12-11-2009

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VISUAL PERCEPTION AND GESTALT GROUPING IN THE LANDSCAPE: ARE GESTALT GROUPING PRINCIPLES RELIABLE INDICATORS OF VISUAL PREFERENCE?

By

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A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Landscape Architecture
in Landscape Architecture
in the Department of Landscape Architecture

Mississippi State, Mississippi

December 2009

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Title of Study: VISUAL PERCEPTION AND GESTALT GROUPING IN THE LANDSCAPE: ARE GESTALT GROUPING PRINCIPLES RELIABLE INDICATORS OF VISUAL PREFERENCE?

Pages in Study: 172

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Landscape visual preference research has indicated many potential indicators of preference; however a comprehensive framework concerning the relationship between visual preference and perception has not been solidified. Gestalt psychology, the predecessor to visual perception, proposes certain visual grouping tendencies to explain how humans perceive the world. This study examines if Gestalt grouping principles are reliable indicators of preference, and if they may be used to develop a broad context for visual assessment.

Visual preference for 36 landscape scenes testing the proximity and similarity of landscape elements were ranked one through five by 1,749 Mississippi State University undergraduate, graduate, and faculty members in a web-based preference survey. Using a two-way between groups analysis of variance (ANOVA) to analyze responses, the results indicate that the proximal and similar configuration of landscape elements within a scene does significantly affect visual preference.

DEDICATION

To Kell and Betty Martin

ACKNOWLEDGEMENTS

In any undertaking like this there are so many people who deserve to be recognized. I only have space to mention a handful here, but trust that those of you who are not mentioned know who you are and how you contributed to the completion of this work.

My committee has provided insight and guidance throughout the research and writing process and deserves recognition. Sadik Artunc, Bob Brzuszek, and Taze Fulford have dedicated their time and energy graciously and without hesitation; I am deeply grateful. A special thanks to Bob, who spent extra time examining the text. In all of my years in school, I have never seen a more dedicated staff of educators than the Landscape Architecture faculty at Mississippi State University. I have truly benefited from their hard-work and enthusiasm.

Dr. Roger Stocker, Mississippi State University Assistant Professor of Mathematics and Statistics, and Qian Wang, Mississippi State University graduate student, were instrumental in the data analysis of this research. To my fellow graduate students: thank-you all!

Finally, God has granted me many blessings. One such blessing is my family—thank you mom and dad for lovingly motivating me, and Philip and Andrew for your encouragement.

Susanna, this would not have been possible without your support and patience.

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CHAPTER I

INTRODUCTION

Species innately select environments that give them the best chance of survival (Charlesworth, 1976). Complex species, like humans, do more than select suitable environments. Humans are capable of selected environments based on aesthetic preference (S. Kaplan, 1979). Psychologists define preference as an outcome of complex processes that results from perceiving a space, and reacting to its usefulness (S. Kaplan, 1979). Deductively, then, humans are predisposed to prefer certain landscapes.[1] This line of reasoning, that certain landscapes are innately preferred, acts as a justification for landscape theory, and makes visual preference research an extremely important topic.

Recent inclusion of public perception in the definition of landscape in the European Landscape Convention (Council of Europe, 2000) is illustrative of the growing concern to understand how visual perception and landscape preference are linked. Although the reposition by the Council of Europe substantiates the significance of visual perception in public landscape policy, it is a declaration, not an explanation. Furthermore, a recent resurgence of the topic of landscape preference studies in academia signifies that researchers are more concerned than every to understand which landscape humans prefer and why—"for more empirical evidence is needed to understand the

[1] This notion is support by visual preference researchers Kaplan (1979), Kaplan et al. (1989), Ulrich (1983), Coetereier (1996), and Sevenant and Antrop (2008)

interrelationships between different preferences related to landscape perception" (Sevenant and Antrop, 2008).

Background

One of the results of the massive human-induced decay of the environment occurring in the past 30 years is an increased public awareness of the landscape as a visual resource (Acar and Sakici, 2008). The piece of legislature responding to this effect was the National Environment Policy Act of 1969 which set in motion the systematic assessment of landscapes that had previously been unquatified (Kent, 1993). In an effort to understand how people perceive their environments, which landscapes people tend to prefer, and what attributes are indicators of visual preference preference, several methods emerged under the broad term landscape visual assessment. As researchers sought to scientifically quantify visual preferences and emotional responses to landscapes for the first time in history, a number of landscape assessment paradigms emerged. Zube, Sell, and Taylor (1982) and Daniel and Vining (1983) classified these paradigms (discussed in Chapter II), but found that each model had serious deficiencies (Kent, 1993). Moreover, researchers blamed the problem on a lack of landscape assessment theory (Kent, 1993).

Landscape assessment theory is based on the conceptual notion that humans, as evolutionary and adaptive species, will select attributes that increase chances of survival. Appleton's (1975) prospect-refuge theory, Ulrich's (1983) psychoevolutionary framework, and Kaplan and Kaplan's Informational model (1998) (discussed thoroughly in Chapter II) all conclude that there are certain attributes of landscapes that are preferred, regardless of the user attribute (Sevenant and Antrop, 2008). Furthermore, although researchers use different criteria in their assumptions about visual preference indicators, each landscape theory has been tested with reasonable reliability. More recent studies, like Coterier (1996), confirm the notion that certain attributes of a landscape are selected based on biological factors, not individual or cultural factors (Sevenant and Antrop, 2008). And while researchers have determined that cultural and individual may affect visual preference (Tveit, 2008), it does not disprove the notion that "most people see the same attributes as relevant" (Sevenant and Antrop, 2008). A fundamental characteristic of this study revolves around the concept that certain landscape attributes appeal to a broad-based audience on the most basic level—visual perception.

Psychology of Form, Gestalt, and Visual Perception

The cognitive process by which a person understands a landscape scene is a complicated series of steps occurring more or less instantaneously. Humans do not create the world, they apprehend the order and meaning that exists in the world (Murphy, 1949). To understand the process of recognition, and eventually preference, one must grasp the order awaiting apprehension and how a perceiver moves from one orderly form to another creating order in succession (Murphy, 1949). These task, as early as 1910, fell to a sect of German psychologists referred to as the Gestalt school. In determining the laws of visual perception, the Gestalt psychologists redefined the entire theory of cognition including perception, learning, thinking, and imagining (Murphy, 1949). Their method of defining visual order was to observe and experiment with visual phenomena. Psychology chronicler Robert Woodworth says:

> If the Gestalt psychologists had contented themselves with theoretical considerations…their school would not have shown the great vitality that it does show. They were experimentalists, however, and proceeded to take their guiding principle into the laboratory and to follow its lead in devising many novel and suggestive experiments. They have studied problems new and old—mostly old, but approached from a new angle; and they have obtained results which challenge the attention of all psychologists. (Woodworth, 1931)

A classic example of this experimental approach is illustrated in Gestalt "leading spirit", Max Wertheimer (Woodworth, 1931). Wertheimer, Czech-born psychologist, formulated the idea of Gestalt theory while observing flashing lights at a railroad crossing that resembled a theater marquee (Behrns, 1998). He exited the train in Frankfurt to purchase a motion picture toy called a "zoetrope" which began a series of experiments conceptualizing the visual experience (Behrns, 1998).

The basic concept of Gestalt is that a whole is not simply a sum of its parts, but a "'whole effect'" (Beherns, 1998). The "whole effect" is sometimes confused with a greater effect, but is more precisely a different effect. The familiar statement—"The whole is greater than the sum of its parts"—inaccurately describes the Gestalt concept. Psychologist Von Ehrensfels, who conceived the term Gestaltqualität— English translation, "form quality," observed that melodies are noticeable when played in different keys, even though all of the notes are different (Murphy, 1949). This straightforward illustration is perhaps the most germane example of a gestalt, one that is still studied today in psychology. Von Ehrensfels, Wertheimer's teacher and forerunner, did not attempt to solve the questions of what to do with the new elements; he merely took note (Murphy, 1949).

Much scientific investigation ensued Von Ehrensfels conjecture, experimentation which laid the groundwork for Wertheimer's 1923 paper entitled, "Laws of Organization in Perceptual Form." In "the dot essay," as it is now common referred to, Wertheimer unfolds a series of perceptual principles that guide the visual system in its clarification of the retinal image, i.e. visual perception (Wolfe et al., 2006). These Gestalt rules explain which elements in an image will appear as a group (Wolfe et al., 2006). Wertheimer named seven factors in his groundbreaking essay: proximity, similarity, objective set, direction, the common fate, good curve, good continuation, and closure. Today, in psychology textbooks, four of the original seven grouping principles remain—proximity, similarity, continuation, and common fate.

The grouping principles of proximity, similarity, and similarity/proximity are the focus of this study. The cognitive paradigm, attributed to the seminal works of Jay Appleton and Stephen and Rachael Kaplan, (refer to Chapter II, "Theories of Cognitive Processes") theorizes that human preference can be explained by either 1) the role of visual perception on the evolutionary survival instinct or 2) the role of visual perception on humans' information-seeking capacity (Appleton, 1975; Kaplan et al., 1998). This study, while technically classified as a cognitive approach to visual assessment, does not focus of landscape context or process as previous studies have (Kent, 1993). Instead, this study will test whether the Gestalt grouping patterns of proximity, similarity, or proximity/similarity are significant and reliable indicators of visual preference regardless of landscape context, process, or user attribute.

Research Background

Research Motivation

There are three compelling reasons for studying the application of Gestalt theory on visual assessment research and landscape theory. In order to capture the ubiquity of Gestalt, the three reasons are outlined generally.

First and foremost, is the belief that visual perception research has concentrated too much on the details without fully understanding the general situation. To use an American idiom—visual perception research in landscape fields has "missed the forest for the trees." Even a hasty review of visual perception studies in landscape fields reveals that most studies are so specific that they fail to mention Gestalt as the basis of visual perception. More empirical evidence is needed to establish a general landscape perception theory which employs the Gestalt's original principles.

