating, ventilation, and air conditioning system; the use of natural sunlight as a light source; a number of environmentally friendly construction materials; and a rainwater collection system to reuse water (Anderson, 2006). The Kelley Engineering Center has been LEED certificated by the United States Green Building Council. Figures 4 and 5 show images of the Kelley Engineering Center conference room used in this study.

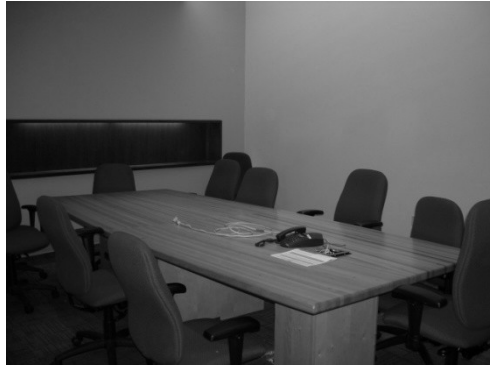


Figure 4. Photograph of the Kelley Engineering Center room 1114.



Figure 5. Photograph of the Kelley Engineering Center room 1114.

The second interior space used for this study was the Bates Hall conference room 129. It is unknown whether Bates Hall was built using some sustainable practices because Bates Hall did not follow any sustainable building rating system such as LEED. Therefore, the Bates Hall conference room was categorized here as non-sustainable. Figures 6 and 7 show photographs of the Bates Hall conference room.



Figure 6. Photograph of the Bates Hall conference room 129.



Figure 7. Photograph of the Bates Hall conference room 129.

Pilot Test

After the Institutional Review Board approval of the survey, a pilot test was completed in order to test the efficacy of the mixed method survey instrument. IRB approval for the pilot and study was applied for and granted during the summer of 2008. For the pilot, three students from the Design and Human Environment Department at the College of Health and Human Sciences at Oregon State University participated. After signing the Informed Consent forms as per IRB approval, the students completed the survey in both of the interior environments.

Survey Development and Analysis

Reasoning for each section's analysis will now be discussed. The survey included open-ended questions; questions about pleasure and arousal from Mehrabian and Russell's (1974) "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale; Mehrabian and Russell's (1974) "Verbal Measure of Approach-Avoidance" scale involving dominance; and satisfaction questions about thermal comfort, lighting, and noise (Anderson, 2006). In the final statistical analysis, each section was evaluated to the fullest extent possible by comparing groups of surveys taken in the two interior environments. This grouped method of analysis included both the all and between groups but focused on the between responses. The between group results were focused on because this research sought knowledge about the same users' opinions of two separate interior environments, one sustainable and one non-sustainable.

Pleasure and Arousal

The first emotional response model included in the survey was Mehrabian and Russell's (1974) "Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions" scale. The validity and reliability of this scale were broken down by item. Validity and reliability were tested by using the Kruder-Richardson reliability coefficient (Mehrabian & Russell, 1974). The pleasure reliability was 0.81, with a retest value of 0.72 (Mehrabian & Russell, 1974). The arousal reliability was 0.50, with a retest value of 0.69 (Mehrabian & Russell, 1974). Furthermore, in 1980, when Russell used Mehrabian and Russell's 1974 pleasure and arousal scale, he found an alpha level of reliability for pleasure of 0.84. In 1980, Russell found an alpha level of reliability for Mehrabian and Russell's 1974 arousal of 0.74. The pleasure and arousal (P, A) scores for a subject come from the averaging of answers given to Mehrabian and Russell's (1974) scale where some questions relate to pleasure and others to arousal. Ultimately, this means that a point on the circumplex (from Russell, 1980) was the (X,Y) or (P, A) pleasure and arousal score given by a subject in evaluation of one of the interior environments. This meant that the subject's pleasure and arousal scores could be interpreted in several ways. The mean and standard deviation pleasure and arousal values could be extracted from the group scores. In addition, interpretation could be completed by visually evaluating the placement of the points on the circumplexes relating to each space. Lastly, for the between group, two-sided paired t-tests were run comparing pleasure scores from each interior and arousal scores from each environment. A two-sided paired t-test compared answers from the between group for each interior for pleasure and arousal by calculating the differences in scores and looking at the distribution of those differences.

Aside from the removal of dominance, it should be noted that the emotional response scale developed by Mehrabian and Russell in 1974 was altered slightly for use in this research process. The original scale ranged from -4.00 to + 4.00, with a total of 37 levels between and including the -4.00 and +4.00 (Mehrabian & Russell, 1974). The pleasure and arousal scale used in this study was exactly the same proportionally, but it ranged differently. Instead of having answers ranging from -4.00 to +4.00, the answers ranged from -9.00 to +9.00. The scale from -9.00 to +9.00 included the same 37 levels, keeping the meaning of each level proportionally equivalent. This alteration to the scale was done so that subjects could more easily see the meaning of each level on the scale in the survey (See Appendix B). Instead of having 37 levels with only -4.00, +4.00, and 0 indicated, subjects chose from -9.00 to +9.00 with every level valued (See Appendix B).

Dominance

The second scale used in the survey was Mehrabian and Russell's (1974) "Verbal Measure of Approach-Avoidance" scale, which involved questions regarding dominance (Mehrabian & Russell, 1974). In 1974, Mehrabian and Russell found dominance to have a 0.72 reliability based on the Kruder-Richardson (1937) reliability coefficient. In addition, after retest, the reliability value was 0.77. Dominance scores were averaged. This averaging was done instead of the summing because, with one exception, all of the individual questions that ultimately make up a dominance score were "highly correlated" (Mehrabian and Russell, 1974). Dominance scores were not interpreted and evaluated using Russell's (1980) circumplex, but rather interpreted with means and standard deviations for the all and between groups. Furthermore, the between group scores were compared using the two-sided paired t-test.

Satisfaction

The third quantitative section included in this survey was modified from Anderson's (2006) work on satisfaction of interior environments. Anderson developed questions regarding satisfaction for thermal comfort, noise, and lighting. The satisfaction scores for the between group were the main scores examined. The all group satisfaction scores were generally discussed by looking at the scoring. The between group scores were analyzed additionally with the Wilcoxon signed-rank test. The Wilcoxon signed-rank test takes the differences in scoring and adds up both the positive and negative differences into groups. If there is no difference in scoring for a variable, then the negative and positive valued groups should be similar.

The last method of questioning in the survey was qualitative and constituted of open-ended questions. These open-ended questions were located in two places in the survey: at the beginning and at the end. These qualitative questions were included in the study to allow for responses that may not have been collected in the quantitative scales previously discussed (Bartenuk et al., 2006, Mossholder et al., 1995, Richins, 1997). In previous research, open-ended questions have been paired with other methods of questioning in order to find out more about subjects than could have been obtained otherwise (Dickinson et al., 2007). Therefore, by including the open-ended questions, more information could be gathered about the emotional responses of subjects to each interior environment. These open-ended questions were evaluated through content analysis. Common themes in answers were sought out and analyzed. In the all group results discourse, only general interpretation of content was completed. In the between group results discussion, partial responses from subjects were listed in groups based on content. These content groups were then further investigated.

Possible Bias

Previous research has shown that subjects who have a tendency toward negative emotional responses tend also to report a larger number of negative responses (Fortunato, 2004). People may have specific tendencies toward certain emotional responses (either positive or negative), which could be problematic when measuring emotions. For example, previous research has shown bias in subjects when testing job stressors and the work environment (Fortunato, 2004). In order to control for negative bias in this study, users were asked questions in multiple formats. For example, the emotional response

scales included multiple questions regarding both pleasure and arousal. Furthermore, the open-ended questions allowed subjects to respond to similar topics in survey.

Many studies of emotional response are constituted of self-reports from subjects. This use of self-reporting as a method of data collection may pose an issue for researchers. For example, women tend to express higher or more positive levels of emotional response than men (Youngstrom & Green, 2003). Although, a recent study by Youngstrom and Green that looked into the self-reporting of emotions showed that difference in reporting based on gender was not an inhibiting factor during data interpretation (Youngstrom & Green, 2003). With the inclusion of demographics data, bias in specific groups may be noted if occurring. In addition, by using open-ended questions during the survey, reasons for possible bias could be found through content analysis.

CHAPTER 4

Results

This chapter is divided into sections discussing first the pilot results and then the study results. The study itself was broken down further based on the grouped results: all and between. The results are separated by the all groups and the between group.

Pilot Study

The pilot study was completed prior to the survey itself. A total of three subjects took part in the pilot study, completing a survey in both the Bates Hall conference room and the Kelley Engineering Center conference room. All pilot and study subjects were recruited in the same manner. Subjects were approached in an undergraduate class at the discretion of the instructor, and some were given extra credit for participation. For this reason, the subjects were considered a sample of convenience. The pilot participants completed the survey in the Bates Hall interior environment first and then the Kelley Engineering Center interior environment. This ordering meant that there was less randomization during the pilot study than in the formal study where subjects randomly completed the surveys in each interior environment.

There were missing data in the pilot for the pleasure and arousal scores from the “Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions” scale for the Bates Hall conference room. The data were missing due to fault of the researcher. In addition, one subject stated confusion about the meaning of one of the qualitative inquiries regarding sustainability. The subject related sustainability to one of

the interior environments and also discussed being confused in response to the question, “*What do you know about environmental sustainability?*” Although the subject stated confusion, this open-ended manner of questioning was intended. If subjects were to relate sustainability to an interior environment, it was important to know (through content analysis) why. For this reason, the qualitative questions as well as all of the quantitative questions remained the same in the survey after the pilot for the formal study.

The Study

Bates All

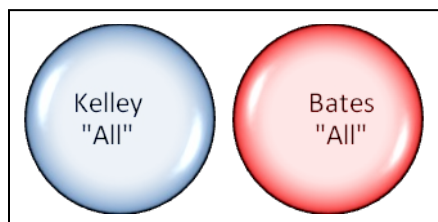


Figure 8. Visual depiction of the all group formation.

Bates Hall Quantitative Results

Table 1
Bates all demographic results

Variable	Item/#						
	18yrs	19yrs	20yrs	21yrs	22yrs	23yrs	24yrs
Age	14	21	10	7	3	0	1
Gender	Male 4	Female 51	No Response 1				
	White	Asian	Middle Eastern	PacificNative Islander	“Other” American	No	Response
Race/Ethnicity	45	6	1	1	1	1	1
ID	MM	Apparel	Double	Housing	“Other”	No	
Major	26	13	6	Major 6	2	2	Response 1
Grade	Fresh. 11	Soph. 29	Jun. 10	Sen. 5	No Response 1		

The Bates all group was constituted of 56 subjects. The ages of this group have been shown in Table 1. There were four males, 51 females, and one subject who did not respond. The race/ethnicity category included 45 Whites (80.3%), six Asians (10.7%), one Middle Easterner (1.78%), one Pacific Islander (1.78%), one Native American (1.78%), one “Other” (1.78%), and one subject who did not respond (1.78%). The grade levels included 11 Freshman (19.64%), 29 Sophomores (51.78%), 10 Juniors (17.85%), five Seniors (8.92%), and one subject who did not respond (1.78%). Lastly, in this group there were 13 Merchandising Management majors (23.21%), 26 Interior Design majors (46.42%), six Apparel Design majors (10.71%), two Housing Studies majors (3.57%), six double majors (10.71%), two “Other” (3.57%), and one subject who did not respond (1.78%). .

Table 2
Bates All Group Pleasure, Arousal, and Dominance Statistics

Response category	Range	<i>M</i>	<i>SD</i>
Pleasure	-4.75 to 6.83	1.992	2.389
Arousal	-4.41 to 6.80	-0.497	2.534
Dominance	1.75 to 3.37	2.591	0.398

The pleasure and arousal values shown in Table 2 signify that the group had a mean pleasure score of 1.992 with a standard deviation of 2.389 and an arousal mean of -0.497 with a standard deviation of 2.534. These values reflect that the pleasure and arousal scores from subjects were not neutral, or near a value of zero. To further show the

pleasure and arousal results from the Bates all group, these data have been plotted on a circumplex depicted in Figure 9.

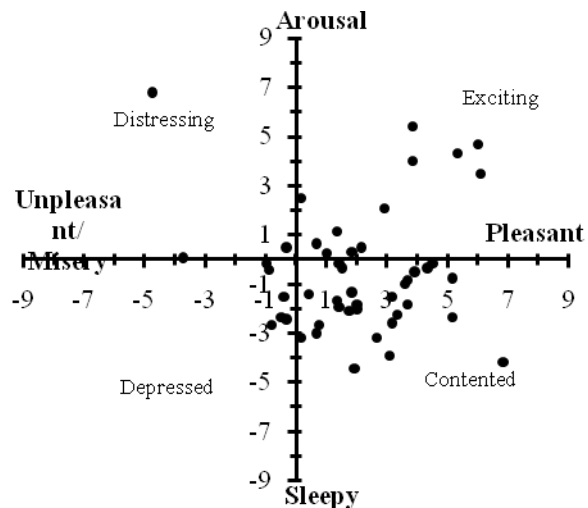


Figure 9. Bates Hall conference room all group circumplex.