Secondly, even as Gestalt theory has made headway in other aesthetically-minded professions, landscape architecture has been slow to apply the principles, or at least sluggish to recognize just how relevant Gestalt theory is to the design process. Gestalt in architecture is illustrated in Walter Gropius' Bauhaus movement (Behrens, 1998). Perhaps, more than any other field, art has accepted Gestalt as a guiding philosophy. Behrens says, "None of the gestalt psychologists were artists, much less designers, but early on there were signs of mutual interest between the two disciplines (1998). Gestalt psychology's most enduring influence on design is Wertheimer's "the dot essay" which explained that humans will group elements that "look alike, are close together, or have structural economy" (Behrens, 1998). Moreover, in Rudolph Arheim's "Gestalt and Art" essay, the notable Gestaltist and art critic points out that a melody, an artistic creation, was the first example of a whole, whose structure is unexplainable by the qualities of a single element, or the relationship between the elements (Arnheim, 1943).

It is high time in landscape perception research to apply Wertheimer's grouping principles as established in "the dot essay" to visual perception—a topic that is in many ways based on Gestalt, but has not completely realized it.

The final research motivation is the most pragmatic—Gestalt theory applied to landscape visual assessment and visual resource management may be used to combat the threatening and constant human-induced environmental decay. There is a great need for concise, easy-to-use visual assessment method that can accurately and efficiently quantify general preferences and attitudes of a landscape in order to preserve and protect visual resources. If the grouping principles of proximity and similarity significantly affect visual preference, then developing a conceptual method to quantify landscape preference in the most general terms is plausible. The first step to measuring the efficacy of Gestalt grouping principles as preference indicators is to develop workable objectives.

Research Objectives

The objectives in this research progress from specific to general. The first objective forms the empirically-testable hypothesis. The second objective determines if the results of the hypothesis are culturally and contextually insulated. Finally, the third question applies the research to landscape architecture broadly. The analysis will concentrate on the following questions:

- Are the Gestalt grouping principles of proximity, similarity and similarity/proximity reliable indicators of visual preference?
- If so, can Gestalt grouping principles be used to predict aesthetic preferences between different, unrelated landscape types? Can the Gestalt grouping tendencies predict preference regardless of user attribute?
- What are other possible implications for Gestalt theory in landscape visual assessment research, landscape preference research, landscape theory, and landscape architecture generally?

Visual Preference Survey

To accomplish the research purposes as stated above, a web-based preference survey will administer the landscape scenes and collect responses ratings. Landscape scenes will be viewed independently, using the online survey software QuestionPro™. Participants will be asked to rate their "liking" toward a certain scene on a one to five likert scale. The response data will serve as the dependent variable for one of three levels within the independent Gestalt variable: proximity, similarity, similarity/proximity. Landscape scenes used in the survey are designed to test a number of landscape types, but more importantly a range of 'Gestalt levels." Scenes containing more noticeable Gestalt patterns than the control scenes (i.e. no discernable Gestalt patterns) are considered "highly discernable" Gestalt scenes. Statistical analysis of the response data will determine how reliable the Gestalt grouping principles are as indicators of visual preference.

The mean preference score for each landscape scene will be used to form conclusions only after a test of between subjects effects from a two-way between groups analysis of variance is produced. If the independent variable significantly affects the preference response rate, conclusions can be drawn safely.

Organization of this Document

This study is organized into five chapters. The current chapter introduces the background of visual assessment research, the cognitive paradigm, Gestalt psychology, and landscape theory. Chapter I also explains the research motivation and the purposes of the thesis.

Chapter II, the LITERATURE REVIEW, explores more deeply the pertinent topics of visual assessment paradigms, visual assessment theory, cognitive process, the Informational Model, Gestalt psychology, Gestalt grouping rules, and potential application of Gestalt principles as means of visual assessment. The purpose of the literature review is to familiarize readers with the state-of-the- art in landscape visual assessment, as well as inform readers of the many faceted functions of Gestalt in other aesthetic fields. A clear understanding of Gestalt theory is crucial because this method evaluates landscape visual preference through the Gestalt grouping principles of proximity and similarity.

The METHODS chapter, Chapter III, is a detailed account of various visual preference methods. Historically, landscape preference research has not followed a single method; this chapter carefully outlines a few common methods used to measure landscape preference. Chapter III concludes that no established method perfectly fits the present research model, therefore, a hybrid visual preference method will best test the research hypothesis.

The hybrid visual preference method is carefully examined in Chapter IV, entitled the STUDY. In Chapter IV, details of the visual preference method are accounted so that the study may be repeated for reliability tests. Details of the survey including the following sections: digital photography, scene coding, software/interface aesthetics, photograph order, and timeline.

RESULTS, DISCUSSIONS, and CONCLUSIONS are the focus of Chapter V. Chapter V reveals the empirical findings of the visual preference survey—the statistical justification for answering the aforementioned research questions. The final three sections—conclusions, limitations, and suggestions for future research—respond to the final research question which includes Gestalt application in landscape visual assessment, and other “big picture” topics.

CHAPTER II

LITERATURE REVIEW

Introduction

This literature review surveys current research in the field of visual landscape assessment as it applies to landscape perception and visual landscape preference. As the primary vehicle for preference research in landscape architecture, visual assessment studies, as well as related visual perception theory, will be discussed, in order to establish a context for the current preference study. This section can be subdivided into three general parts. Chapter II begins with an overview of relevant terms, historical context, and significance of visual assessment. The middle portion of the literature review discusses current visual assessment paradigms, theoretical basses, and highlights the cognitive paradigm of visual assessment. The final portion of the literature review explores the concept of Gestalt psychology as a means to assess visual landscapes. The purpose of the literature review is to assess current visual preference literature in order determine the most appropriate method for testing the concept of Gestalt as an indicator for visual preference predictors.

Defining Landscape

The breadth and diversity of landscape architecture is corollary to the ambiguous term landscape. For this reason, before forging ahead in the study of landscape visual preference, the term landscape must be developed. Literature suggests that there remains question in how to define the term landscape (Cosgrove, 1985). Researchers have described the term landscape as “confusing.” (Riley, 1987). J.B. Jackson (1984) echoed this sentiment explaining that although everyone thinks they “understand” the meaning of landscape, no one agrees on the meaning of it. In the broadest sense, landscape means “the object of one’s gaze,” or virtually anything in sight (Oxford English Dictionary, 1998). To limit the scope, researchers will qualify a landscape or associate behavioral responses to the meaning of a landscape (Riley, 1987). Descriptive landscapes have portrayed everything from Szymanski’s “low” landscape of the Nevada brothel (1974), to the dietary landscape of food and drink studied by Zelinksy (1973) (Riley, 1987). Even the emergence of fast-food chains on the land has evoked landscape studies (Riley, 1987).

The English noun “landscape” is derived from the Dutch word landschap, a painter’s term describing natural scenery of land (Oxford English Dictionary, 1989). In its original form, the term landschap referred to piece of inland scenery that was primarily the background to a portrait or a figure (Oxford English Dictionary, 1989). The Germanic root landschaft, developed later, referred to a “cultivated space surrounded by wilderness” (Murphy, 2005). Geographer Jackson (1984) defines a landscape as “an environment modified by the permanent presence of a group.” Barrell (1972) describes landscape as the physical setting where human interactions occur. In both definitions human interaction and human adaptation of the physical environment characterizes a landscape (Jackson, 1984; Barrell, 1972). While geographers agree that human activity is a defining characteristic in landscape, others believe nature itself forms a landscape when human activity is not present (Rose, 1992) In this viewpoint, the landscape is itself a "medium", although it is rare to find a place in the environment that has not been affected by human activity (Rose, 1992; Murphy, 2005). Landscape ecologists use a spatial approach focusing specifically on the heterogeneity across a range of scales to study ecosystem processes and the flow of energy, minerals and species (Turner, et al. 2001). Landscape architect Michael Murphy defines landscape broadly "encompassing the totality of our physical surroundings: environment, place, region, and geography" (2005). According to Murphy, all contiguous definable land is considered a landscape (2005).

While a generally accepted definition of landscape remains elusive, in the context of the current research, the term landscape will refer to the retinal projection of the image observed, perceived, and understood by viewers. With the ambiguity surrounding the term landscape, the complexity in defining visual assessment of landscape should not be startling.

The Birth of Visual Assessment

According to Lambe and Smardon (1986) the visual landscape is an important part of human's everyday life experience (Bulut and Yilmaz, 2008). Nevertheless, the task of measuring the landscape objectively—to determine which characteristics of the landscape are preferred—is a relatively new phenomenon. Prior to 1960, visual assessment was an emerging field, limited to the doldrums of academic studies. During this period, the public was largely unaware of the relationship of landscape perception and visual preference. Not until 1969, with the passage of the National Environmental Policy Act (NEPA), was there a requirement for a systematic approach to visual landscape assessment. NEPA was designed to "regulate the decision making process of the federal agencies" by requiring agencies to adhere to a "systematic" and "interdisciplinary" approach to "decision-making that may have an impact on the environment" (NEPA IB, NEPA III.A.102(2) [A]). Evidence of this mandate is seen in procedural approach of the Visual Resource Management System and Scenic Management System employed by the U.S. Department of Agriculture (USDA) and the Bureau of Land Management (BLM). Today, visual quality assessment plays an integral role in data gathering for planning processes (Bulut and Yilmaz, 2008). Visual assessment literature is widely published in the fields of environmental psychology, management and planning disciplines. Understanding visual assessment and its monikers is vital preceding the explanation of visual assessment paradigms and visual assessment theory.

The Role of Visual Assessment in Environmental Design and Management

Visual assessment is the objective measure of a landscape based on some pre-existing value. Visual measurement may be based on aesthetic values, or the mutual relationship between values such as biological, social, cultural, and economic (Daniel and Vining, 1983; Amir and Gidalizon, 1990; Angileria and Toccolini, 1993; Bulut and Yilmaz, 2008). According to Kane (1981), the purpose of landscape visual assessment is to determine areas to be protected for the cultural heritage protection program, determine the aesthetic value of a landscape, and to determine the physical attributes of a landscape that affect preferences (Bulut and Yilmaz, 2008). The current study focuses on the final theme: the physical arrangement of objects on the landscape affecting preferences.