The circumplex shown in Figure 9 visually reflects the pleasure and arousal scores. The points are not near the origin; rather, they are spread outward. In addition to pleasure and arousal scores, the circumplex gives more information about the emotional responses of subjects with semantic quadrant values. The circumplex shows that most of the Bates all subjects felt contented in the conference room interior. There were some subjects who felt excited, depressed, and distressed inside the space, but as shown this was a smaller portion of the Bates all group.

The dominance scale ranges from 0 to 7. The Bates Hall conference room all group dominance scores had a mean of 2.591 and a standard deviation of 0.398.

Table 3
Bates All Thermal Comfort, Lighting, and Noise Values

Variable	Not at all Satisfied						Very Satisfied
	1	2	2.5	3	4	4.5	5
Thermal Comfort	1	7	0	6	19	0	23
Lighting	6	11	1	12	18	0	8
Noise	2	5	0	15	15	1	18

The next section of results from the Bates all group to be discussed are the satisfaction scores on thermal comfort, lighting, and noise level. These results do not have mean and standard deviation computations due to the Likert-style scale. As shown in Table 3 there was one subject in this group who used different values for some scores: for example, a lighting score of 2.5. The thermal comfort and noise scores had many values between 3 and 5. While the lighting scores were more evenly distributed on the Likert-style scale compared to the other two variables, noise and thermal comfort appear to be more satisfactory to the participants than lighting in the environment.

Bates Hall Qualitative Responses

The last data gathered on the Bates all group were qualitative in nature. Content analysis alone provides information on the results from the all groups, whereas specific aspects of responses are shown during the between discussion. The first question asked was *“How do you feel today?”* The responses to this question included the amount of rest the participant felt he or she had achieved, a use of the word *“good,”* a school-related comment, future activities the participant had planned, the weather, a food- or hunger-related comment, a discussion of stress level, a comment on personal hygiene, and lastly the level of their perceived general health. For example, participants responded, *“tired”* and *“today I am tired.”* Another example is *“I have 2 unfinished assignments due today.”* and, *“ready for the term to be over.”* One last pair of examples is *“it’s cold out”* and *“not too cold today.”*

The second question asked was *“Is there anything happening today that you have been preoccupied with (i.e a test, paper, etc.)?”* Responses to this question discussed homework and school-related responsibilities, perceived stress level, general health, and personal commitments. For example, one individual said, *“Yes, the mass amount of reading I have to do.”* Another participant commented, *“so stress about homework is the forefront of thought.”*

The next question was *“Are there any other feelings that you want to describe about this interior?”* Participant comments discussed the furniture in the interior, lighting and/or windows, activities that the participant felt he or she could do in the space, an emotional response, the color in the room, a negative comment, a positive comment, the

noise level in the room, the shape of the room, the smell of the room, how the room looked “out-dated,” how the space seemed “homey,” and lastly the artistic decorations used in the interior environment. For instance, one person commented, *“My eyes literally hurt from the glare of the lights...”* More examples include *“not very welcoming”* and *“I do not like this interior!”* Also, a person claimed, *“I like the feeling of this room...”*, and another said, *“It feels welcoming, friendly, calming.”*

The next question posed was *“What do you know about environmental sustainability/green design?”* Responses to this question included not having much knowledge of sustainability, previous learning about sustainability/green design, sustainability being good for the environment, examples of sustainable practices and/or products, LEED, future impact of sustainable design, interest in knowing more about sustainable design, and feeling indifferent towards sustainability. For example, one participant said, *“A lot I guess especially from my classes like DHE 180 and now DHE 183.”* Another example is when the participant stated, *“...as bad as it sound I’m not very interested in learning about or supporting it either.”*

Another question asked was *“How do you feel about environmental sustainability/green design?”* Participants claimed feeling indifferent to sustainability, thinking that sustainability was a “good” idea, sustainability being positive for the future, stating that he or she did not know what sustainability was, and lastly commenting on the high cost of sustainable designs. For example, one participant asserted, *“It’s a good cause... but the only problem is... it’d be more expensive.”*

The next question asked was *“What do you know about this particular interior space (building)?”* Answers to this question discussed knowledge of the function of the

space; its use as a daycare and children's learning center, never having visited before filling out the survey or this being their first time in the interior, stating that the space was a conference room and lastly relating sustainability to the space. For example, one participant said, *"I think its not kind of green design."*

The last question posed was *"Have you visited this (building) before this date? Why?"* Responses to this question were limited. Participants stated "yes," "no," or that he or she did not have a reason to come in previously.

*Kelley All**Kelley Engineering Center Quantitative Results*

Table 4
Kelley All demographic results

Variable	Item/#					
Age	18yrs	19yrs	20yrs	21yrs	22yrs	
	16	16	11	6	3	
Gender	Male	Female				
	3	49				
Race/ Ethnicity	White	Asian	Pacific Islander	Middle Eastern	“Other”	
	44	4	2	1	1	
Major	ID	MM	Apparel Major	Double	“Other”	Housing
	24	11	6	5	4	2
Grade	Fresh.	Soph.	Jun.	Sen.	“Other”	
	15	22	9	5	1	

52 subjects constituted the Kelley all group. The ages of the participants are shown in Table 4. The Kelley Engineering Center conference room all group had a large number of females compared to males like the Bates all group. Out of the 52 Kelley all group members, 49 were female and three were male. There were 44 Whites (84.61%), four Asians (7.69%), two Pacific Islanders (3.84%), one Middle Easterner (1.92%), and one “Other” (1.92%). In terms of majors, there were 11 Merchandising Management (21.15%), 24 Interior Design (46.15%), six Apparel Design (11.53%), two Housing Studies (3.84%), five double majors (9.61%), and four “Other” (7.69%). Lastly, in this

Kelley all group, there were 15 Freshman (28.84%), 22 Sophomores (42.30%), nine Juniors (17.30%), five Seniors (9.61%), and one “Other” (1.92%).

Table 5
Kelley All Pleasure, Arousal, and Dominance Statistics

Response category	Range	<i>M</i>	<i>SD</i>
Pleasure	-2.25 to 7.83	4.017	2.827
Arousal	-4.33 to 6.33	0.311	2.895
Dominance	1.62 to 3.25	2.512	0.434

The Kelley all group had a mean pleasure score of 4.017 and a standard deviation of 2.827. The arousal scores for Kelley all had a mean of 0.311 and a standard deviation of 2.895. These pleasure and arousal scores do differ from the Bates all group pleasure and arousal scores as shown by the measures of central tendency. Further investigation of the pleasure and arousal scores from the Kelley all group were with the scores placed on a circumplex shown in Figure 10.

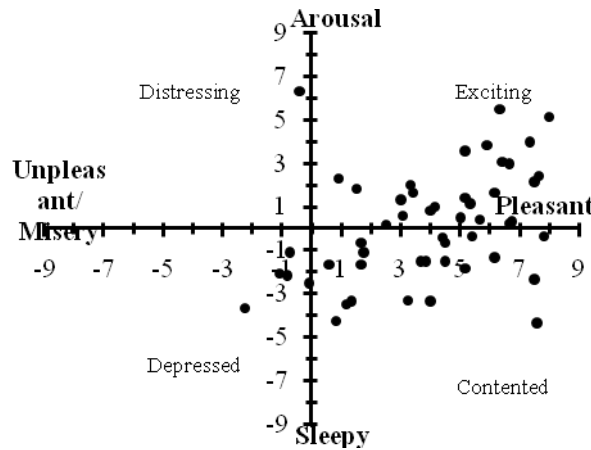


Figure 10. Kelley Engineering Center conference room all group circumplex.

In Figure 10, the circumplex shows the majority of the scores as positive on the pleasant axis. The scores are relatively split on the positive and negative portion of the arousal axis. This means that most subjects in the Kelley all group had an emotional response of contentment or excitement in the interior of the Kelley Engineering Center conference room.

The mean of the dominance results for this group was 2.521, with a standard deviation of 0.434. These measures of central tendency are similar to those from the Bates all group dominance values.

Table 6
Kelley all Thermal Comfort, Lighting, and Noise Values

Variable	Not at all Satisfied				Very Satisfied
	1	2	3	4	5
Thermal Comfort	0	2	7	23	20
Lighting	0	1	7	17	27
Noise	1	3	11	17	20

The noise and thermal comfort values range did not include the lowest “not at all satisfied.” This was not similar to the Bates all group. The lighting values reported by participants were generally higher on the satisfaction scale compared to the Bates all group.

Kelley Engineering Center Qualitative Responses

The first question was, “*How do you feel today?*”; responses included comments on the amount of rest attained by the subject, use of the word “*good*,” a school-related comment, and comment on future activities. In addition, subjects commented on the status of the weather, about food or hunger, stress level, general health, mood, and personal commitments/situations (for example, “*very stressed out*”).

The second question asked was “*Is there anything happening today that you have been preoccupied with (i.e. a test, paper, etc.)?*” Responses to this question covered homework/school, personal commitments, stress level, and general health.

The next question was “*Are there any other feelings that you want to describe about this interior?*” Topics discussed included furniture, windows and/or lighting, possible activities the participant could do in the space, an emotional response, color use, noise level, the shape of the space, seating, cleanliness of the interior, preference of the Kelley Engineering Center conference room over the Bates Hall conference room, a general negative comment, and the use of the word “modern” when discussing the interior. For instance, one participant claimed “*I love the lighting.*” Another example of a participant’s comment is “*just the right balance between the red, white, and cream colors to make the room feel lively.*”

The fourth question asked was “*What do you know about environmental sustainability/green design?*” Responses from the Kelley all group included topics such as being indifferent to the topic, thinking that sustainability was a good idea, believing that sustainability was positive for the future, not having much knowledge on the topic, thinking that sustainability looks new and updated, having previous knowledge on sustainability from classes taken, relating sustainability to the interior of the Kelley Engineering Center conference room itself, mentioning LEED, and describing sustainable practices.

The next question asked to participants was “*How do you feel about environmental sustainability/green design?*” Participants’ answers to this question covered topics such as feeling indifferent towards sustainability, having positive

comments about sustainability, and linking the conference room to sustainable design. In addition, subjects in this group stated a desire to learn more about the topic and that green design should still be aesthetically pleasing.

The next question posed was “*What do you know about this particular interior space (building)?*” Responses to this inquiry covered the function of the space (being an Engineering building), commenting that this was his or her first time in the interior, linking the Kelley Engineering Center to sustainability, color use, LEED, comments on the lighting and/or windows, stating that the interior environment was “*modern,*” and lastly commenting that he or she did not know anything. For example, “*...it’s one of the buildings that support green design...*”

The last qualitative question posed was “*Have you visited this interior (building) before this date? Why?*” Responses to this question revealed individuals having visited the building previously and having already answered this question.

In conclusion, both qualitative and quantitative results showed differences when looking at the Kelley and Bates all groups. The last group, which was the focus of this results discussion, is the between group, which can shed more light on participants’ feelings about the two interior environments.

Kelley and Bates Between Spaces Quantitative Results

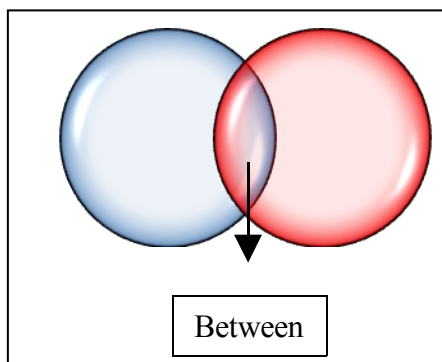


Figure 11. Visual depiction of the between group formation.

Demographics

Table 7
Between demographic Results

Variable	Item/#					
Age	18yrs	19yrs	20yrs	21yrs	22yrs	
	11	11	9	6	2	
Gender	Male	Female				
	2	37				
Race/ Ethnicity	White	Asian	Pacific Islander	Middle Eastern	"Other"	
	33	3	1	1	1	
Major	ID	MM	Apparel	Double Major	"Other"	Housing
	18	7	6	5	2	1
Grade	Fresh.	Soph.	Jun.	Sen.		
	10	17	7	5		

The ages of the between group are shown in Table 7. Out of the 39 people in the between group there were 37 females and two males. There were 33 Whites (84.61%), three Asians (7.69%), one Pacific Islander (2.56%), one Middle Easterner (2.56%), and one “Other” (2.56%). The majors included seven Merchandising Management (17.94%), 18 Interior Design (46.15%), six Apparel Design (15.38%), one Housing Studies (2.56%), five double majors (12.82%), and two “Other” (5.12%). Lastly, there were 10 Freshman (25.64%), 17 Sophomores (43.58%), seven Juniors (17.94%), and five Seniors (12.82%).

Pleasure and Arousal

Table 8
Between Group Pleasure, Arousal, and Dominance Results

Response category	<i>M</i>	<i>SD</i>
Bates Hall Conference Room		
Pleasure	2.015	2.171
Arousal	-0.531	2.451
Dominance	2.610	0.385
Kelley Engineering Center Conference Room		
Pleasure	3.845	2.749
Arousal	0.596	2.651
Dominance	2.507	0.432

As shown in Table 8, the pleasure and arousal scores from the two interior spaces were not similar. When comparing the responses from subjects in the two spaces, the pleasure and arousal means and standard deviations show that the scoring was different in the non-sustainable and the sustainable interior environment. In addition, interpretation of the pleasure and arousal scores from the between groups was completed through the use

of the circumplex. The circumplex for the Bates scores from the between group has been shown in Figure 12. Figure 13 shows the Kelley scores.

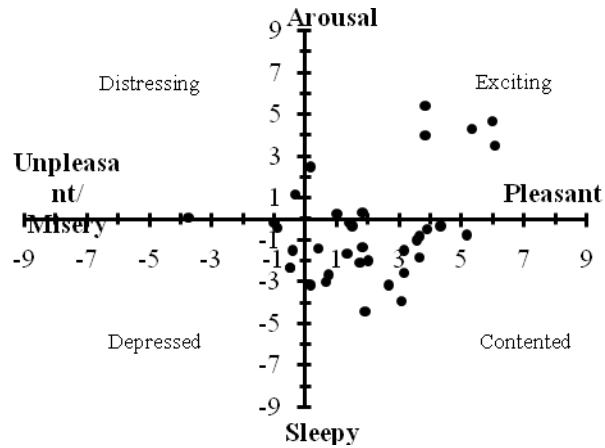


Figure 12. Bates Hall conference room between circumplex.

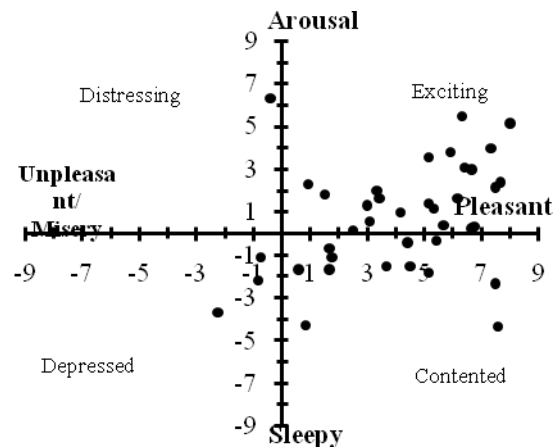


Figure 13. Kelley Engineering Center conference room between group circumplex.

As shown in Figures 12 and 13, the two interior spaces were rated differently by the between group. When looking at the concentration of points on the two circumplexes,

this difference is visually apparent. The Kelley Engineering Center conference room circumplex scores are positive on the pleasure and arousal axes, showing that participants felt excited in the interior. The Bates Hall conference room scores are also positive on the pleasure axis, but less so compared to the sustainable interior. In addition, the scores in the Bates Hall conference room were generally negative on the arousal axis. This means that participants felt contented in the Bates Hall conference room and some even sleepy. The final manner in which the pleasure and arousal between group scores were compared was by two-sided paired t-tests.

Table 9
Two-Sided Paired t-test for Pleasure, Arousal, and Dominance

	<i>p</i> value	<i>df</i>
Pleasure	0.0065**	35
Arousal	0.0238*	35
Dominance	0.1740	38

***p* -value <.01

**p*-value <.05

The two-sided paired t-tests included 36 values for pleasure and arousal due to the missing values from the Bates Hall conference room interior. The two-sided paired t-test for pleasure showed convincing evidence of a difference in scoring of the sustainable Kelley Engineering Center conference room and the non-sustainable Bates Hall conference room ($p = 0.006$ with 35 *df*). The arousal two-sided paired t-test showed moderate evidence of a difference ($p = 0.02$ with 35 *df*).

Dominance

The dominance mean and standard deviation scores shown in Table 8 were relatively similar for each interior environment. This meant that participants who completed surveys in both interior environments generally felt similar levels of dominance in each space. In addition, a two-sided paired t-test compared the dominance scores from the between group (shown in Table 9). There were no missing values for the between group for the dominance scores, so all 39 observations were included in this statistical test. The two-sided paired t-test showed no evidence of a difference in dominance between the two spaces ($p = 0.17$ with 38 *df*).

Satisfaction

Table 10
Between Thermal Comfort, Lighting, and Noise Results

Bates						
Variable	Not at all Satisfied					Very Satisfied"
	1	2	3	4	4.5	5
Thermal Comfort	0	5	4	12	0	18
Lighting	5	7	9	11	0	7
Noise	1	4	13	9	1	11
Kelley						
Variable	Not at all Satisfied					Very Satisfied"
	1	2	3	4	4.5	5
Thermal Comfort	0	1	7	18	0	13
Lighting	0	1	6	13	0	19
Noise	1	3	10	10	0	15

As shown in Table 10, the thermal comfort scores for the two interiors were similar. In addition, noise scores for the sustainable and non-sustainable interior environments were similar. The lighting scores were not similar from the between group for the two interior environments.

Table 11
Wilcoxon signed-rank test for Thermal Comfort, Lighting, and Noise

Variable	z-score	<i>p</i> value
Thermal Comfort	0.068	0.946
Lighting	-3.326	0.0009**
Noise	-1.666	0.0956

** *p*-value <.001

The satisfaction scores for each interior space were compared by running a Wilcoxon signed-rank test. The test showed that there was no evidence of a difference in thermal comfort scores ($z = 0.068$, two-sided $p = 0.946$ from the Wilcoxon signed-rank test). In addition, there was no evidence of a difference in noise scores ($z = -1.666$, two-sided $p = 0.0956$ from the Wilcoxon signed-rank test). Lastly, there was convincing evidence of a difference in lighting scores ($z = -3.326$, two-sided $p = 0.0009$ from the Wilcoxon signed-rank test). This convincing evidence of a difference in lighting satisfaction scores showed that subjects rated the lighting in Kelley with higher satisfaction than that in Bates.

Kelley and Bates Between Spaces Qualitative Responses

The results from each question have been placed into themed content groupings in table form. The first question posed was “*How do you feel today?*”

Table 12
Bates Between Results Question 1 Section 1 *“How do you feel today?”*

Sleep Level	
ID 5	<i>“Feeling a little tired b/c lack of sleep...”</i>
ID18	<i>“I feel tired...”</i>
ID22	<i>“...well rested.”</i>
ID62	<i>“... I am well rested...”</i>
Classes/Schoolwork	
ID 7	<i>“...long day of classes...”</i>
ID35	<i>“... midterms this week...”</i>
ID48	<i>“... studying so much for a midterm this morning.”</i>
ID58	<i>“...just finished classes for the week.”</i>
ID63	<i>“... focusing on school work...”</i>
Weather	
ID13	<i>“...The weather is crapy out!...”</i>
ID45	<i>“...it is nice outside.”</i>
ID47	<i>“...its raining.”</i>
ID60	<i>“...It is finally not raining...”</i>
ID65	<i>“... it’s sunny outside...”</i>

Table 13
Kelley Between Results Question 1 Section 1 *“How do you feel today?”*

Sleep Level	
ID 5	<i>“Got to sleep in a little so I’m well-rested...”</i>
ID14	<i>“I feel tired...”</i>
ID34	<i>“...feel rested...”</i>
ID48	<i>“...a little tired...”</i>
ID53	<i>“...A little tired...”</i>
Classes/Schoolwork	
ID 7	<i>“...only have one class for the rest of the day then I’m done...”</i>
ID26	<i>“classes and midterms...”</i>
ID58	<i>“... my homework is done, and I’m getting extra credit right now...”</i>
General Health	
ID13	<i>“...Just getting over a cold...”</i>
ID16	<i>“...a little sick...”</i>
ID61	<i>“...Throughout my day I’ve been getting sicker and sicker.”</i>

The content discussed by the between group in each interior for question one was similar. Participants in the between group discussed similar topics in each interior environment, including sleep level and classes/schoolwork. In the Bates Hall conference room, subjects also discussed the weather. In the Kelley Engineering Center conference room, subjects discussed general health.

The second question asked was “*Is there anything happening today that you have been preoccupied with (i.e. a test, paper, etc)?*” The results from this question are in Tables 14 and 15.

Table 14

Bates Between Results Question 2 Section 1 “*Is there anything happening today that you have been preoccupied with (i.e. a test, paper, etc)?*”

	Classes/Schoolwork
ID14	“ <i>Studying for midterms...</i> ”
ID15	“ <i>Homework, class...</i> ”
ID22	“ <i>Midterm and paper ...</i> ”
ID26	“ <i>...homework</i> ”
ID34	“ <i>...a presentation</i> ”
ID48	“ <i>Yes, I had a huge assignment due this morning...</i> ”
ID63	“ <i>I have a paper due tomorrow...</i> ”
ID65	“ <i>I have an assignment...</i> ”

Table 15
Kelley Between Results Question 2 Section 1 *“Is there anything happening today that you have been preoccupied with (i.e. a test, paper, etc.)?”*

Classes/Schoolwork	
ID13	<i>“...test on Thursday (midterm)...”</i>
ID16	<i>“lots of studying/homework to do...”</i>
ID22	<i>“...Ecom paper, Textiles assignment, all due tomorrow.”</i>
ID26	<i>“A midterm for physics and homework...”</i>
ID34	<i>“Presentation...”</i>
ID45	<i>“Yes. I just took a midterm...”</i>
ID56	<i>“...homework in general.”</i>
ID63	<i>“... homework, make up labs.”</i>
Personal Commitments/Concerns	
ID14	<i>“...memorizing a speech for something outside of school.”</i>
ID48	<i>“... this evening for my sorority.”</i>
ID55	<i>“... and my cat is possibly pregnant.”</i>

As shown in Tables 14 and 15, participants in the between group discussed classes/schoolwork. In addition, in the Kelley Engineering Center conference room, subjects discussed personal commitments/concerns.

The next question asked was *“Are there any other feelings that you want to describe about this interior?”* Results from the between group for this inquiry are in Tables 16 and 17.

Table 16

Bates Between Results Question 1 Section 5 *“Are there any other feelings that you want to describe about this interior?”*

Activities Subject Could Complete in the Space	
ID 3	<i>“... a place where I feel like I would be able to get a lot of my homework done.”</i>
ID7	<i>“... I could spend 2 hours sitting in.”</i>
ID35	<i>“...This is a place I could productively study.”</i>
Color Use	
ID47	<i>“...Color is kind of dull.”</i>
ID53	<i>“...The warm color on the wall helps brighten it.”</i>
ID60	<i>“... this room is relatively neutral in color choice use...”</i>
ID64	<i>“I like the warmth of the wall color...”</i>
ID65	<i>“The walls are painting a pleasant color...”</i>
Lighting/Windows	
ID13	<i>“...I don’t really like the light fixtures plus I think they are making a buzzing sound, kinda annoying but I could get used to it.”</i>
ID39	<i>“The noise from the lights could get irritating...”</i>
ID42	<i>“...There was a constant hum in the space (maybe from the lights/HVAC???)...”</i>
ID48	<i>“I think that the things that bother me the most about the space is the lighting and the noise coming from the lights (a quiet buzz). I really wouldn’t want to spend a lot of time in here...”</i>
ID52	<i>“Although the use of windows for natural light is good, the flourescant lighting is way to harsh & the buzzing is annoyed...”</i>
ID55	<i>“I do not like this interior! I don’t like the lighting...”</i>
ID58	<i>“My eyes literally hurt from the glare of the lights...”</i>
ID63	<i>“...The flourscent lights defintly over do the rest of the room, the outside light is a lot better...”</i>
Paintings/Aesthetic Accents	
ID14	<i>“the pictures make it warming...”</i>
ID18	<i>“...the flower paintings and the colors used in the room.”</i>
ID22	<i>“...has nice artwork compared to the other place.”</i>
ID24	<i>“It’s very homey. I like that there’s picture...”</i>
Furniture Discussion	
ID15	<i>“... I don’t like the general set of the table, chairs.”</i>
ID16	<i>“...the chairs are nice”</i>
ID34	<i>“...large table”</i>
Appears Dated	
ID17	<i>“...the furniture is very outdated.”</i>
ID26	<i>“...a plain conference room, that is dated...”</i>
ID45	<i>“... make me feel like I’m at grandma’s house...”</i>

Table 17

Kelley Between Results Question 1 Section 5 *“Are there any other feelings that you want to describe about this interior?”*

Comparison of the Two Interior Spaces	
ID 3	<i>“I like this room over the first room ... Bates.”</i>
ID34	<i>“This space is much more stimulating however I find it difficult to determine whether it occurs in a good or bad way...”</i>
ID36	<i>“... The lighting is much better than in the other one...”</i>
ID37	<i>“... I think the room gets really great natural lighting, but the lighting isn’t direct of pointing right at you, which I like! ... I like the shape of this room (Kelley) more than the Bates room...”</i>
ID48	<i>“I enjoy this room much more than the first. There is no sound (humming) from the lighting...”</i>
ID62	<i>“It makes me a lot happier than the other one because it is brightly colored...”</i>
Color and Texture Use	
ID 5	<i>“I like the neutral calming colors ... the contrast of red...”</i>
ID18	<i>“...The colors are nice...”</i>
ID42	<i>“...I do not like the red chairs. Something a little less harsh would be more appealing (neutral, green, etc.)...”</i>
ID45	<i>“I love the wood grain in the table...”</i>
ID46	<i>“The bright red chairs kind of hurt my eyes...”</i>
ID54	<i>“...The color scheme is bright balanced with cool.”</i>
Perceived Cleanliness	
ID7	<i>“... its not cluttered...”</i>
ID13	<i>“I really like the clean feeling...”</i>
ID59	<i>“It feels more clean... less cluttered then the first space.”</i>
Possible Activities Subject could complete in Space	
ID14	<i>“...This space is a place I could get a lot of work done in.”</i>
ID16	<i>“... I wish I got to take classes in this building!”</i>
ID24	<i>“... it’s a place I could study & be productive”</i>
ID35	<i>“.... Feels like a place where I’d be intimidated to talk during a meeting.”</i>
Like/Dislike of Interior	
ID17	<i>“The interior is very boring, could be livend up...”</i>
ID47	<i>“I really like how it is set up...”</i>
ID61	<i>“I really like the design of the room...”</i>
Lighting/Windows	
ID26	<i>“...I like the lighting above the table. The glass window floor to ceiling is really neat.”</i>
ID49	<i>“...lighting provide a relaxing...environment for me.”</i>
ID55	<i>“... I love how the lighting is displayed and how the glass is frosted...”</i>

The similar themes discussed by subjects in response to “*Are there any other feelings that you want to describe about this interior?*” (as shown in Tables 16 and 17) are color use, possible activities subjects could complete in the space, and lighting/windows. In the Bates Hall conference room, the between group also discussed paintings and aesthetic accents, the furniture, and that the space appeared “*dated.*” In the Kelley Engineering Center, the subjects in the between group also compared the two interior spaces, discussed texture use, perceived cleanliness, and made general comments on likes and dislikes about the interior environment.