Confusing Terms

As landscape visual assessment research accumulated after the passage of NEPA, the term visual assessment took on many meanings. As a result, vocabulary like visual quality, visual perception, scenic beauty, visual resource management, and visual preference are often erroneously used to describe visual assessment. In order to comprehend visual assessment as it relates to the interdisciplinary fields of psychology, art, aesthetics, and management, the aforementioned terms should be defined individually.

- Visual quality is an objective term for landscape beauty used in landscape evaluation (Jacques, 1980).
- Scenic beauty is a visual perception attribute of a given environment. "Scenic" is used to describe beauty, because, in this case, beauty refers specifically to visual perception (Daniel and Boster, 1976).
- Visual perception is "the process of becoming aware of physical objects, phenomena, etc." through the sense of sight (Oxford English dictionary, 2008).

  The framework of knowledge for visual perception is attributed to Gestalt psychology, a topic which will be thoroughly explored in later sections (Arnheim, 1976).

- Visual resource management (VRM) is "a system for minimizing the visual impacts of surface-disturbing activities and maintaining scenic values for the future" (BLM, 2007).
- Visual preference is the degree a user likes one landscape compared to another (Jacques, 1980). Visual preference refers specifically to the pleasing visual stimuli provided by the landscape (Natori and Chenoweth, 2008). Preferences for landscapes are most commonly measured by ranking alternatives within a given set of options (Hanley et al., 2009).

This list of terms associated with the visual assessment process is provided to relieve some common misconceptions within the broad category of visual assessment. To further ease confusion, this study will concentrate on the following terms: visual landscape assessment, visual landscape perception, and visual landscape preference.

Moving ahead, the current needs in visual landscape assessment will be discussed; visual assessment paradigms will be explored; and the limitations of visual assessment paradigms will be indicated.

Why Now?

With the scope and scale of changing landscapes, it is no wonder that now, as much as ever, understanding how humans perceive landscape and which landscapes humans prefer is important. Antrop (2003) suggests that completely new landscapes are appearing, and traditional ones deteriorating rapidly (Sevenant and Antrop, 2008). In order to preserve traditional landscapes public support is critical. Research indicates that landscape policy is ineffectual and unfeasible without support from the public (Sevenant and Antrop 2008). In addition to this, in 2000, the European Landscape Council (ELC) recognized the importance of visual landscape perception by adding it to their definition of landscape (Sevenant and Antrop, 2008). The ELC defines landscape as “an area, as perceived by people, whose character is a result of the action and interaction of natural and/or human factors” (Council of Europe 2000). This action, whether consequential or not, corresponds to a host of new research on visual assessment theory, landscape visual perception, and reliable methods for measuring landscapes (Sevenant and Antrop, 2008; Singh et al., 2008; Bulut and Yilmaz, 2008; Natori and Chenoweth, 2008; Ode et al., 2009). For these reasons, understanding landscape perception and landscape preference is a worthy topic of consideration.

Visual Assessment Paradigms

An Introduction to Visual Assessment Paradigms

The visual landscape is itself a non-renewable resource, and should be treated as such; the federal enactment of NEPA in 1969 legitimized this fact. Ten years after the passage of NEPA, several studies evaluating the progress of visual assessments were published (Kent, 1993). Among the published research were the visual assessment studies conducted by Zube et al. (1982) and Daniel and Vining (1983) that established a methodological context for visual assessment techniques. Fabos (1979) pointed out that visual assessment is the synthesis preceding landscape evaluation (Kent, 1993). He showed that visual assessment is vital in determining the trade-offs in the potential future outcomes of the landscape (Fabos, 1979; Kent, 1993). Fabos (1979) suggests that the value of the visual landscape should be determined by some combination of "professional judgment, public preference, values of the elite, [or] economic…means" (Kent, 1993). By separating the values of professional/public, elite/layperson, etcetera, Fabos established the visual assessment paradigm as dependant on some predetermined factor. The commonality in all visual assessment paradigms is the establishment of some preconceived variable as a parameter for the research.

In 1982, Zube et al., identified four landscape visual assessment paradigms: expert, psychophysical, cognitive, and experiential (Zube et al., 1982, p. 35). The expert paradigm is the assessment of landscape visual quality based on the trained eye of a skilled observer (Zube et al., 1982). Skilled observers include those in an environmental design discipline or closely related field such as environmental resource management (Kent, 1993). The psychophysical paradigm measures the stimulus response of an observer to a specific landscape. Correlations between observer reactions and landscape elements are evaluated (Zube et al., 1982.; Kent, 1993). In the cognitive approach, human meanings and values associated with specific landscapes are tested. Current visual assessment research relies heavily upon the cognitive paradigm, a paradigm which has been modified by Rachael and Stephen Kaplan (S. Kaplan, 1979; Kaplan and Kaplan, 1982; Kaplan et al., 1998) with the purpose of building predictive models of landscape preference (Singh et al., 2008). Zube et al.'s (1982) final paradigm, the experiential model, regards landscape perception as a relational process between the observer and his or her previous experience with a landscape (Zube et al., 1982; Kent, 1993).

Daniel and Vining (1983) classified the visual perception of landscapes with five criteria: landscape quality definition, aesthetically-relevant variables, observer involvement, observers' perceptions, and the connection linking landscape and other human needs (Kent, 1993). These criteria were developed into five visual assessment paradigms: ecological, formal-aesthetic, psychophysical, psychological, and phenomenological (Kent, 1993). The ecological model was identified by the lack of intrusion of man or the "naturalness" of scenic beauty (Kent, 1993). This paradigm is primarily concerned with the biological factors of a visual assessment.

The categorical "determination of aesthetically relevant attributes" evolved into the formal-aesthetic paradigm (Kent, 1993). The formal-aesthetic paradigm characterizes landscapes in terms of its artistic quality. Artistic elements like line, colors, and textures are used to represent the innate visual qualities of a landscape in the formal-aesthetic approach (Kent, 1993; Macaulay Land Institute, 2005). The formal-aesthetic paradigm requires professional training, and is usually applied by a landscape architect (Macaulay Land Institute, 2005). Because the formal-aesthetic model does not consider social values, Daniel and Vining (1983) found the formal-aesthetic model to be "seriously deficient with regard to the fundamental criteria of sensitivity and reliability" (Macaulay Land Institute, 2005).

The psychophysical model described major environment elements in the visual landscape in terms of the "measureable biological and physical components" (Kent, 1993). Moreover, this paradigm measures visual factors based on the relationship between human experience and meaning of a landscape.

The psychological paradigm is concerned with interpreting qualities of the landscape that evoke specific feelings on those who inhabit the landscape. Closely related to Zube et al.'s (1982) cognitive model, Daniel and Vining's (1983) psychological model used different observers with varying environmental training to yield some quantitative variables (Kent, 1993; Macaulay Land Institute, 2005). For this reason the reliability and sensitivity can be ascertained, making the psychological paradigm a valid methodological approach (Macaulay Land Institute, 2005). Finally the phenomenological paradigm characterizes the environment as a highly subjective experience between the user and physical and biological landscape elements. Phenomology is "a descriptive science, the heart of which is concern, openness, and clear seeing"; phenomology is often referred to as "humanist" (Seamon, 1987). The phenomological paradigm is normally administered with verbal questionnaires or personal interviews and is not usually used to rank scenic beauty of a landscape; however, it is a valuable method for determining personal, subjective user experience (Macaulay Land Institute, 2005).

Limitations of Visual Assessment Paradigms

Each of the visual assessment paradigms are met with a serious challenges, and the purpose here is to report the deficiencies to provide justification for a more conceptual approach to assessing landscape visual preference.

Following the establishment of their five visual assessment paradigms, Daniel and Vining (1983) tested the reliability, validity, sensitivity, and utility of each approach (Kent, 1993). Central to this study was the internal/external reliability and validity of their visual assessment approaches. According to Buyhoff et al. (1995), external validity measures how well generated assessments correspond to known visual factors measures, and internal validity measures how well the internal logic of the methodology responds to testing and assumption changes (Macaulay Land Institute, 2005). These factors are critical, as a current trend in research is to question the reliability of various visual assessment paradigms (Palmer, 2000). Daniel and Vining's (1983) ecological, formal-aesthetic, and phenomological models all failed reliability testing (Kent, 1993). The disadvantage of the ecological model is a reliability breakdown when applied to landscape generally. The ecological model is designed for specific landscape areas (Macually Land Institute, 2005). As previously mentioned, the formal-aesthetic model did not withstand reliability testing because it was unable to relate to interval measures; it could not be used to cross-reference social value or economic value (Macually Land Institute, 2005). The biggest weakness in the phenomological model is the practicality of such methods in empirical situations (Seamon, 1987). Because phenomology is a personal, descriptive science, gathering empirical data has proven problematic (Seamon, 1987). Moreover, although the psychological and psychophysical paradigms faired better than other paradigms, they too, had problems. Oftentimes, the difficulty with psychological model is determining the researcher's purpose. Rapoport (1977) describes the psychological paradigm as having both knowledge and meaning-based components (Low, 1987). Also, the psychological model measures psychological feedback of the landscape on psychological reactions causing "correlation feedback loop" (Macaulay Land Institute, 2005). In spite of these shortcomings, the psychological method has received distinction among researchers, and should be considered a "dominant approach" (Singh et al., 2008). Sometimes called the cognitive method, the psychological paradigm, is the basis for the Kaplan preference model (Singh et al., 2008). The psychological model, in conjunction with the psychophysical model, will be the basis of this research.