The next question posed was “*What do you know about environmental sustainability?*” The between group results for this question are listed in Tables 18 and 19.

Table 18
 Bates Between Results Question 2 Section 5 *“What do you know about environmental sustainability?”*

Previous Classwork/Knowledge of Sustainable Design	
ID 5	<i>“I know some general knowledge. Maybe more than the average person because the classes I’ve taken...”</i>
ID7	<i>“... from my classes like DHE 180 and now DHE 183.”</i>
ID42	<i>“...I have taken environmental/green design class with professor Caughey.”</i>
Explains Elements of Sustainability	
ID13	<i>“... Being conscious of our waste and carbon footprint.”</i>
ID26	<i>“... grow grass on the roof.”</i>
ID35	<i>“I know that just about everything in a house can be made w/ “green” materials. i.e. paint, floors (bamboo), cabinets, etc. There are a lot of tricks to help use less energy...”</i>
ID36	<i>“I know about light bulbs, insulation, alternative/recycled materials... I don’t know if I’d be able to tell a green room from a traditional room.”</i>
ID45	<i>“It’s focused on wasting as little as possible and using materials that are good for the environment...”</i>
Not Much Knowledge on Sustainability	
ID18	<i>“I don’t know anything...”</i>
ID24	<i>“Not ... much.”</i>
ID43	<i>“Still not much...”</i>
ID61	<i>“... don’t know anything...”</i>
ID62	<i>“I know very little about environmental sustainability/green design... I’m not very interested in learning about or supporting it either.”</i>
ID65	<i>“No too much....”</i>

Table 19
Kelley Between Responses Question 2 Section 5 *“What do you know about environmental sustainability?”*

Previous Knowledge/Classwork on Sustainable Design	
ID 5	<i>“have some knowledge... specifics from class”</i>
ID7	<i>“...all that I learned about during class DHE 180, 245, & now textiles 255.”</i>
ID19	<i>“... like LEED certified buildings/homes</i>
ID42	<i>“I took the environmental/green design course from Professor Caughey last fall... Sustainability/green design uses... “Cradle to Cradle” type approaches...”</i>
Relates Sustainable Design to the Interior	
ID13	<i>“...I know Kelley is enery savvy with there water in such, ex: toilet water.”</i>
ID18	<i>“... alot of the products used in this room are from recycled material.”</i>
ID55	<i>“I know that Kelley was built to be environmentally friendly...”</i>
Not Much Knowledge on Sustainability	
ID24	<i>“Not ... much”</i>
ID43	<i>“Nothing...”</i>
ID46	<i>“...very little.”</i>
ID61	<i>“...don’t know anything.”</i>
ID62	<i>“... don’t know very much about it & honestly don’t care that much.”</i>
Positive take on Sustainability	
ID41	<i>“... I know it’s good & the economy should go towards it.”</i>
ID47	<i>“...great for the environment.”</i>
ID52	<i>“A very important issue today!...”</i>
ID54	<i>“... I by all means support & value green designs.”</i>

As shown in Tables 18 and 19, there were some of common themes discussed in the two interior environments regarding the question, which asked about the subject’s knowledge on sustainability. Common themes included the subject having previous classwork and/or knowledge about sustainability and the subject stating that he or she did not have much knowledge on the topic. In the Bates Hall conference room, the between group also discussed elements of sustainability. In the Kelley Engineering Center, participants also related sustainable design to the interior and discussed each individual’s

position on the subject. In the Kelley Engineering Center conference room, only one individual mentioned LEED. This user's response was included as an example of content but placed under the theme of previous knowledge/class work on sustainable design.

The next question posed was "*How do you feel about environmental/green design?*" The content themes of the responses from the between group participants were listed in Tables 20 and 21.

Table 20
Bates Results Question 3 Section 5 "*How do you feel about environmental/green design?*"

Positive Perspective on Environmental Design	
ID 3	<i>"I think it is great because we need to start thinking smart ... want to be healthy..."</i>
ID 5	<i>"I think it's absolutely necessary and needs to pervade everyday life..."</i>
ID13	<i>"... it is very important topic."</i>
ID14	<i>"I think it is good..."</i>
ID16	<i>"... it's a positive step"</i>
ID35	<i>"I think it's great..."</i>
ID36	<i>"I'm <u>very</u> pro-sustainability..."</i>
ID37	<i>"I think it's wonderful! If we can decrease our ecological footprint I think we need to go there..."</i>
ID39	<i>"... think it is a very good idea."</i>
ID48	<i>"I think that green design is wonderful."</i>
ID52	<i>"It's a very important cause for me..."</i>
ID54	<i>"Love it, and all for it!..."</i>
Indifferent	
ID17	<i>"Don't ... have any feelings towards it."</i>
ID62	<i>"I don't really care about it doesn't matter to me either way...sounds selfish but things don't bother me the way they are so I don't see a need for change."</i>

Table 21
Kelley Responses Question 3 Section 5 *“How do you feel about environmental/green design?”*

Positive Perspective on Environmental Sustainability	
ID 5	<i>“It’s a great idea!...”</i>
ID18	<i>“I think it is a good idea...”</i>
ID19	<i>“I like it...”</i>
ID26	<i>“I think it is good...suits me just dandy.”</i>
ID41	<i>“Good. WE should all try and do it...”</i>
ID46	<i>“I think its great...”</i>
ID58	<i>“I think it’s awesome...”</i>

As shown in Tables 20 and 21, subjects in the between group discussed having a positive perspective on sustainability in both interiors. In addition, in the Bates Hall conference room, subjects mentioned feeling indifferent towards the topic.

The next question asked was *“What do you know about this particular space (building)?”* Like the previous question, material responses were listed in groups and are shown in Tables 22 and 23.

Table 22
Bates Responses Question 4 Section 5 *“What do you know about this particular space (building)?”*

First Time in Space/ Never Visited Before	
ID 3	<i>“... this is my first time in this building.”</i>
ID 5	<i>“... never been in it before.”</i>
ID13	<i>“...First time I’ve been in here, had to look it up on a map first..</i>
ID15	<i>“Nothing... first time in here”</i>
ID61	<i>“... didn’t even know where this building was!”</i>
Describes Function of Space for Children	
ID14	<i>“day care...”</i>
ID16	<i>“...it has little kids!”</i>
ID17	<i>“... for child practicums –preschool”</i>
ID41	<i>“... is a child care center where students can learn about kids.”</i>
ID45	<i>“... it is the family study center...”</i>
ID46	<i>“... know it’s the family research building...”</i>

Table 23

Kelley Responses Question 4 Section 5 *“What do you know about this particular space (building)?”*

Connects Kelley to Sustainability/LEED	
ID7	<i>“... that it's one of the buildings that support green design...”</i>
ID34	<i>“... has LEED certification.”</i>
ID36	<i>“...I'd guess that the materials used are greener...”</i>
ID42	<i>“... LEED Gold Certified...”</i>
ID45	<i>“... a green building that collects rain water on the roof to flush the toilets.”</i>
ID52	<i>“LEED certified...”</i>
ID54	<i>“This entire building was designer green, inside and out!...”</i>
ID55	<i>“...I know it is built that way to be part of a green design, but some of it I don't know what's green.”</i>
Function of the Space/Building for Engineering	
ID13	<i>“...was built recently 4 Engineering students.”</i>
ID14	<i>“Just that its an engineering building...”</i>
ID15	<i>“I know its the engineer building...”</i>
ID18	<i>“It is the Engineering place...”</i>
ID19	<i>“...I think it's the engineering building though.”</i>
ID24	<i>“It's the engineering building...”</i>
ID65	<i>“.... I know it is the engineering building.”</i>
Not Much Knowledge	
ID16	<i>“not much...”</i>
ID48	<i>“Not much...”</i>
ID58	<i>“I know nothing about it...”</i>
ID60	<i>“I do not know a lot about this building...”</i>

As shown in Tables 22 and 23, participants reported the function of the interior/building. In the responses from the Kelley Engineering Center conference room, participants from the between group also connected Kelley to sustainability/LEED and stated not having much knowledge on the topic. In the Bates Hall conference room, participants also discussed having never been in the space before.

The final question in the survey was “*Have you ever visited this interior (building) before this date? Why?*” Responses to this question are listed in Tables 24 and 25 by common content.

Table 24
Bates Responses Question 5 Section 5 “*Have you ever visited this interior (building) before this date? Why?*”

First Time in Space/Never Visited Before/No	
ID 3	“...my first time here.”
ID15	“No...”
ID18	“... have not visited this building before.”
ID26	“no....”
ID56	“...have not.”
ID58	“... I haven’t, this is my first experience with this building.”
ID65	“...I have never been inside this building before.”
No Reason to Come/No Classes in Building	
ID 5	“... never had a class in it or a reason to come in”
ID7	“... I don’t have classes in this building.”
ID13	“...Haven’t had a class in it...I usually don’t go into builds on campus unless I have a reason”
ID34	“...never needed to...”
ID35	“... I’ve never had any classes here before.”
ID36	“... No need.”
ID39	“...had no big reason to come here.”
ID41	“... Never any reason to...”
ID43	“... I’ve never been in this building before, because I’ve never had a class in here or had a reason to come in...”
Yes	
ID42	“Yes. I had an ambassador/advisor session...”
ID45	“Yes...”

Table 25
Kelley Responses Question 5 Section 5 *"Have you ever visited this interior (building) before this date? Why?"*

First Time in Space/Never Visited Before/No	
ID 3	<i>"... my first time"</i>
ID15	<i>"No, I never have..."</i>
ID18	<i>"No, I have not visited this building..."</i>
ID41	<i>"No...This is my first time in here."</i>
ID46	<i>"No, I have never been here..."</i>
ID65	<i>"Nope, this is the first time..."</i>
No Reason to Visit/No Classes in Building	
ID 5	<i>"...no classes in here"</i>
ID34	<i>"...never had a reason."</i>
ID45	<i>"...I haven't had the need to do so."</i>
ID47	<i>"...I have never been in here before because I have really never had a reason to come in here and have not had a class in here before."</i>
Yes/Café	
ID13	<i>Yes... I usually get coffee or tea here..."</i>
ID22	<i>"...get coffee"</i>
ID43	<i>"Yes...quite often to buy coffee from their coffee shop."</i>
ID52	<i>"Yes- to go to the café..."</i>
ID62	<i>"Yes... to get coffee."</i>
ID63	<i>"Yes...to get coffee."</i>
Yes/Study	
ID24	<i>"Yes to study for chemistry..."</i>
ID39	<i>"yes, ...good place to study..."</i>
ID42	<i>"Yes...great place to study..."</i>

The content in Tables 24 and 25 shows similarities and some differences.

Common themes included first time in the space/the subject never having visited the interior before/no and not having a reason to come in/no classes in the building. As shown in Table 25, many subjects had visited the Kelley Engineering Center previously. Common reasons for having previously visited the Kelley Engineering Center were to study or to get an item from the café located on the first floor of the building.

CHAPTER 5

Discussion and Conclusion

Qualitative

The first null hypothesis of this study stated that there would be no difference reported in the feelings of users between the sustainable and non-sustainable interior environments. The qualitative results collected to test this hypothesis showed that the differences were apparent but moderate. Participants' responses before entering each interior environment were similar. As shown in the results to questioning from section 1, there was not enough evidence of differences to reject the null hypothesis, although there was variation in the responses given by participants after experiencing the interior environments. The most convincing evidence was related to preference stated for the interior of the Kelley Engineering Center conference room over the Bates Hall conference room. Some subjects stated this preference without reasoning, while others pointed out aspects of the sustainable space that gave a reason for the preference. The predominant aspects preferred in the Kelley Engineering Center conference room over the Bates Hall conference room were color use and lighting/windows.