Problems with the psychophysical model occur because this approach can only measure specific landscapes, not landscapes generally (Kent, 1993). Because this model tests physical landscape elements like topography, vegetation, and water, accurate statistical measurements can be gathered (Macaulay Land Institute, 2005). According to Hull and Revell (1989) even slightly varying landscapes can be tested to provide predictors of "scenic beauty" and preference (Macaulay Land Institute, 2005). In fact, this method is highly efficient at taking objective, qualitative observer data to measure visual perception and landscape visual preference. Even though the psychophysical model is limited to a specific landscape, assumptions about landscape elements can be ascribed to wide range of landscapes. This process is called determining preference predictors.

While a single visual assessment paradigm never emerged as a clear cut best, literature reveals that a combination of the psychological and psychophysical paradigms can most accurately measure landscape perception (Daniel and Vining, 1983). The authors stated, "While neither psychophysical nor psychological model are sufficient alone, a careful merger of these two approaches might well provide the basis for a reliable, valid and useful system of landscape-quality assessment" (Daniel and Vining, 1983). This research attempts to fill this gap by providing a cognitive basis for objectively measuring physical elements in the landscape.

Some researchers attribute the shortcomings in the visual assessment paradigms to a lack of unifying theory on the subject (Kent, 1993; Francis, 1987a). Urban space researcher Mark Francis echoed this sentiment saying, visual "perception and aesthetics are important but poorly understood aspect of landscape quality" (Francis, 1987a). Environmental-studies generally are in need of "theory building" (Francis, 1987a). A closer look at advancements in visual assessment theory should determine if, indeed, Francis' remarks are as pertinent today as they were 30 years ago.

Visual Assessment Theory

The importance of developing a theoretical framework for visual perception transcends the purpose of unifying visual assessment models. It is generally accepted that before a problem can be solved, it must be identified and understood (Murphy, 2005). Nevertheless, one of the chief criticisms of landscape architects is "their lack of knowledge base from which to propose changes to the environment" (Murphy, 2005). Grasping visual landscape perception through quantitative and qualitative methods to determine preferences, allows designers' valuable, predictable evidence about the "advantages or disadvantages of a proposed course of action" (Murphy, 2005).

The goal of visual assessment is not merely to measure landscape features for the sake of visual resource management. Visual assessments are intrinsically linked to visual preferences and valuations of landscape predictors. Because the visual quality of landscape is measured by observer preference in visual assessment paradigms, visual preference is considered the backbone of visual assessment. Researcher's fascination with landscape preference is both theoretical and practical (Herzog and Leverich, 2003). Theoretically, landscape preference studies allow researchers to gain insight into the fundamental process of how humans function (Herzog and Leverich, 2003). Practically, because aesthetic landscapes are not an "indispensable luxury", but a valuable resource, landscape preference studies provide a logical basis for protection and preservation of landscapes (Herzog and Leverich, 2003).

In some regards, the demand for a cohesive theoretical framework followed the development of visual assessment paradigms. The current research focuses on the cognitive paradigm (Zube et. at., 1982; S. Kaplan, 1979; Kaplan et al., 1998, Kaplan and Kaplan, 1982) or psychological paradigm (Daniel and Vining, 1983), so relevant theory falling into these categories will be highlighted.

Theories of Cognitive Processes

Prospect-Refuge Theory of Visual Preference

Appleton (1975) developed the theoretical notion of landscapes based on human's innate preference for sheltering and protection; he called it the "prospect-refuge theory" (Murphy, 2005). If this theory were applied to a visual assessment paradigm, it was fall squarely under the psychological or cognitive paradigms (Zube et al., 1982; S. Kaplan, 1979; Kaplan et al., 1998), because it does not result from conscious action. The prospect-refuge theory maintains that our ancient predecessors were attracted to landscapes where they had the ability to both hunt (i.e. prospect) and hide from prey (i.e.

refuge) (Murphy, 2005). Appleton suggested that our perceptual "aesthetic satisfaction" with a landscape is based on survival instincts (Kent, 1993). Furthermore, Appleton claimed that if designed environments are to be preferred on a subconscious level, they must provide recognizable prospect and refuge conditions (Murphy, 2003). Researchers Heerwagen and Orians (1993) measured the concept of prospect and refuge in art finding that both elements are present in many landscape paintings (Joye, 2007).

Psychoevolutionary Theory of Visual Preference

Roger Ulrich's (1983) psychoevolutionary framework is another theoretical orientation of landscape that supplies meaning to visual assessment. The psychoevolutionary theory suggests that the initial reaction toward a landscape is based on a "quick occurrence of generalized affect" (Joye, 2007). Ulrich's "affective states" occur independent of recognition—in a precognitive state—so it is best described as an adaptive state (Joye, 2007). Like the prospect-refuge theory, the psychoevolutionary notion is based on a species survival mechanisms. The affective state allows organisms to move quickly with little information to adapt to a particular environment (Joye, 2007). Even before recognition and cognition, humans have an idea about a landscape's potential for their well-being, namely survival and reproduction (Joye, 2007). Recognition and cognition occurring after the affective reaction give more detailed information about the environment, including ideas of memories and associations (Joye, 2007). Ulrich developed six tenets of physical or structural landscape elements that elicited immediate positive reaction in the environment. He referred to the inherent principles as 'preferenda:'[2]

- Complexity refers to the amount of autonomous landscape elements that are present in an environmental scene.
- Gross structural features refers to the composition and arrangement of a visual scene facilitating visual understanding and processing. The physical structuring of patterns, textures, grouping, and connections are examples of gross structural features.
- Depth or spatiality refers to the depth and breadth of openness or closeness in a visual scene. Open settings are visually preferred because they reveal more information than closed settings. Closed settings block escape routes and may not reveal hidden dangers.
- Threats or tensions are visual hazards in an environment. The presence of dangerous elements in the landscape is negatively associated with preference.
- Deflected vista refers to visual scene where the line of sight is blocked or deflected in a manner suggesting more information exists beyond what is visible in the scene. Ulrich admits that the deflected vista property occurs after cognition, so that it probably does not occur in the affective state (1983).
- Contents is Ulrich's final 'preferenda' which is not a structural or spatial environmental factor, but a specific, tangible inventory of the landscape elements

[2] List adapted by Y. Joye (2007) from Roger Ulrich's "Aesthetic and affective response to natural environment."

present in a visual scene. For example, water and vegetation are associated with preference.

Ulrich's (1983) psychoevolutionary model was instrumental in advancing basic environment theory in landscape preference. Just as Appleton's (1975) prospect-refuge theory form the foundation for Ulrich's (1983) psychoevolutionary model, so would Ulrich's model helped conceive the Informational Model of Rachael and Stephen Kaplan.

Informational Theory of Visual Preference

The informational theory of visual landscape preference is based on a simple notion: information is central to all human experience and survival (Kaplan et al., 1998). Acquiring and processing information is the theoretical hub of Rachael and Stephen Kaplan's research in environmental psychology, and their rationale of why humans prefer one landscape to another (Kaplan et al., 1998). In the Kaplan informational theory, "information is central to our effectiveness, to our sense of esteem, to our interdependencies, to the basis for distinguishing ourselves from others…information is inescapable, essential, and pervasive." (Kaplan et al., 1998). The informational theory makes a couple of well-researched assumptions about the environment and human's perception of the environment in the development of a preference matrix to measure landscape visual quality. The first assumption is that information in the environment is derived from landscape elements or contents and the organization or arrangement of the contents (Kaplan et al., 1998). The second assumption is that the arrangement of the contents in a visual scene significantly affects a human's ability to pursue understanding and exploration of an environment (Kaplan et al., 1998). Understanding is a basic human function, which similar to the prospect-refuge theory and psychoevolutionary theory explains human preference as a means of adaptation and survival (Kaplan et al., 1998). Exploration provides humans with the basic need for advancement and opportunities, and the ability to increase understanding (Kaplan et al., 1998). Together, understanding and exploration form the framework for the informational preference matrix (Kaplan et al., 1998).

Detailed Look at the Informational Model

Understanding and exploration exclusively are meaningless in the informational preference matrix without 'predictors' of structural landscape elements to qualify them. Based on extensive research into human visual preference of the environment (S. Kaplan 1979, Kaplan and Kaplan, 1982; Kaplan et al., 1998), the informational model suggests that two primary factors facilitate understanding in visual scene and two primary factors enhance exploration in a visual scene. The two variables that facilitate understanding are coherence and legibility (S. Kaplan, 1979; Kaplan et al., 1998). The two variables that enhance exploration are complexity and mystery (S. Kaplan, 1979; Kaplan et al., 1998).

Coherence and Legibility

According to the informational model, coherence and legibility facilitate understanding of a visual scene (S. Kaplan, 1979; Kaplan et al., 1998). Both coherence and legibility involve the configuration of a visual scene based on the perception of landscape elements in terms of patterns, groupings and placement (S. Kaplan, 1979; Kaplan et al., 1998). Coherence is the initial perceptual inventory of a scene or the visual elements contributing to the textures of a landscape scene (S. Kaplan, 1979; Kaplan et al., 1998; Joye, 2007). Legibility refers to the “interpretation of spaces” based on visual elements of a scene (Joye, 2007). The concept of legibility in the informational model is a modified from the 1960’s research of Kevin Lynch, in which Lynch characterized urban environments (Herzog and Leverich, 2003). Lynch coined the term ‘imageability’ (i.e. legibility) to describe a “physical object which gives it a high probability of evoking a strong image in any given observer” (Lynch, 1960). The Kaplan definition refers to the ability of an object “to predict or maintain orientation in the landscape as one further explores it” (Joye, 2007). In both cases, legibility is a component of understanding a visual scene. Coherence and legibility both provide information about a scene which makes it easier to understand (Kaplan et al., 1998).

Complexity and Mystery

Complexity and mystery, according to the informational model, are structural properties that enhance the exploration of a visual scene (S. Kaplan, 1997; Joye, 2007). Complexity refers to the visual measure of elements associated with a scene or “how much is ‘going on’ in” a landscape scene (S. Kaplan, 1979, p. 243). Mystery refers to the visual cues that suggest “more information can be acquired if [one] penetrates the scene more deeply (Joye, 2007). Both complexity and mystery involve exploration because more information can be determined than is initially perceived.

Two-Dimensional Versus Three-Dimensional Planes

The informational model not only categorizes the structural elements of 'predictors' of a visual scene, but also how a scene is projected. The preference matrix of the informational model is made up of two binary dimensions (Herzog and Leverich, 2003). The first dimension is based on humans' basic need of understanding and exploration (Herzog and Leverich, 2003). The second dimension deals with how the information is processed. According to the model, a scene may be viewed as a two-dimensional "picture plane" or as a three-dimensional plane (Kaplan et al., 1998). The distinction of the two-dimensional plane and the three-dimensional plane is mainly cognitive. Primary perceptual information involves "a very rapid assessment of the patterns of light and dark" (Kaplan et al., 1998). The primary perceptual information allows visual grouping, patterns, and textures to occur very rapidly when viewing a two-dimensional scene. While both two-dimensional processing and three-dimensional processing occur subconsciously, three-dimensional processing takes fractions of a second longer than two-dimensional processing (Kaplan et al., 1998). Of the four visual 'predictors' of the informational model, coherence and complexity occur on the two-dimensional plane, and legibility and mystery occur on the three-dimensional plane. Figure 2.1 illustrates the Informational Model's preference matrix.

Table 2.1

Informational Model Preference Matrix[3]

	Understanding	Exploration
2-D	Coherence	Complexity
3-D	Legibility	Mystery

Coherence and complexity occur on the two-dimensional plane because processing the visual scene is a matter of direct perception of grouping, pattern, texture, and composition (Kaplan et al., 1998). Legibility and mystery, however, require 'inference' of being in the picture (Kaplan et al., 1998). Regularly in their research, the Kaplan's use the term "inference" to describe the fundamental distinction between the second and third visual dimensions (Kaplan et al., 1998). In the context of the visual environment, however, the four informational variables operate together (Kaplan et al., 1998). And, according to the informational model, "even small amounts of coherence, legibility, complexity, and mystery" displayed in visual scene make a "substantial difference in how comfortable people feel" in an environment (Kaplan et al., 1998). However, literature suggests our landscapes are rife with settings that do not provide minimal amounts of coherence, legibility, complexity, and mystery (Kaplan et al. 1998).

Unifying Themes is Landscape Theory

Since the appeal for stronger unifying theories in landscape assessment (Priestly, 1983; Zube et al., 1982; Zube et al., 1983), researchers (Appleton, 1975; Ulrich, 1983; S. Kaplan, 1979; Kaplan et al., 1998, Daniel and Boster, 1976) have focused on forming a

[3] Reproduced from Kaplan et al., 1998, *With People in Mind*, p. 13

conceptual framework to determine which landscape are preferred. All of the aforementioned theories share the general principle that a species preference for a landscape is closely tied to its survival instincts. Furthermore, within these models, a common thread is the organization of patterns, textures, and placement of landscape elements. Specifically, in Ulrich's (1983) gross structural features 'preferenda,' and 'coherence' within the Kaplan Informational model, do researchers mention the relationship between the visual array of landscape elements and preference. Within both models, the visual configuration of landscape elements is independent of the observers' idea of what the place could offer (Sevenant and Antrop, 2008). For this reason, the cognitive or psychological approach has emerged as a leading paradigm by which landscape theorists view biological or innate preference responses. Recent literature suggests that the developments in landscape perception are primarily adapted from the discipline of psychology (Sevenant and Antrop, 2008). While the importance of visual organization of a landscape scene into patterns, textures, and shapes is often cited in literature (Ulrich, 1983; Kaplan et al., 1998; Joye, 2007), the psychological justification has not been thoroughly researched. In fact, landscape elements used as variables in landscape assessment studies are rarely broken down categorically based on a psychological method. This study will determine if Gestalt theory may be applied to landscape assessment, and if these cognitive variables are preference predictors. Because visual perception has its roots in Gestalt psychology, understanding the historical institution of Gestalt is a good starting point upon which to build a hypothesis (Arnheim, 1974).

Gestalt Psychology as a Theoretical Paradigm

Introduction to Gestalt

The German word gestalt (pronounced gush-stalt) does not have an exact translation in the English language, but closely resembles the English word configuration (Woodworth, 1931). The essay "On Gestalt Qualities," written by the Austrian philosopher Christian von Ehrenfels, introduced the word Gestalt to psychology, and is responsible for setting in motion "one of the most characteristic schools of scientific thought in our time" (Arnheim, 1961). The word gestalt, the German noun meaning shape or form, has been associated since the turn of the century to a body of scientific principles resulting primarily from research in sensory perception (Arnheim, 1974). Much of what is know today about visual perception was learned in Gestalt laboratories (Arnheim, 1974). The phrase the whole is greater than the sum of its parts is frequently attached to the theoretical underpinning of the Gestalt institution (Pratt, 1969). This phrase, however, is an inaccurate description of Gestalt theory (Pratt, 1969). Gestaltists do not say the whole is "more" than the sum of its parts, but rather "something else" or "different" (Arnheim 1961; Pratt, 1969). The "something else" is defined as a form quality. A form quality is a quality possessed by a whole which is not possessed by any of the parts making up the whole (Woodworth, 1931). A musical melody is an example. A musical melody is made up of notes on a scale, what distinguishes the melody is the pattern or organization of the notes, because many melodies can be made up of few notes (Woodworth, 1931). The early goal of the Gestalt institution was to determine properties associated with the organized wholes. Gestaltists argued that this particular problem was the most worthwhile problem to study in psychology (Woodworth, 1931). Arnheim says another objective in defining visual perception was understanding "under what conditions does a certain pattern occur?" (Woodworth, 1931). Wolfgang Köhler (1969), German psychologist and one of the Gestalt triumvirates (along with Max Wertheimer and Kurt Koffka) explained their early purposes:

> First… we have to inspect perceptual scenes quite impartially, to try to find in these scenes such facts as strike us as remarkable, if possible to explain their nature, to compare it with the nature of other interesting facts, and to see whether, in this fashion, we can gradually discover general rules which hold for many phenomena.[4]

Based on Kohler's notion, the application of Gestalt psychology to the research of landscape visual assessment should be clear. After all, visual preference researchers follow the same basic method of Gestalitstism. A closer look at the grouping principles developed by the Gestalt psychologists is now necessary to frame a hypothesis for the current study.

Gestalt Grouping Principles

Gestalt theory not only made its way into the realms of hard sciences, but also transitioned to pervade the thoughts of "practical affairs" (Pratt, 1969). Since its relatively recent inception in the field of psychology in the early 1900's, doctors, economists, ecologists, and conservationists have become aware of Gestalt principles

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[4] *The Task of Gestalt Pyschology*, Wolfgang Köhler (1969), p. 34

(Pratt, 1969). As Pratt says, "even those who bulldoze our landscape—some of them, at any rate—seem increasingly aware that an operation in one place is often a contradiction in terms, for any one place may be part of a larger area in which the operation will produce unexpected and sometimes disastrous results" (1969). In terms of visual landscape resources, Gestalt theory describes visual perception of landscape elements primarily in structural terms. In "Laws of Organization in Perceptual Form," sometimes called "The Dot Essay", Wertheimer launched the theoretical basis for grouping principles by describing, of all things, a landscape; the opening line of his essay—I stand at my window and see a house, trees, sky. (1923). Wertheimer goes on to describe the relationship amongst the visual landscape elements, and ask the question "Do such arrangements and divisions follow definite principles?" (1923). Based on experimental trials, Wertheimer determined that arrangements do have definite principles (Wertheimer, 1923).

While the Gestaltists' original description of grouping principles were based largely on observations, and did not involve extensive experimentation, modern researchers Kubovy and Cohen (2001) have quantified and confirmed the validity of Wertheimer's early demonstrations (Wolfe et al., 2006). Wertheimer named several perceptual grouping principles in "Laws of Organization in Perceptual Form" including: the factor of proximity, the factor of similarity, the factor of the objective set, the factor of direction, the factor of common fate, the factor of "good curve," the factor of good continuation, and the factor of closure (1923). According to Gestalt theory, these general grouping principles explain how our visual system explains the projection of the raw retinal image (Wolfe et al., 2006). Although early Gestaltists developed more than eight grouping principles, modern researchers have modified early work—removing and adding some grouping principles—to now accept four primary perceptual groupings that explain how stimulus elements are perceptually assembled (Zimbardo et al., 2003; Wolfe et al., 2006). Understanding the Gestalt grouping principles of proximity, similarity, continuation, and common fate, as well as their basic applications will further strengthen the notion that landscape elements within scenes can be measured in terms of their Gestalt pattern.

Proximity

Proximity is the Gestalt grouping rule declaring that the propensity of two figures being grouped together will increase as the distance between the two figures decreases (Wolfe et al., 2006). Wertheimer (1923) first noticed this quality saying that most natural grouping involves the smallest interval between figures.

Figure 2.1 Wertheimer's Original Example of Proximity[5]

Figure 2.1 one is example based on Wertheimer's original illustrations in "Laws of Organization in Perceptual Form" (1923). When the dots are given alphabetical

[5] Figure 2.1 created by the author based on Wertheimer's original drawing in "Laws of Organization in Perceptual Form" (1923). Online image available at <http://psychclassics.asu.edu/Wertheimer/Forms/forms.htm>

designations, it becomes apparent that ab/cd/ef/gh is more easily perceived than some other combination such as ac/bd/eg/fh or a/bc/def/ghij.

Similarity

Similarity is the Gestalt grouping rule stating that the tendency of two figures being grouped together will increase as they become more similar (Wolfe et al. 2006) In other words, like objects tend to band together (Wertheimer 1923).

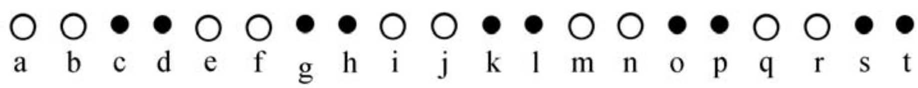

Figure 2.2 Wertheimer's Original Example of Similarity[6]

Figure 2.2 illustrates the perceptual tendency to visually group ab/cd/ef/gh as opposed to other combinations. In experiments where proximity and similarity are tested together, the spatial arrangement is crucial to how the elements will be perceived. As depicted in Figure 2.3, with equal proximity the circles and squares tend to be grouped by similarity so the eye perceives horizontal rows, instead of vertical columns.