Many subjects stated a preference for the use of the warmer tones in the Kelley Engineering Center conference room compared to the cooler tones used in the Bates Hall conference room. This color variation in the two interior environments was only in the fabric on the upholstered chairs. The Kelley Engineering Center conference room had red upholstery fabric while the Bates Hall conference room had light blue upholstery fabric. Previous research has shown that color greatly impacts perception of an interior

environment. Hue choices have an impact on the emotional responses of users by calming, exciting, or annoying them depending on the color application (Demirbilek & Sener, 2003). Previous research has studied blue green office settings and red office settings in relation to levels of perceived job satisfaction (Kwallek, Soon, Woodson, & Alexander, 2005). This previous research found that perceived job satisfaction was higher in one color of interior compared to another. The variance in color use in the two interiors did seem to have an impact on the user's responses to the spaces. However, this variation could not be avoided due to the use of two spaces in two different buildings; not every detail in the interiors could be identical.

Subjects often stated preference for the Kelley Engineering Center conference room lighting/windows over the Bates Hall conference room. These findings were also related to the results from the satisfaction scale on lighting.

In addition to color use and lighting/windows, many subjects stated positive feelings towards sustainability. Furthermore, some subjects linked sustainability to the Kelley Engineering Center stating that he or she knew the building was built sustainably. Although these ideas were discussed in the responses from participants, users did not directly connect the preference of one interior over the other due to sustainability.

In summation, the strongest evidence to reject this first null hypothesis came from the positive and negative comments about the interior environments and stated preference of one space over the other. No between group subject stated outright preference for the Bates Hall conference room over the Kelley Engineering Center conference room. On the contrary, some subjects did state preference for the Kelley Engineering Center over the

Bates Hall conference room. There was a moderate difference in the feelings reported by users between the sustainable and non-sustainable interior environments.

Pleasure and Arousal

The second null hypothesis of this study stated that there would be no difference on the pleasure and arousal scale between the sustainable and the non-sustainable interior environments. This null hypothesis was rejected based on the significant p -values from the two-sided paired t -tests for both pleasure and arousal. In addition, the circumplexes from each interior environment showed differences in the rating of the Kelley Engineering Center conference room and the Bates Hall conference room. These circumplex results relate to findings discussed in the literature review of the Kwallek et al. article (2005). As these authors discussed, previous research has shown that “a warm environment, especially red, stimulates higher...feelings of arousal, whereas cool colors such as blue tend to elicit lower...arousability” (Kwallek et al., 2005, p. 474). Furthermore, this article discussed that light blue has been linked to pleasant responses (Kwallek et al., 2005). These findings relate to the results shown in this study by the circumplexes for the pleasure and arousal scores from the two interiors because the Kelley Engineering Center was positive on both the pleasure and arousal axes. The Bates Hall circumplex showed that participants scored the interior positive on the pleasure axis, but less so than the other interior, and negatively on the arousal axis. These circumplex differences mean that participants felt excited in the Kelley Engineering Center conference room and contented in the Bates Hall conference room. It could be, as discussed earlier, that here again color associations played a larger role in the emotional responses than planned. In summation,

based on the emotional response scale used in this study, users of the two environments did not rate the two interior environments similarly for pleasure and arousal; therefore, the second null hypothesis was rejected.

Dominance

The third null hypothesis stated that there would be no difference reported by subjects on the dominance scale in either the sustainable or the non-sustainable interior environment. This null hypothesis was tested with a two-sided paired t-test, which concluded that there was no difference reported by users. This statistical finding meant that subjects did feel similar levels of dominance in the sustainable Kelley Engineering Center conference room and the non-sustainable Bates Hall conference room. Dominance has been previously found to have a smaller role in the ratings of users' emotional responses to environments compared to pleasure and arousal (Russell, 1980). Since dominance was included in this study because it might play a role in the ratings of interior environments by users, it is not surprising that the third null hypothesis was accepted.

Satisfaction

The fourth null hypothesis of this study stated that the level of satisfaction felt by users in regard to thermal comfort, lighting, and noise would be similar in the sustainable and the non-sustainable interior environments. The results from the Wilcoxon signed-rank tests used to test this hypothesis were different depending on the variable. Thermal comfort and noise did not have significant p -values from the Wilcoxon signed-rank test, while lighting did. The results on thermal comfort may be because many interiors have set

controls on the temperature of a space. Thermal comfort can be controlled so that most users of a space do not feel too hot or cold. The noise results were particularly interesting when compared to the lighting results. During qualitative questioning, many subjects commented on a buzzing noise emitted from the lighting in the Bates Hall conference room. However, any negative feelings about this buzzing sound were not connected to the satisfaction of users to the noise level in the Bates interior environment. Instead, subjects related the sound to the perceived source, the lighting of the Bates interior. Therefore, the noise findings were not significant, meaning that subjects felt the same about the noise in the two interior environments based on the satisfaction scale developed by Anderson (2006). Lastly, the lighting in the interior environments did produce a significant *p*-value based on the Wilcoxon signed-rank test. This meant that subjects did feel differently about lighting in the sustainable and the non-sustainable interior environments. Leather, Pyrgas, Beale, and Lawrence (1998) discussed previous research, which found that the lighting of a space can impact user's responses. Leather et al. (2005) studied the relationship between sunlight, view, and stress in the work environment. These authors found that the "area of sunlight penetration" was related to job satisfaction (Leather et al., 2005). These previous findings could relate to the results of this study.

The Bates Hall conference room had multiple windows with exterior views and the Kelley Engineering Center conference room had one large frosted window with indirect exterior views. The window in the Kelley Engineering Center brought light into the space because there was a hallway, which had many windows with exterior views, on the opposite side of the window in the conference room, so the light carried from the hall into the window of the researched interior (See Figures 14 and 15). Both interior environments use T12 lamps with coding “F40CW/RS/EW/Alto” to supplement any natural sunlight penetration.



Figure 14. Photograph of the Bates Hall conference room.



Figure 15. Photograph of the Kelley Engineering Center conference room.

As shown in previous research, it could be that the amount of natural light that penetrated into the interiors of the conference rooms rather than the view influenced the lighting satisfaction scores reported by participants.

Limitations

This study had some limitations that affected the outcomes of the research. The first limitation was the lack of inclusion of the “Semantic Differential Measures of Emotional State or Characteristic (Trait) Emotions” scale questions in the Bates Hall conference room during the pilot study and also for a very small portion of the main study. The lack of inclusion of some pleasure and arousal questions meant that there were fewer data collected for the second null hypothesis compared to other portions of the study.

The second limitation of this study was that some subjects went to only one interior environment instead of both interior environments. It was intended for each

subject to complete a survey in each interior environment, allowing results for each subject to be compared for both interior spaces through the answers of the same users. As discussed throughout the paper, due to this situation, data were analyzed in groups: the all groups and the between group. Therefore, the focus of this research study was the between group, although it was smaller than originally planned.

The third limitation of this study was the unavoidable differences between the two interior spaces that affected the findings of the study. The upholstered fabrics and window styles used in the two interior spaces were not identical.

The buzzing noise emitted from the lighting in the Bates Hall conference room was a limitation of the study. It is unknown if the buzzing occurred constantly throughout the study or just episodically. If it did occur constantly, subjects could have heard it and not commented, not heard the sound, or heard the noise and reflected that in their scoring of the interior. If the buzzing occurred episodically, it is unknown which days and times the study was coinciding with the sound or how often the noise occurred.

During one session of the survey inside the Kelley Engineering Center, a person was playing the piano on the main floor, which could be heard inside the conference room. In addition, in the Bates Hall conference room children walked through the halls at times and made noises. The noises could have had an impact the responses of participants.

The survey responses were predominantly from women. This limits the generalizability of the findings. Ideally, there would have been more men participating in the study.

The buildings themselves could have influenced users' perceptions of the conference rooms. Participants had to walk through portions of the building before

entering the tested environments, which could have influenced their perceptions and ultimately the study results. In addition, some participants knew that the Kelley Engineering Center was built sustainably. This knowledge of the green aspects of the conference room could have colored these users' perceptions of the two environments. However, no participant directly linked preference to one interior over the other due to sustainability.

In addition, this study was limited due to the use of data collected through participant self-reporting. There may always be some inherent bias in data collected from self-reported responses. Lastly, this study may have been limited because emotional responses from participants are often subjective. This subjectivity may be hard to avoid when asking participants to report on their feelings, but researchers cannot deny the possibility.

Further study

Additional study on this topic could go in multiple directions. Since the study of sustainable interior environments is relatively new, researchers could focus on this topic in a variety of ways.

Researchers could collect information on the feelings of users in a sustainable compared to a non-sustainable interior space. Researchers could conduct the same or a similar study to this one, but in a different type of commercial interior or residential interior.

An additional way to continue this research topic could be to run a similar study, but start off the survey by asking if participants know about sustainability. After the data

has been collected, the researcher could divide the results into groups based on the subject having previous knowledge on the topic or not.

Another method could be used with two spaces that are both alike and non-sustainable. The researcher could tell participants that one is sustainable and the other is not. By including deceit into the method, the researcher may be able to find out more about the associations users make to sustainable spaces they “know” (believe) are environmentally friendly.

A researcher could use just one non-sustainable interior and tell half of the subjects that it is sustainable, explaining what that means and the other half that it is not. The study could then look at the impact of a subject “knowing” (believing) that a space is sustainable compared to when a participant does not have such knowledge about the interior. The researcher could then compare and contrast the results.

If users’ emotional reactions were not the focus, research could aim at perceived health effects of sustainable spaces to users. Sustainable spaces are created to have a less harmful effect on the earth. It could be interesting to see what expectations people have about the effect sustainable spaces have on human health.

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APPENDIX A
LEED NEW CONSTRUCTION CHECKLIST



LEED 2009 for New Construction and Major Renovation Project Scorecard

Project Name:
Project Address:

Yes No

☐ ☐ SUSTAINABLE SITES 26 Points

<input checked="" type="checkbox"/>	Prereq 1	Construction Activity Pollution Prevention	Required
<input checked="" type="checkbox"/>	Credit 1	Site Selection	1
<input checked="" type="checkbox"/>	Credit 2	Development Density and Community Connectivity	5
<input checked="" type="checkbox"/>	Credit 3	Brownfield Redevelopment	1
<input checked="" type="checkbox"/>	Credit 4.1	Alternative Transportation - Public Transportation Access	6
<input checked="" type="checkbox"/>	Credit 4.2	Alternative Transportation - Bicycle Storage and Changing Rooms	1
<input checked="" type="checkbox"/>	Credit 4.3	Alternative Transportation - Low-Emitting and Fuel-Efficient Vehicles	3
<input checked="" type="checkbox"/>	Credit 4.4	Alternative Transportation - Parking Capacity	2
<input checked="" type="checkbox"/>	Credit 5.1	Site Development - Protect or Restore Habitat	1
<input checked="" type="checkbox"/>	Credit 5.2	Site Development - Maximize Open Space	1
<input checked="" type="checkbox"/>	Credit 6.1	Stormwater Design - Quantity Control	1
<input checked="" type="checkbox"/>	Credit 6.2	Stormwater Design - Quality Control	1
<input checked="" type="checkbox"/>	Credit 7.1	Heat Island Effect - Nonroof	1
<input checked="" type="checkbox"/>	Credit 7.2	Heat Island Effect - Roof	1
<input checked="" type="checkbox"/>	Credit 8	Light Pollution Reduction	1

☐ ☐ WATER EFFICIENCY 10 Points

<input checked="" type="checkbox"/>	Prereq 1	Water Use Reduction	Required
<input checked="" type="checkbox"/>	Credit 1	Water Efficient Landscaping	2 to 4
<input checked="" type="checkbox"/>		Reduce by 50%	2
<input checked="" type="checkbox"/>		No Potable Water Use or Irrigation	4
<input checked="" type="checkbox"/>	Credit 2	Innovative Wastewater Technologies	2
<input checked="" type="checkbox"/>	Credit 3	Water Use Reduction	2 to 4
<input checked="" type="checkbox"/>		Reduce by 30%	2
<input checked="" type="checkbox"/>		Reduce by 35%	3
<input checked="" type="checkbox"/>		Reduce by 40%	4