[6] Figure 2.2 created by the author based on Wertheimer's original drawing in "Laws of Organization in Perceptual Form" (1923). Online image available at <http://psychclassics.asu.edu/Wertheimer/Forms/forms.htm>

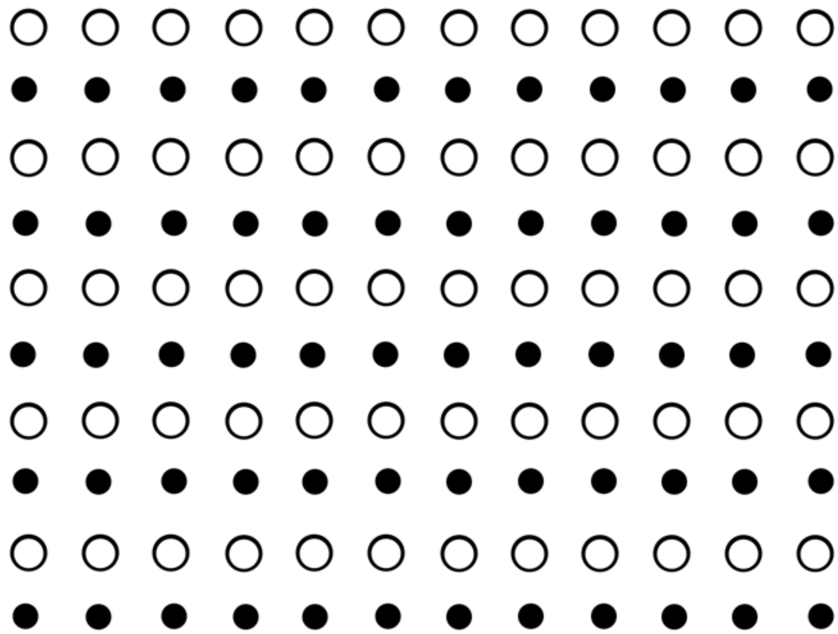

Figure 2.3 Wertheimer's Original Example of Similarity and Proximity[7]

Figure 2.4 illustrates a scene where proximity is given preferential status over similarity. In spite of the preferential status of proximity, Wertheimer suggested that similarity is the dominant grouping rule (Wertheimer, 1923).

Figure 2.4 Similarity and Proximity: Similarity More Easily Seen than Proximity[8]

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7 Figure 2.3created by the author based on Wertheimer's original drawing in "Laws of Organization in Perceptual Form" (1923). Online image available at <http://psychclassics.asu.edu/Wertheimer/Forms/forms.htm>

8 Figure 2.4 created by the author based on Wertheimer's original drawing in "Laws of Organization in Perceptual Form" (1923). Online image available at <http://psychclassics.asu.edu/Wertheimer/Forms/forms.htm>

The Gestalt grouping principle of similarity is not limited to color or shape as illustrated in Figures 2.2, 2.3, and 2.4. Color, size, texture, orientation, as well as other aspects of form contribute to the properties of an element that may make it appear similar to another object (Wolfe et al., 2006). This concept is important for the application of Gestalt grouping principles to landscape elements, because naturally-occurring landscape elements are rarely geometrically shaped.

Common Fate

Common fate is the Gestalt grouping principle stating that objects with a common motion are grouped together (Zimbardo et al., 2003). In other words, objects in the visual array doing the same thing are grouped together (Wolfe at. al., 2006). Common fate is a critical Gestalt grouping principle, because it is the only rule that requires motion to be recognized. The classic example of common fate is a school of fish, a marching band, or a flock of geese, or (Zimbardo et al., 2003). Though each description is made of up of many individual members, when moving together, in the same motion, they are perceived as a single Gestalt (Zimbardo et al., 2003). While common fate is a foundational principle in Gestalt theory, it is not perceivable in photographic pictures; therefore it will not be used in this study.

Continuity

The Gestalt principle of continuity states that observers prefer smooth, connected lines and continuous regions to incoherent lines and regions (Zimbardo et al., 2003). In other words, elements that lie on the same contour will likely be grouped together (Wolfe et al., 2006). This Gestalt grouping rule is sometimes called “good continuation” (Wertheimer, 1923). Wertheimer describes the inherent properties of continuity: “In designing a pattern, for example, one has a feeling how successive parts should follow one another; one knows what a "good" continuation is, how "inner coherence" is to be achieved, etc.; one recognizes a resultant "good Gestalt" simply by its own "inner necessity"” (Wertheimer, 1923). Figure 1.5 illustrates the rule of continuity.

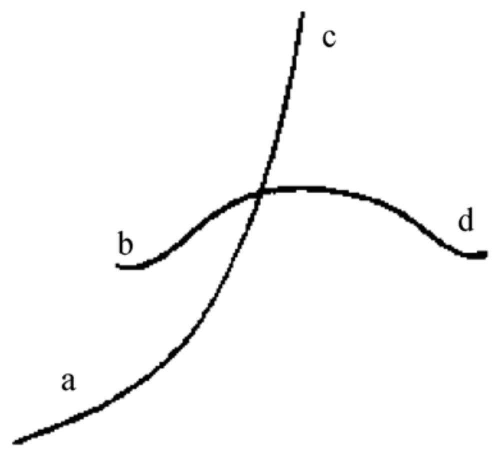

Figure 2.5 Wertheimer’s Original Example of Good Continuation[9]

In the Figure 2.5, lines ac/bd are clearly perceived as the same lines, instead of another combination like ab/dc or b/adc. The principle of continuity is developed from what the Gestaltists called Prägnanzstufen: the ability of strong arrangements to ‘triumph’ over others, and intermediate arrangements to be “more equivocal” (Wertheimer, 1923).

[9] Figure 2.5 created by the author based on Wertheimer’s original drawing in “Laws of Organization in Perceptual Form” (1923). Online image available at <http://psychclassics.asu.edu/Wertheimer/Forms/forms.htm>

Pragnanz

The job of an observer is not creating a visual scene, but to apprehending the meaningfulness which objectively exists in the world (Murphy, 1949). The observer perceives meaningfulness in a scene by its organization. The *Law of Pragnanz*, the German term for "meaningfulness" is the general Gestalt law stating humans will perceive the simplest pattern which requires the least amount of cognitive effort (Zimbardo et al., 2003). As a result, the kind of organization that is most orderly, coherent, unambiguous, logical will be perceived as the most "good" (Murphy, 1949. p. 289). *Pragnanz* is the 'goodness' occurring as a self-fulfilling attribute of perceived organized wholes (Murphy, 1949). Gestalt grouping principles are tangential to the notion of *Pragnanz*. The current research will measure Gestalt grouping principles specifically instead of the general Law of *Pragnanz*, however the most orderly configuration of elements achieve the highest level of *Pragnanz*.

Gestalt and Aesthetics

Applications of Gestalt theory has made headway in a variety of disciplines (psychology, sociology, physics), as mentioned previously; but aesthetic disciples, and artists in particular, have made quick application of Gestalt principles (Arnheim, 1943). In practice, artists, architects and designers are asked to create conditions that bring about "certain crucial effects," these effects occur only in conditions where structural features are clearly recognized (Arnheim, 1943. p. 72). Formulating the artistic method scientifically is only accomplished after the artist has seen the phenomenon (Arnheim, 1943). Though none of the early Gestalt psychologists were artists or designer, there were signs of shared interest between the disciplines of art and psychology very early on (Beherens, 1998). The melody, a byproduct of art, was one of the first examples used by the Gestaltist to describe a "whole," because it could not be explained by the qualities of single elements or by the relations between the elements (Arnheim, 1943). Architects and designers of the Dessau Bauhaus, Beherns, Breuer, Kandinksy, Albers, as well as American architect Frank Lloyd Wright, were influenced by Gestalt psychology in their aesthetic approach (Beherens, 1998). Graphic designers, McAdam (1996) and Lechenberg (1996) provide examples of Gestalt application in the field of graphic design (Beherens, 1998).

Figure 2.6 Graphic Designer Ryan McAdam's Dada Café Trademark[10]

[10] Ryan McAdam's "Dada Café" (1996). This trademark exemplifies Gestalt grouping principles of similarity and proximity, as like elements are instinctively grouped to make sense of the image. Picture used in and reproduced from Behrens, R. (1998). "Art, Design, and Gestalt Theory." *Leonardo* 31:4 (1998): 299-303. p. 300.

The acceptance of Gestalt theory into the aesthetic realms is largely due to the scientific validation of principles that artists have "always known" and used (Beherens, 1998). The organization of sensory elements in an artists work can be classified as unity, segregation, and balance associated with the Law of *Pragnanz* (Arnheim, 1943). With basic Gestalt principles, an artist can create order and harmony, or disorder and confusion (Arnheim, 1943). If these same principles apply to visual aesthetics of real landscapes, it will be possible to use the arrangement of landscape elements as a predictor for visual preference in visual landscape assessment. The next section will discuss common landscape variables in visual assessment with a focus on Gestalt grouping principles as possible variables.