☐ ☐ ENERGY & ATMOSPHERE 35 Points

<input checked="" type="checkbox"/>	Prereq 1	Fundamental Commissioning of Building Energy Systems	Required
<input checked="" type="checkbox"/>	Prereq 2	Minimum Energy Performance	Required
<input checked="" type="checkbox"/>	Prereq 3	Fundamental Refrigerant Management	Required
<input checked="" type="checkbox"/>	Credit 1	Optimize Energy Performance	1 to 19
<input checked="" type="checkbox"/>		Improve by 12% for New Buildings or 8% for Existing Building Renovations	1
<input checked="" type="checkbox"/>		Improve by 14% for New Buildings or 10% for Existing Building Renovations	2
<input checked="" type="checkbox"/>		Improve by 16% for New Buildings or 12% for Existing Building Renovations	3
<input checked="" type="checkbox"/>		Improve by 18% for New Buildings or 14% for Existing Building Renovations	4
<input checked="" type="checkbox"/>		Improve by 20% for New Buildings or 16% for Existing Building Renovations	5
<input checked="" type="checkbox"/>		Improve by 22% for New Buildings or 18% for Existing Building Renovations	6
<input checked="" type="checkbox"/>		Improve by 24% for New Buildings or 20% for Existing Building Renovations	7
<input checked="" type="checkbox"/>		Improve by 26% for New Buildings or 22% for Existing Building Renovations	8
<input checked="" type="checkbox"/>		Improve by 28% for New Buildings or 24% for Existing Building Renovations	9
<input checked="" type="checkbox"/>		Improve by 30% for New Buildings or 26% for Existing Building Renovations	10
<input checked="" type="checkbox"/>		Improve by 32% for New Buildings or 28% for Existing Building Renovations	11
<input checked="" type="checkbox"/>		Improve by 34% for New Buildings or 30% for Existing Building Renovations	12
<input checked="" type="checkbox"/>		Improve by 36% for New Buildings or 32% for Existing Building Renovations	13
<input checked="" type="checkbox"/>		Improve by 38% for New Buildings or 34% for Existing Building Renovations	14
<input checked="" type="checkbox"/>		Improve by 40% for New Buildings or 36% for Existing Building Renovations	15
<input checked="" type="checkbox"/>		Improve by 42% for New Buildings or 38% for Existing Building Renovations	16
<input checked="" type="checkbox"/>		Improve by 44% for New Buildings or 40% for Existing Building Renovations	17
<input checked="" type="checkbox"/>		Improve by 46% for New Buildings or 42% for Existing Building Renovations	18
<input checked="" type="checkbox"/>		Improve by 48%+ for New Buildings or 44%+ for Existing Building Renovations	19
<input checked="" type="checkbox"/>	Credit 2	On-Site Renewable Energy	1 to 7
<input checked="" type="checkbox"/>		1% Renewable Energy	1
<input checked="" type="checkbox"/>		3% Renewable Energy	2
<input checked="" type="checkbox"/>		5% Renewable Energy	3
<input checked="" type="checkbox"/>		7% Renewable Energy	4
<input checked="" type="checkbox"/>		9% Renewable Energy	5
<input checked="" type="checkbox"/>		11% Renewable Energy	6
<input checked="" type="checkbox"/>		13% Renewable Energy	7
<input checked="" type="checkbox"/>	Credit 3	Enhanced Commissioning	2
<input checked="" type="checkbox"/>	Credit 4	Enhanced Refrigerant Management	2
<input checked="" type="checkbox"/>	Credit 5	Measurement and Verification	3
<input checked="" type="checkbox"/>	Credit 6	Green Power	2



LEED 2009 for New Construction and Major Renovation Project Scorecard

Project Name:
Project Address:

Yes 7 No

Yes 7 No

2 MATERIALS & RESOURCES 14 Points

<input checked="" type="checkbox"/>	Prereq 1	Storage and Collection of Recyclables	Required
<input checked="" type="checkbox"/>	Credit 1.1	Building Reuse - Maintain Existing Walls, Floors and Roof	1 to 3
		<input type="checkbox"/> Reuse 55%	1
		<input type="checkbox"/> Reuse 75%	2
		<input type="checkbox"/> Reuse 95%	3
<input checked="" type="checkbox"/>	Credit 1.2	Building Reuse - Maintain Interior Nonstructural Elements	1
<input checked="" type="checkbox"/>	Credit 2	Construction Waste Management	1 to 2
		<input type="checkbox"/> 50% Recycled or Salvaged	1
		<input type="checkbox"/> 75% Recycled or Salvaged	2
<input checked="" type="checkbox"/>	Credit 3	Materials Reuse	1 to 2
		<input type="checkbox"/> Reuse 5%	1
		<input type="checkbox"/> Reuse 10%	2
<input checked="" type="checkbox"/>	Credit 4	Recycled Content	1 to 2
		<input type="checkbox"/> 10% of Content	1
		<input type="checkbox"/> 20% of Content	2
<input checked="" type="checkbox"/>	Credit 5	Regional Materials	1 to 2
		<input type="checkbox"/> 10% of Materials	1
		<input type="checkbox"/> 20% of Materials	2
<input checked="" type="checkbox"/>	Credit 6	Rapidly Renewable Materials	1
<input checked="" type="checkbox"/>	Credit 7	Certified Wood	1

Yes 7 No

INDOOR ENVIRONMENTAL QUALITY 15 Points

<input checked="" type="checkbox"/>	Prereq 1	Minimum Indoor Air Quality Performance	Required
<input checked="" type="checkbox"/>	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
<input checked="" type="checkbox"/>	Credit 1	Outdoor Air Delivery Monitoring	1
<input checked="" type="checkbox"/>	Credit 2	Increased Ventilation	1
<input checked="" type="checkbox"/>	Credit 3.1	Construction Indoor Air Quality Management Plan - During Construction	1
<input checked="" type="checkbox"/>	Credit 3.2	Construction Indoor Air Quality Management Plan - Before Occupancy	1
<input checked="" type="checkbox"/>	Credit 4.1	Low-Emitting Materials - Adhesives and Sealants	1
<input checked="" type="checkbox"/>	Credit 4.2	Low-Emitting Materials - Paints and Coatings	1
<input checked="" type="checkbox"/>	Credit 4.3	Low-Emitting Materials - Flooring Systems	1
<input checked="" type="checkbox"/>	Credit 4.4	Low-Emitting Materials - Composite Wood and Agrifiber Products	1
<input checked="" type="checkbox"/>	Credit 5	Indoor Chemical and Pollutant Source Control	1
<input checked="" type="checkbox"/>	Credit 6.1	Controllability of Systems - Lighting	1
<input checked="" type="checkbox"/>	Credit 6.2	Controllability of Systems - Thermal Comfort	1
<input checked="" type="checkbox"/>	Credit 7.1	Thermal Comfort - Design	1
<input checked="" type="checkbox"/>	Credit 7.2	Thermal Comfort - Verification	1
<input checked="" type="checkbox"/>	Credit 8.1	Daylight and Views - Daylight	1
<input checked="" type="checkbox"/>	Credit 8.2	Daylight and Views - Views	1

Yes 7 No

INNOVATION IN DESIGN 6 Points

<input checked="" type="checkbox"/>	Credit 1	Innovation in Design	1 to 5
		<input type="checkbox"/> Innovation or Exemplary Performance	1
		<input type="checkbox"/> Innovation or Exemplary Performance	1
		<input type="checkbox"/> Innovation or Exemplary Performance	1
		<input type="checkbox"/> Innovation	1
		<input type="checkbox"/> Innovation	1
<input checked="" type="checkbox"/>	Credit 2	LEED® Accredited Professional	1

Yes 7 No

REGIONAL PRIORITY 4 Points

<input checked="" type="checkbox"/>	Credit 1	Regional Priority	1 to 4
		<input type="checkbox"/> Regionally Defined Credit Achieved	1
		<input type="checkbox"/> Regionally Defined Credit Achieved	1
		<input type="checkbox"/> Regionally Defined Credit Achieved	1
		<input type="checkbox"/> Regionally Defined Credit Achieved	1

Yes 7 No

2 PROJECT TOTALS (Certification Estimates) 110 Points

Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points

APPENDIX B
SURVEY FOR BATES AND KELLEY

**Design and Human Environment**

Oregon State University, 224 Milam Hall, Corvallis, Oregon 97331

Tel 541-737-3796 | Fax 541-737-0993 | <http://www.hhs.oregonstate.edu/dhe>

You are being invited to take part in this study that is investigating interior environments. The purpose of this survey is to find out more about emotional responses to different interior environments.

You are being invited to participate because you are 18 years of age or older. If you choose to participate in this study you will be asked to complete the attached survey. Your participation is entirely voluntary and you may refuse to answer any question or stop the survey at any time.

You will be asked questions about two different interior environments. The survey will take approximately [10-15] minutes to complete per space.

There are no foreseeable risks associated with your participation in the study, and there are no direct benefits for participating. In the future, others might benefit from this study because the results may provide interior designers and community members with valuable information when it comes to emotional responses to sustainable and non-sustainable interior environments.

The information you provide will be kept confidential to the extent permitted by law. The information obtained in this study will only be viewed by the researchers. This information will be stored in a securely locked cabinet and in computer files that are not accessible to the public. Individual responses will not appear in the study's results.

If you have any questions regarding this survey please contact Reade Northup at northupr@onid.orst.edu or (971) 207-3459, or Marilyn Read at (541) 737-0982 or by email at Marilyn.Read@oregonstate.edu.

Thank You!

ID # _____

SURVEY

The questions below are regarding your feelings towards this interior space. There are short sections and each will include its own specific directions if needed. Please take your time.

SECTION 1

Please take your time in filling in all of the questions with your answers.

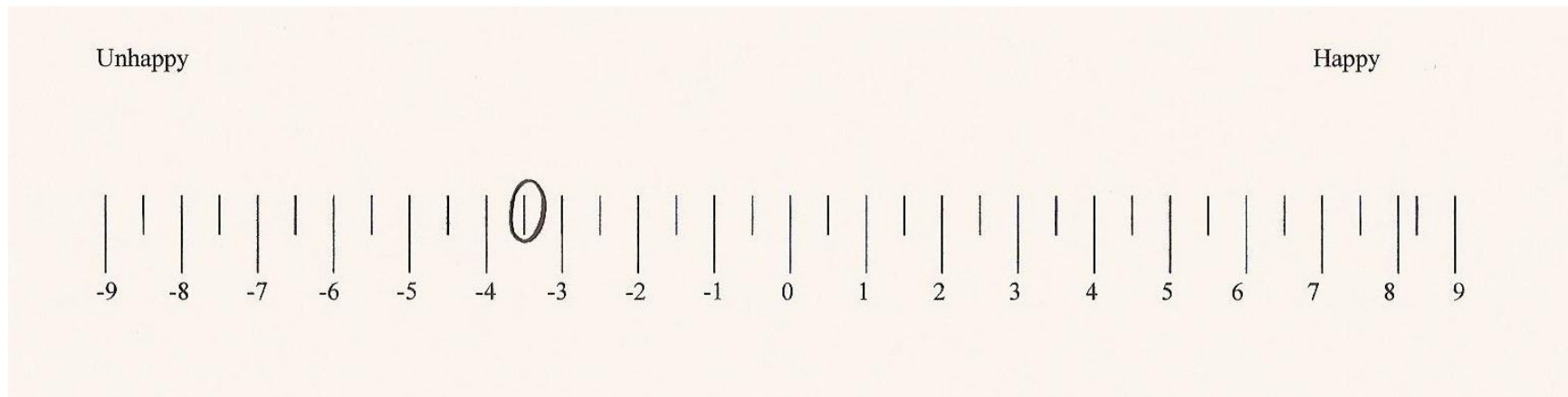
1. How do you feel today?

2. Is there anything happening today that you have been preoccupied with (i.e. a test, paper, etc.)?

SECTION 2

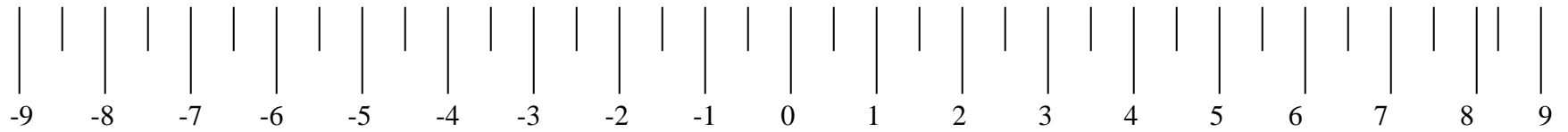
For the following section, please circle the tick mark that best applies to your **feeling in the space**. There is a range of tick marks between words that describe opposing feelings, so you must pick the tick mark that best suits your feelings about the space within the given range.

For Example =



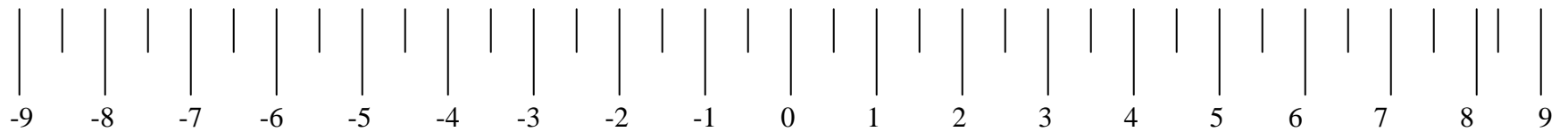
Unhappy

Happy



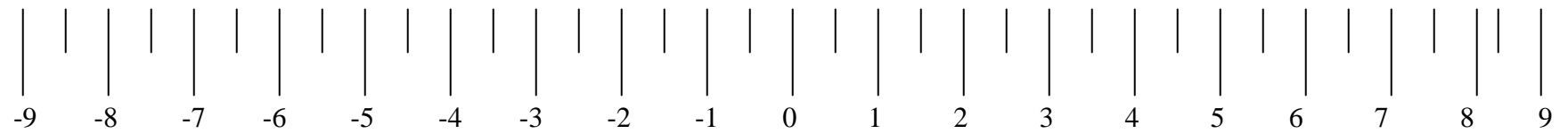
Annoyed

Pleased



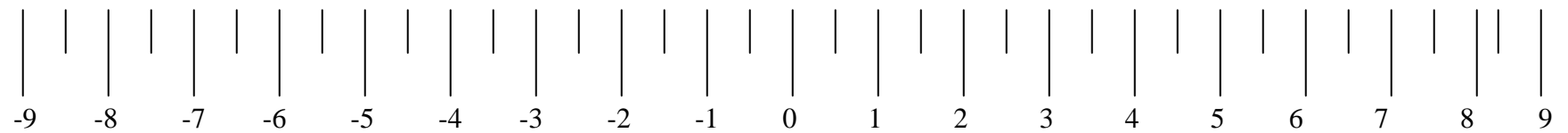
Relaxed

Stimulated



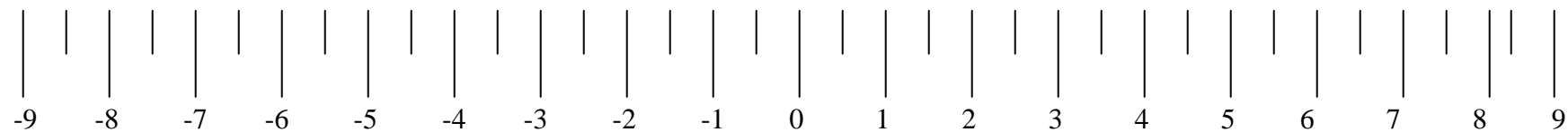
Unsatisfied

Satisfied



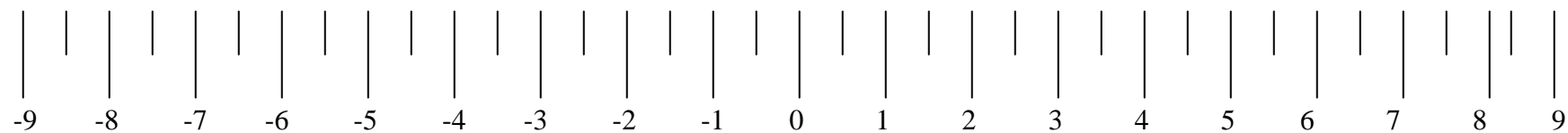
Melancholic

Contented



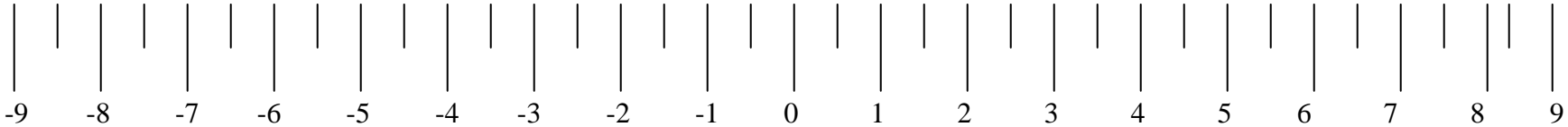
Despairing

Hopeful



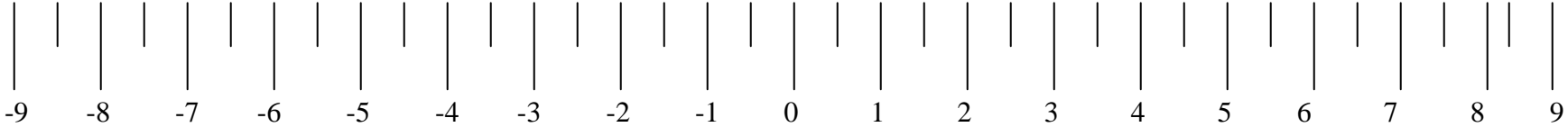
Sluggish

Frenzied



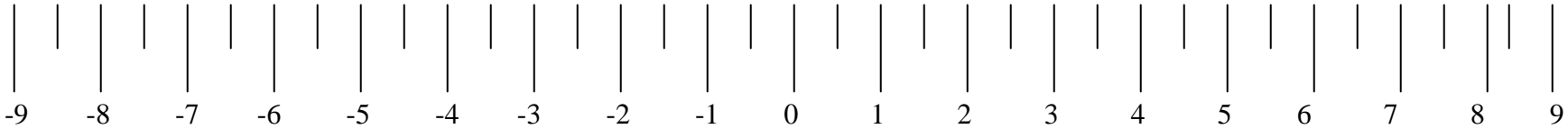
Bored

Relaxed



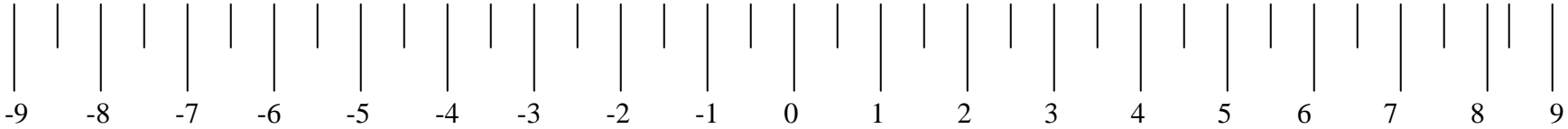
Calm

Excited



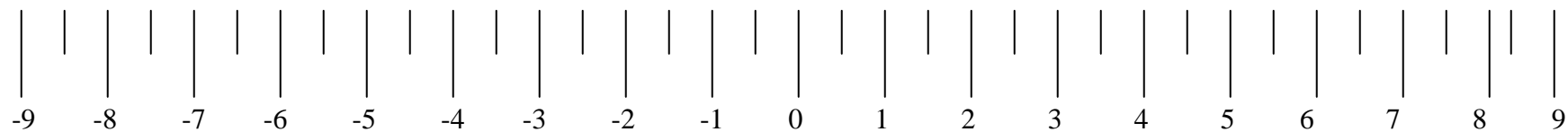
Dull

Jittery



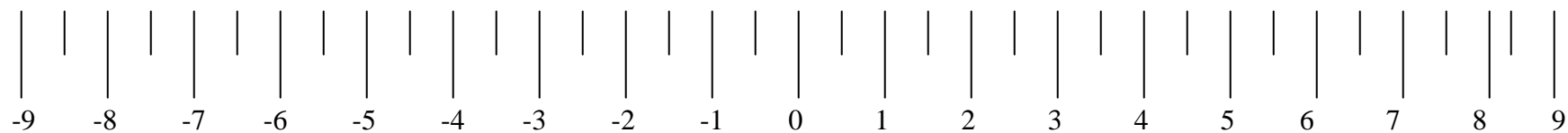
Sleepy

Wide-Awake



Unaroused

Aroused



SECTION 3

The following questions may be answered by circling the number and correlating statement that best suits how you feel.

For example:

How much time would you like to spend in this situation?

0: None

1: A few minutes

2: Half hour

3: One hour

4: A few hours

5: A day

6: A few days

7: Many, many days

1. How much time would you like to spend in this room?

0: None

1: A few minutes

2: Half hour

3: One hour

4: A few hours

5: A day

6: A few days

7: Many, many days

2. How much would you try to leave or get out of this room?

0: Not at all

1: Very slight

2: Slight

3: Slight to moderate

4: Moderate

5: Much

6: Very much

7: Extremely so

3. Once in this situation, how much would you enjoy exploring the room?

- 0: Not at all
- 1: Very slight
- 2: Slight
- 3: Slight to moderate
- 4: Moderate
- 5: Much
- 6: Very much
- 7: Extremely so

4. How much would you try to avoid any looking around or exploration in this room?

- 0: Extremely so
- 1: Very much
- 2: Much
- 3: Moderate
- 4: Slight to moderate
- 5: Slight
- 6: Very slight
- 7: Not at all

5. To what extent is this situation a good opportunity to think out some difficult task you have been working on?

- 0: Extremely so
- 1: Very much
- 2: Much
- 3: Moderate
- 4: Slight to moderate
- 5: Slight
- 6: Very slight
- 7: Not at all

6. How much would you dislike having to work in this situation?

- 0: Not at all
- 1: Very slight
- 2: Slight
- 3: Slight to moderate
- 4: Moderate
- 5: Much
- 6: Very much
- 7: Extremely so

7. To what extent is this a room in which you would feel friendly and talkative to a stranger who happens to be near you?

- 0: Not at all
- 1: Very slight
- 2: Slight
- 3: Slight to moderate
- 4: Moderate
- 5: Much
- 6: Very much
- 7: Extremely so

8. Is this a room in which you might try to avoid other people, avoid having to talk to them?

- 0: Extremely so
- 1: Very much
- 2: Much
- 3: Moderate
- 4: Slight to moderate
- 5: Slight
- 6: Very slight
- 7: Not at all

SECTION 4

1. How satisfied are you with the temperature in this space?

(Not at all satisfied) **1** **2** **3** **4** **5** (Very satisfied)

2. How satisfied are you with the visual comfort of the lighting (i.e. glare, reflections, contrast)?

(Not at all satisfied) **1** **2** **3** **4** **5** (Very satisfied)

3. How satisfied are you with the noise level in this space?

(Not at all satisfied) **1** **2** **3** **4** **5** (Very satisfied)

SECTION 5

Please take your time in filling in all of the questions with your answers.

1. Are there any other feelings that you want to describe about this interior?

2. What do you know about environmental sustainability/green design?

3. How do you feel about environmental sustainability/green design?

4. What do you know about this particular interior space (building)?

5. Have you visited this interior (building) before this date? Why?

SECTION 6

The following section will ask about your demographic information. Please circle or fill in the answer that best suits you. **Please do not fill this section out if this is the second space that you are completing the survey for.**

You are:

- A. Female
- B. Male

Your present age_____.

Which of the below best describes you? Circle all that apply.

- A. Black
- B. White
- C. Asian
- D. Hispanic
- E. Other_____.

Your year in school is:

- A. Freshman
- B. Sophomore
- C. Junior
- D. Senior
- E. Graduate Student
- F. Other

What is your major at Oregon State University?

You have now completed this survey! Thank you very much for your time and participation. Please give your survey to the survey proctor.

APPENDIX C
IRB PAPERWORK

Users Emotional Responses to a Sustainable Interior Environment and a Non-Sustainable Interior Environment

Principal Investigator: Dr. Marilyn Read

Student Researcher: Reade Northup

1. Brief Description

The purpose of this study is to explore the emotional reactions of users in sustainable interior spaces. A sustainable interior space is a place that has been constructed and finished using environmentally friendly practices and materials. In particular, this study aims to examine the difference in the emotional responses of people in a sustainable interior environment versus a non-sustainable interior environment. This study also aims to examine whether there are differences in the specific emotional responses of pleasure and arousal, and lastly the desire to remain in the space.

Evidence exists that people have emotional reactions to various interior spaces based on light quality, amount of space, color of the interior, material uses, and other factors, but no testing has been completed on emotional reactions to sustainability. The previous research that has been compiled involving sustainability has focused on product design (Chen & Burns, 2006). In particular, there is a lack of research on sustainable interior environments compared to non-sustainable environments. Due to this gap in knowledge about sustainability designed interior environments, little is understood about the impact of such spaces on the users of these spaces. Previous research has employed emotional scales to provide a way to measure the psychological impact of interior spaces on people (Mehrabian & Russell, 1974; Russell, 1980). Although this research has focused on emotional responses to spaces, investigation has not been completed testing people's feelings in sustainable interior environments compared to non-sustainable interiors environments. This research testing the emotional responses of users to a sustainable interior versus a non-sustainable interior will be used as part of a master's thesis, and the results may be used for publication and/or conference presentation.

2. Background & Significance

People are emotionally affected by that which surrounds them. Built structures surround people every day; therefore, they continuously influence the user's emotions within those surroundings. The term "built structure" can include a variety of elements, including an interior space, exterior space, or entire building. The influence of an interior environment on the emotions of the users of sustainable and non-sustainable spaces is the focus of this research study.

Sustainability has become a prevalent topic in popular culture and has permeated the interior design community. Sustainable building practices have been implemented in many building projects, but all of the effects are not known. Much is known about the positive impacts that sustainability has on interior spaces, such as enhanced air quality, lower energy expenditure, and less water use, but the emotional impacts of sustainable spaces on the people that use them is not known. Specifically, this study will examine the influence that a sustainably designed interior environment has on users' feelings within the space. In this time where sustainable practices have moved past a phenomenon and into common practice, it will be helpful for designers to know as much about the impacts of sustainability as possible.

Previous research has explored the meanings of spaces to people through the use of emotional response scales (Mehrabian & Russell, 1974; Russell, 1980). Emotions or emotional responses can be defined as a way to get information about the stimuli that users encounter in an interior environment (Mehrabian & Russell 1974; Morris, 1989; Russell, 1980). The emotions that a person feels in a space can greatly impact how he or she comes to view that interior environment. For example, if a person has negative emotional responses to a space, he or she may not want to spend a great deal of time in that place. In contrast, if an interior environment brings out positive emotional responses in a human, then he or she will most likely feel an affinity towards the interior. Therefore, this means that the emotional responses of a user within a space may give more information about the space (Damasio, 2000). In this study, by testing people's emotional responses to a sustainable and a non-sustainable interior

environment, knowledge may be gained about the emotional impact of sustainable spaces.

3. Methods & Procedures

There are two parts to this study. In Part I, users will be surveyed in the non-sustainable Bates Hall conference room on the Oregon State University campus. In Part II, users will be surveyed in a sustainable Kelley Engineering Center conference room on the Oregon State University campus. Data will be collected regarding these two interior spaces only.

The subject recruitments for Part I and Part II will be identical. Subjects will complete questionnaires for both spaces. In order to recruit subjects, instructors of Design and Human Environment classes will be asked if their students can participate in this research study. Instructors of those classes may give extra credit for participation in this study; the amount of extra credit, if any, will be determined by the instructors.