Gestalt Grouping Principles as Landscape Variables in Visual Preference

There are a large number of potential attributes that could affect aesthetic preference, so many, that researchers have spent over two decades attempting to identify them (Chenoweth and Gobster, 1990). Gobster and Chenoweth (1989) found that landscape variables in visual assessment studies can be characterized as "physical, artistic, or psychological" (Chenoweth and Gobster, 1990; Kent, 1993). Physical predictors refer to landscape structures and landforms (i.e. mountains, streams, hills lakes, etc.) represented in a scene, or the relationship amongst environmental elements (Kent, 1993). Visual preference studies testing physical descriptors measure preference based on the mere presence of a landscape elements in a scene, not the arrangement of the landscape elements of a scene. Artistic predictors refer to the compositional outcome of physical arrangements of landscape elements in the landscape. Landscape aesthetic theory suggests that spatial arrangement and content of landscape attributes is an important factor in the perception of landscape character (Kaplan et al. 1998; Tveit, 2008); however, some Gobster and Chenoweth (1989) found that artistic variables are unreliable as predictors of landscape preference (Kent, 1993). For this reason, several recent studies (Herzog and Leverich, 2003; Sevenant and Antrop, 2008; Singh et al., 2008; Ode et al., 2009) have focused on psychological predictors as preference determinates. Psychological predictors describe more than an aesthetic landscape, they are indicative of an aesthetic experience (Chenoweth and Gobster, 1990). However, studies testing the validity of the Kaplan Informational Model's (S. Kaplan, 1979; Kaplan et al. 1998) psychological variables have yield contradictory conclusions (Herzog and Leverich, 2003; Sevenant and Antrop, 2008; Singh et al., 2008; Ode et al., 2009). In short, there is still much needed research to determine if psychological variables are reliable indicators of preference.

The purpose of this study is to test preference of landscape scenes based on the grouping and patterns of landscape elements within the visual array, without extracting or interpreting the feelings and emotions often associated with psychological models. As the Gestaltist and art-critic Arnheim said, "One has to see the phenomenon long before he can formulate it scientifically" (Arnheim, 1943). This research will test whether perceptual "seeing" can be categorized in Gestalt grouping terms, and if so, do Gestalt variables tell us anything of visual landscape preference?

Conclusion

The call for researchers to look more closely into the visual perception (Zube et al., 1982; Priestly, 1983; Francis, 1987a) of landscapes and the theoretical basis for visual assessment paradigms did not go unanswered. Researchers (Zube et al., 1982; Daniel and Vining, 1983; Kaplan et al., 1998) developed a number of 'criteria' to measure the visual landscape, and these methods have been tested for validity and reliability (Palmer, 2000; Singh et al., 2008). One dominant method—the cognitive or psychological paradigm—seeks to explain human landscape preference on basic survival tendencies (Singh et al., 2008). Within the theoretical framework of the cognitive paradigm three distinct theories have arisen: Appleton's prospect-refuge theory (1975), Ulrich psychoevolutionary theory (1983), and Kaplan et al.'s informational theory (1998). Generally, all of these models base human visual preference of landscapes on an instinctive survival mechanisms. The cognitive approach, particularly the Kaplan model, has received significant empirical support; however there is evidence that the 'operationalization' of the binary Informational Model has not been 'faithful' to the underlying theory (Singh et al., 2008). Based on a review of literature, there is still a lack of systematic studies testing the "relationship between visual indicators and landscape preference" (Ode et al., 2009). Evidence suggests that the spatial arrangement of landscape attributes can be used to predict landscape visual preference (Kaplan et al., 1998; Tveit, 2008). However, paradigms that attached psychological meaning (i.e.: emotions/feelings) to explain visual preference are very different from a spatial approach. Moreover, no literature discusses the basis of preference on the theoretical constructs of the founders of visual perception—the Gestalt psychologists. Understanding the assumptions humans make about perception of a visual scene is a well-deserving topic for further study.

The gap that exists in landscape research between perception and visual preference is not a matter of disinterest, but a matter of focus. This literature survey concludes that the most noteworthy research published on the topic of landscape preference in the past 40 years can be classified into one of three categories: *landscape-type, perceiver-attribute*, and *landscape element-type*.

First, a large number of studies have been conducted on the preferential treatment of a specific landscape or the preferential comparison between two landscapes. This categorical visual preference study could be called a *landscape-type* preference study. Examples of *landscape-type* preference studies include agriculture (Natori and Chenoweth, 2008), urban environments and recreational sites (Schroeder and Anderson, 1984), urban open space (Francis, 1987a), highway and roadside scenes (Lambe and Smardon, 1986; Kent, 1993), campus landscapes (Zhang, 2006), and forest environments/woodlands (Natori and Chenoweth, 2008; Daniel and Boster, 1976; Bergen et al., 1995).

A second classification could be called *perceiver-attribute* preference research. Perceiver-type preference research concentrates on the socioeconomic/demographic/experiential character of the perceiver as predictive means of landscape preference. Examples of user group preference studies include individual age groups (i.e. children, young adult, adult, and elderly) (Zube et al., 1983), park user and park designers (Francis, 1987b), farmers and naturalists (Natori and Chenoweth, 2008) and students and the general public (Tveit, 2008).

The third classification of landscape preference study is called l*andscape element-type* study. In these studies, landscape elements, such as water, slope, vegetation, trees, man-made elements, and rocky habitats, are tested to determine the corollary affects on visual preference. (Bulut and Yilmaz, 2008; Acar and Sakici, 2008; Ode et al., 2009).

The current study will employ the same methodological approach as a few of the aforementioned studies, but will not be a l*andscape-type, perceiver-attribute*, or *landscape element-type* preference study, per se. This study will be broad-based, measuring visual preference of a landscape scene based on the Gestalt grouping principles of proximity and similarity. Undoubtedly, this research is unique in that it is not concerned with landscape types, perceiver attributes, or landscape elements. The current study concentrates exclusively on Gestalt theory of visual perception as measurable indicator visual preference. The following chapter outlines the methodological design of the study.

CHAPTER III

METHODS

Introduction

This chapter examines traditional as well as state-of-the-art visual preference studies to determine the best method for testing the relationship between Gestalt organization in the landscape and visual preference. The hypothesis states that the relationship between highly organized Gestalt scenes and visual landscape preference is positive. Consequently, as discernable Gestalt characteristics increase, visual preference for a scene increases, and conversely, as Gestalt qualities diminishes, visual preference decrease for landscape scenes. In order to test this hypothesis, four methodological decisions must be made: 1) how to represent the landscape scenes?; 2) how to categorize the landscape scenes?; 3) how to collect responses from the landscape scenes?; and 4) how to analyze the responses from the landscape scenes? Answering these four questions will provide the methodological groundwork to the hypothesis.

The current chapter addresses each of these research questions individually. The first section explains how this study will accurately and efficiently represent landscape scenes. Visual preference has been measured in a variety of media including landscape photographs (Sevenant and Antrop, 2008; Natori and Chenoweth, 2008; Bulut and Yilmaz, 2008; Herzog and Leverich, 2003; Coeterier, 1996; Angileri and Toccolini, 1993; Lambe and Smardon, 1986), artistic renderings (Martin et al., 1989), video imaging (Cackowski and Nasar, 2003), computer simulations (Ode et al., 2009; Bergen et al., 1995; Manning and Freimund, 2004), and slides (Patsfall et al., 1984; Daniel and Boster, 1976). Determining which medium is best-suited to measure the correlation between Gestalt arrangement of landscape elements and visual preference is the focus of the first section.

The second section explains which landscape variables will be tested in this visual preference research. Visual assessment theory (i.e. Appleton's prospect-refuge theory, 1975; Ulrich's psychoevolutionary theory, 1983; and Kaplan information model, 1998) reveals that numerous landscape variables have been tested, some providing reliable predictors for landscape preference, others proving less reliable indicators of preference. This section explores common landscape variables, and explains how the Gestalt qualities of similarity and proximity are classified in this research.

The third section describes the data collection method of the study. In the past, visual preference research has utilized personal questionnaires (Natori and Chenoweth, 2008), slide shows (Tveit, 2008; Herzog and Leverich, 2003; Patsfall et al., 1984; Daniel and Boster, 1976), PC-based surveys (Ode et al., 2009), and visitor-employed photography (Zhang, 2006) to understand visual preference. Determining which data collection method to employ is determined by the target population. Since this preference research measures innate visual perception cues, the Gestalt hypothesis is not concerned with the age, race, sex, education, or economic attributes of the participants. Therefore, the target audience is designated as the general public.

Lastly, the fourth section explores potential data analysis and statistical methods. Answering the hypothesis without getting sidetracked in a statistical quagmire depends greatly on the statistical method. Previous literature cites many potential relationships, other than basic Gestalt cues, which may affect visual preference. Measuring the correct variables with the appropriate statistical method is the focus of the fourth section.

How to Represent a Visual Landscape Scene

Photographs are determined to be reasonably good representation of visual landscapes (Daniel and Boster, 1976; Nassauer, 1983; Shuttleworth 1980; Hull and Stewart, 1992). Real landscapes provide a landscape "experience" appealing to more than just the visual senses (Sevenant and Antrop, 2008), however when comparing many different types of *visual* landscapes types concurrently, photographs are used as substitutes (Daniel and Boster, 1976). A common application of this technique is employed by design professionals when they use landscape photographs to represent potential design solutions and observe client reactions to determine visual preferences (Kaplan et al., 1998 p.134). Photographs are most frequently used to represent landscapes in visual preference surveys, probably because of their logistical ease. Previous research recommends using wide-angle lenses to provide a viewing area similar to human's perceptual viewing area (Shuttleworth, 1980; Nassauer, 1983). Lenses with a focal point 50 mm or shorter are considered wide-angle (Shuttleworth, 1980; Nassauer, 1983). To avoid seasonality biases, it is recommended that landscape photographs be taken and judged in the same season (Buhyoff and Wellman, 1979).

One of the limitations of photographs as representations of landscapes is the control of the content (Ode et al., 2009). In landscape photographs, the visual stimuli affecting observers perception is difficult to control (Ode et al., 2009). For this reason, some recent research has used computer simulations to manipulate landscape scenes. Due to recent advances in technology and 3-dimensional modeling, a level of detail can be achieved in computer a simulation that is considered valid for visual preference studies (Ode et al., 2009). Research suggests that a strong correlation exists between in-field visual preferences and computer simulated visual preferences (Ode et al. 2009; Bergen et al., 1995). The major disadvantage to the computer simulations is the time, programming, and cost of recreating a landscape with an appropriate detail levels.