Both Part I and Part II of the study are the same in procedure except that they take place in different locations. Each subject will show up at the first survey site for Part I. At this time, the subject will be given the consent forms to sign (Appendix II) and the surveys with matching identification number (Appendix I). This identification number will be the same for Part I and Part II. The survey will then be completed in Bates Hall for Part I and turned into the researcher. The subject will then complete the second survey (with the same identification number) for Part II in the Kelley Engineering Center conference room. By giving the subjects identification numbers, answers from one person about the sustainable and non-sustainable interior environment may be compared during analysis without divulging the identity of the subject.

The two surveys for Part I and Part II are identical except for the demographic section. After a subject completes the first survey, which includes the demographic section in Part I, all of the demographic information required for the study will have been obtained. Because of the use of identification numbers, the demographic information recorded from the first part of the study may be matched to the second part, so there is no need for repetition. After the subject completes the second survey in the

Kelley Engineering Center, it will be turned in, and the subject has completed the research process.

After all of the surveys are collected, analysis of the data will begin. Answers from the survey from Part I will be compared with those from Part II. Quantitative questions will be interpreted statistically using the statistical program “Stata.” The qualitative answers will be interpreted through content analysis by finding similar themes over multiple surveys. Once all of the data is analyzed, the information will be included as part of a master’s thesis.

4. Risks/Benefit Assessment

- Risks: There are no foreseeable risks associated with participation in the study.
- Benefits: There will be no direct benefits for participating in the study.

However, students may receive extra credit from their instructor for participating in this research process. Also, the results of the study may provide community members with valuable information about sustainable spaces and the emotional reactions felt by the people that use them.

- Conclusion: In all, there are no foreseeable risks and no direct benefits to participants. However, the study’s results may provide valuable information about emotions evoked in sustainable spaces compared to non-sustainable spaces.

5. Participant Population

For this research, as many as 60 individuals may take part in the survey process. All individuals who are 18 years of age or older will be eligible to participate. In addition, the participants are not restricted to any gender or ethnic group.

6. Subject Identification and Recruitment

For Part I and Part II, instructors of classes at Oregon State University will be asked to allow students in their classes to participate in the study. Instructors from the Design and Human Environment Department will be contacted for this research process. Furthermore, instructors will be told that they may offer extra credit for participation by

a student in the research process, assuming the student completes both Part I and Part II of the survey. In addition, only students who are 18 years or older may participate in the study.

7. Compensation

Participants may be compensated for taking part in this study. Compensation for participation will only be in the form of extra credit in an Oregon State University class, as decided by the instructor of that class.

8. Informed Consent Process

For Part I, a cover letter (or start page) will give information related to informed consent that will be signed by each participant (Appendix I). The purpose of the study and the rights of participants will be repeated on the cover letter and the informed consent (Appendix II) so that each subject has a clear knowledge of his or her rights. In addition, subjects will read and sign an informed consent document giving their consent to take part in this research process (Appendix II).

9. Anonymity or Confidentiality

Participants will be informed that the responses they give will remain confidential in the cover letter (or start page) that will accompany the survey (Appendix I) and in the consent form (Appendix II). The surveys will not include any identifying information to link the results back to the participant other than the identification number. In order to inform instructors of Design and Human Environment classes that a student has completed the two surveys and can receive extra credit (if offered), a sheet with signature by the student researcher will be given to the student to give to the instructor (Appendix III). The principal investigator and student researcher are the only individuals who will have access to the results of the surveys. The results will be kept in a locked cabinet in the student researcher's office and on the principal investigator and student researcher's personal computers, which are private and not accessible by others. Individual identities of participants will not be associated with the project's results and thus will not be included in the research paper.

APPENDIX I

Your student has completed the surveys required for the research project *Users Emotional Responses to a Sustainable Interior Environment and a Non-Sustainable Interior Environment* and can receive extra credit if offered by you.

Thank you,

Reade Northup
northupr@onid.orst.edu

APPENDIX II INFORMED CONSENT DOCUMENT

PROJECT TITLE: USERS EMOTIONAL RESPONSES TO A SUSTAINABLE INTERIOR ENVIRONMENT AND A NON-SUSTAINABLE INTERIOR ENVIRONMENT

Principal Investigator: **Marilyn Read, Design and Human Environment**

Co-Investigator(s): **Reade Northup, Design and Human Environment**

WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to investigate the factors that influence emotional responses in sustainable and non-sustainable interior environment. We are interested in understanding the extent to which people react or do not react emotionally to interior spaces that are similar with exception to being sustainable. We are studying this because the findings from this study are expected to provide useful information about the manner in which people react emotionally to sustainable interior environments, and this information will be used to enhance the knowledge about the impact of interior spaces on users.

WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you can be defined as a user of interior spaces that may be sustainable or not. You must be 18 years of age or older to participate in this study. Your participation in this study is entirely voluntary and you may refuse to answer any question or stop the interview at any time.

WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

If you choose to participate in this survey, you will be asked to visit two locations and fill out the survey in both places. During the survey you will be asked questions about the particular space you are in and the emotions that you are experiencing in that space. If you agree to take part in this study, your involvement will last for approximately 30 minutes, 15 minutes at each of the two locations.

WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks associated with your participation in the study.

WHAT ARE THE BENEFITS OF THIS STUDY?

You will not benefit from being in this study. However, we hope that, in the future, other people might benefit from this study because the findings from the study are expected to provide useful information that can help interior designers knowledge about the impact of sustainable spaces on the users of those spaces.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study. You may be receiving extra credit in a current class for your participation in this study, which will be up to your instructor.

WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. To help protect your confidentiality, we will give you an identification number so that your surveys may be matched up but your person may be kept unknown. If the results of this project are published your identity will not be made public.

DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering. You will not be treated differently if you decide to stop taking part in the study. You are free to skip any questions that you would not prefer not to answer. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Reade Northup at (971) 207-3459 or by email at northupr@onid.orst.edu or Dr. Marilyn Read at (541) 737- 0982 or by email at Marilyn.Read@oregonstate.edu.

If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator, at (541) 737-4933 or by email at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

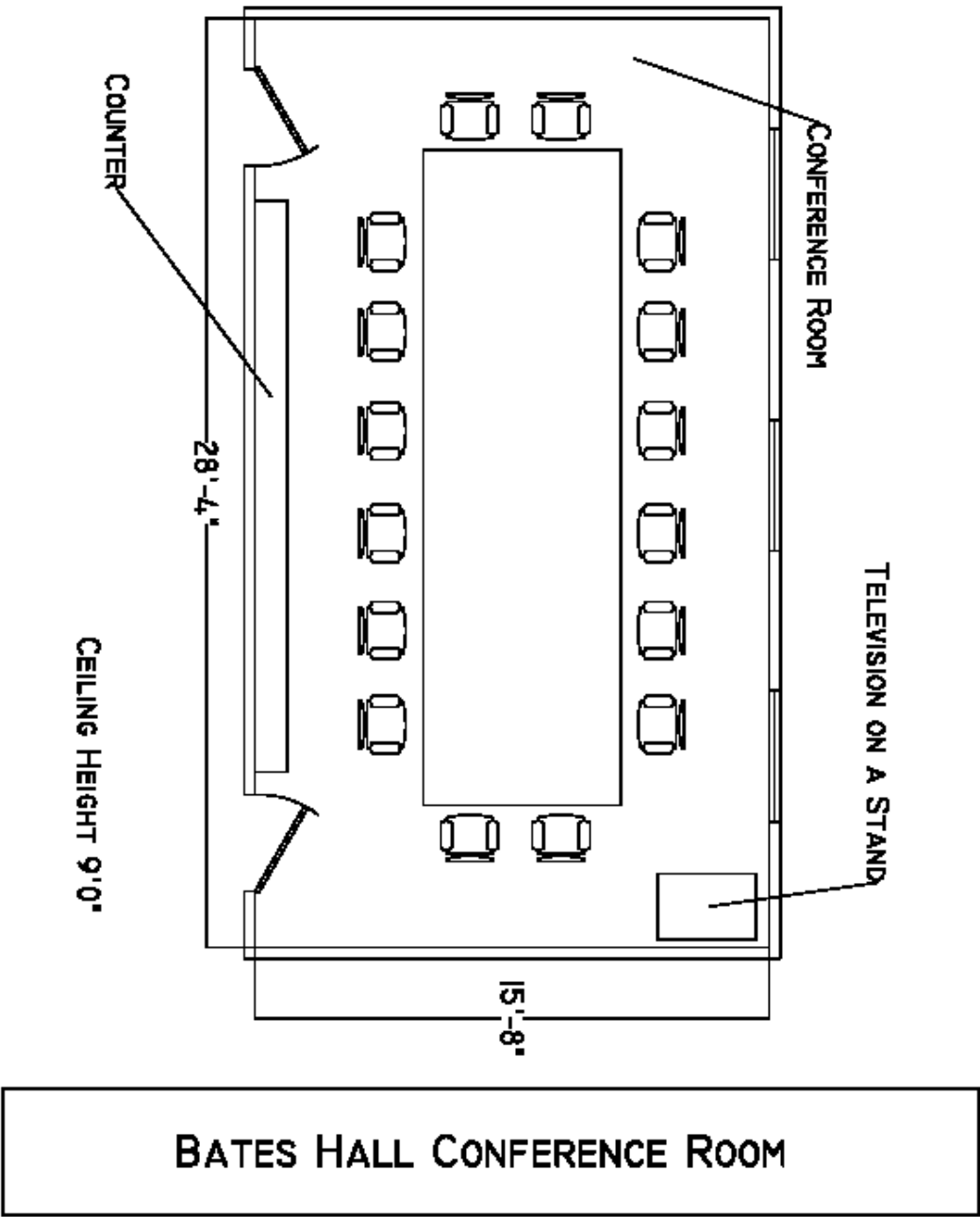
Participant's Name (printed):

(Signature of Participant)

(Date)

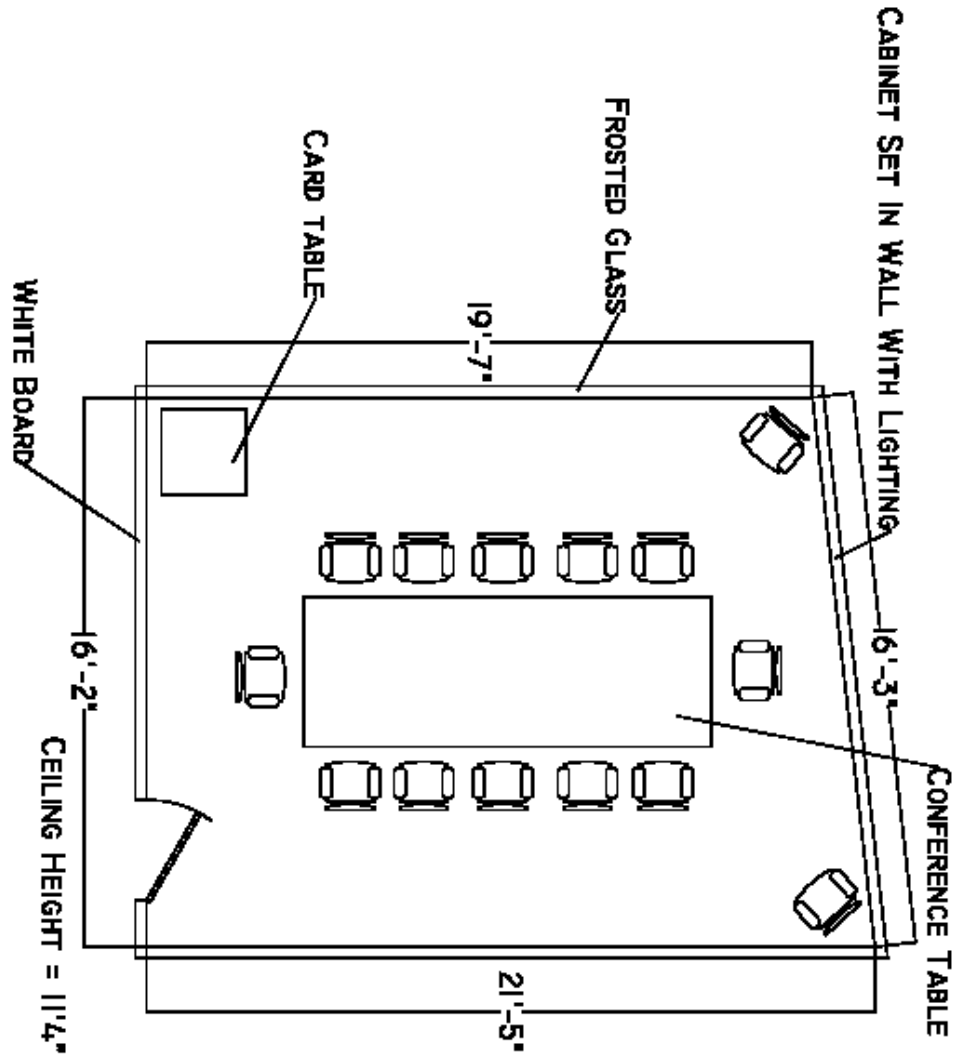
APPENDIX D

BATES HALL CONFERENCE ROOM FLOOR PLAN



APPENDIX E

KELLEY ENGINEERING CENTER CONFERENCE ROOM FLOOR PLAN



KELLEY ENGINEERING CENTER CONFERENCE ROOM