Because landscapes are not always perceived as stationary, some researchers rely on videotape or digital video disk (DVD) to measure visual preference (Manning and Freimund, 2004). Cackowski and Nasar used video to measure the restorative benefit of roadside vegetation (2003). Another study conducted at Gwaii Haanas National Park in British Columbia used videotape to survey sample park visitors of social and ecological conditions (Freimund et al., 2002). Park visitors reported that videotape was helpful in recalling their visit (Manning and Friemund, 2004). Visual resource assessment policy on national or scenic highways also utilizes videotape and DVD to measure roadside visual quality. Table 3.2 illustrates the most common media techniques employed to represent landscapes in visual preference research.

Table 3.1

Media Used to Represent Visual Landscapes

Photograph	Daniel and Boster, 1976; Hull and Buyoff, 1986; Hull et al., 1987; Herog and Leverich, 2003; Bulut and Yilmaz, 2008; Natori and Chenoweth, 2008; Acar and Sakici, 2008
Artistic rendering	Martin et al. 1989
Computer simulation	Bergen et al., 1995; Manning and Freimund, 2004; Ode et al., 2009
Video imaging	Cackowski and Nasar, 2003; Freimund et al., 2002

Landscape Photographs

Daniel and Boster (1976), Schroeder and Anderson (1984), Hull and Stewart (1992), Patsfall et al. (1984), and Kane (1981) are just a few researchers who used photographs to represent visual landscapes before the development of the digital photography. More recently, researchers Natori and Chenoweth (2008), Acar and Sakici (2008), Herzog and Leverich (2003), Bulut and Yilmaz (2008), and Tveit (2008) used digital photographs to represent landscape types. Overwhelmingly, since visual quality assessment's inception in the 1960's, photographs have been the dominate tool used to represent landscape in preference research. For this research, digital photographs will portray landscape scenes.

Selecting a Location to Take a Photograph

Some previous methods recommend a random approach to determining the location of landscape photographs. The Scenic Beauty Estimation Method (SBE), for example, proposes photographs be taken from a randomly defined points

(Daniel and Boster, 1976). This study, however, will utilize a more analytical approach similar to Acar and Sakici (2008), Natori and Chenoweth (2008), and Herzog and Leverich (2003) for selecting locations to capture the landscape photographs. Although, the SBE Method has proven a reliable for measuring aesthetic beauty, its purpose is not to test a hypothesis, but rather to introduce a procedural method to measure beauty (Daniel and Boster, 1976). In order to test this hypothesis, the landscape variables must be visually recognizable in the landscape photographs. Consequently, the location of the photographs is not arbitrary, but selected to best represent the landscape scene that tests the variable in question.

Deciding which landscape variables to assess in visual preference research is frequently discussed in visual preference literature. The presence of several visual assessment paradigms (Zube et al., 1982; Daniel and Vining, 1983) indicates that visual preference researchers have tested many landscape variables. The next section explains the methods available for selecting landscape variables.

Landscape Variables

Common Landscape Variables

Determining which attributes to consider when evaluating a landscape scene is critical to the testing of the hypothesis. Literature denotes several methods for determining which landscape attributes to select as preference variables. The Visual Absorption Capability (VAC) is a method providing a projection of potential visual impacts effects on development type (Amir and Gidalizon, 1990; Anderson et al., 1979).

While the VAC illustrates a variety of physical landscape attributes that may be used to measure preference (see Table 3.2), it is not suited for this visual preference research because it is designed specifically for forest landscapes, to measures change resulting from foresting operations, and is conducted by experts (Anderson et al., 1979).

Table 3.2

Visual Absorption Capability Factors

Biophysical factors	Slope, vegetative pattern and diversity, vegetative screening ability, site recoverability, soil color contrast, landform diversity, waterform diversity, land stability, soil erodobility
Proposed activities factors	Scale, configuration, duration, frequency
Perceptual factors	Distance, visual magnitude, slope relative to observer, aspect relative to observer, number of times seen, number of viewers, duration of view, focal point sensitivity, lighting, seasons

More recent literature characterizes landscapes not in a physical manner, but by their cognitive or psychological effects. The Kaplan Informational Model describes landscape scenes according to psychological attributes; namely coherence, complexity, legibility, and mystery (S. Kaplan, 1979; Kaplan et al., 1998). Although, the Kaplan Informational Model bases cognitive affects on the configuration of the physical elements, measuring these effects involves expert opinion to determine how a landscape scene is perceived. In other words, it does not provide a perceptual framework like Gestalt grouping to determine why a scene is considered coherent, or why a scene is perceived as legible.

Coeterier (1996) contended that a limited set of attributes define landscape representation to individuals and these attributes are not dependant on landscape type

(Sevenant and Antrop, 2008). Coeterier named eight attributes contributing to landscape preference, regardless of landscape type: unity, function, maintenance, naturalness, spaciousness, development in time, soil and water, and sensory qualities (Sevenant and Antrop, 2008). These eight abstract meanings, asserts Coeterier, provided the framework for visual preference no matter who the individual or what the landscape (1996).

Tveit et al. (2006) provided a more general set of variables for analyzing visual preference. The nine visual concepts developed by Tveit et al. (2006) are stewardship, coherence, disturbance, historicity, visual scale, imageability, complexity, naturalness and ephemera. Like Coeterier (1996), Tveit et al. (2006), describe landscape preference independent of observer attributes (Sevenant and Antrop, 2008). The current study tests general visual concepts independent of observer attributes.

Literature supports the notion that a limited set of attributes can be used to describe many landscape types (Coeterier, 1996; Tveit et al., 2006; Sevenant and Antrop, 2008). Although researchers do not always agree on which attributes provide the best theoretical framework for testing landscape preference, most researchers agree that visual preference involves a complicated process of "cognition, affect, and evaluation" (Sevenant and Antrop, 2008). Kaplan (1987) states that cognition, affect, and evaluation are "highly interrelated" processes (Sevenant and Antrop, 2008). The focus of this research is the first phase of this complex process: perception. Using Gestalt grouping principles as the foundation for visual perception, this research tests the visual configuration of landscape elements. Landscape types (e.g. forests, fields, lawns, etc), observer demographics and preconceptions (age, race, sex, income, memory, etc.), and landscape elements (e.g. water, trees, flowers, benches, etc.) are not tested in this research, because they are unrelated to basic visual perception. The testable attributes in this research are those visual elements that contribute to the *Pragnanz* of the visual landscape. The following section explains how landscape physical attributes will be classified by their Gestalt qualities.

Landscape Variables in this Study

The current study will measure the *Pragnanz* (i.e. 'goodness' occurring as a self-fulfilling attribute of perceived organized wholes) of a landscape scene based on the arrangement of physical elements into Gestalt grouping patterns of *proximity* and *similarity*. *Proximity*, *similarity,* and a combination of proximity and similarity *(*hereafter *similarity/proximity)* are the primary independent variables in this study. Because the research is designed to test visual preference for a broad-spectrum of landscape types, the physical attributes contributing to the arrangement of the landscape scene are minimal—vegetation and man-made structures. *Vegetation* includes all physical elements that are plant-like. Examples of *vegetation* in landscape photographs include but are not limited to trees, grass, and shrubs. *Man-made structures* are any objects in the landscape photograph that is constructed by humans. Examples of *man-made structures* include, but are not limited to buildings, benches, fences, playgrounds, concrete pavers, and automobiles. Figures 3.1 and 3.2 illustrate landscape photographs measuring *vegetation* and *man-made structures*.

Figure 3.1   Example of Landscape Scene Testing *Vegetation* Preference

Figure 3.2   Example of Landscape Scene Testing *Man-made Structure* Preference

Determining which physical elements to measure in the visual scene answers only one part of the research problem. In order, to test whether increasing (or decreasing) the level of Gestalt in scene affects visual preference; a range of Gestalt must be classified.

To accomplish a Gestalt scale, a second independent variable, discernibleness, is required. Discernibleness is defined is the act of perceiving or recognizing a difference or distinction in objects (Oxford English Dictionary, 1989). By categorizing each landscape photograph as *not discernable*, *discernable*, or *highly discernable* a Gestalt quantity is introduced to test the hypothesis. Consequently, the hypothesis can test whether scenes classified as *not discernable* (Gestalt qualities) are preferential subordinate to scenes categorized as *highly discernible* (Gestalt qualities), and so forth. Figures 3.3, 3.4, and 3.5 illustrate *not discernable*, *discernable,* and *highly discernable* grouping in the landscape photographs.

Figure 3.3 Example of a Scene Testing a *Not Discernable* Landscape

Figure 3.4 Example of a Scene Testing a *Discernable* Landscape

Figure 3.5 Example of a Scene Testing a *Highly discernable* Landscape

The final independent variable for classifying landscape photographs is the location of landscape attributes within the scene. The previous research of Patsfall, Feimer, Buyoff, and Wellman (1984) measured visual preference based on the location of vegetation within landscape photographs, identifying three classifications—foreground, middleground, and background. In order to more fully comprehend the relationship between the locations of the landscape attributes and visual preference, each photograph is classified as either *foreground* or *background*. *Foreground* refers to the vegetation and man-made structures "in front and nearest the observer" in the photograph (Oxford English Dictionary, 1989), and *background* is the vegetation and man-made structures "lying at the back of or behind the chief objects of contemplation" in the photograph (Oxford English Dictionary, 1989). Even though evaluating visual preference based on the relative position of the perceiver is not the foremost objective of the research, delineating the photographs as *foreground* or *background* provides insight into the degree of visibility and the level of Gestalt grouping in the landscape. Applications of these results may be used to provide information on landscape vistas, as well as contained views. Figures 3.6 and 3.7 illustrates the vast different between landscape photographs classified as *foreground* and *background*.

Figure 3.6 Example of a Scene Testing *Foreground Vegetation*

Figure 3.7 Example of a Scene Testing *Background Vegetation*

Summarizing the Landscape Variables

In order to test the research hypothesis, two Gestalt attributes of a landscape scene, *proximity* and *similarity*, are selected as the primary independent variables. The research will measure the relationship between *proximity, similarity*, and mean visual preference. Within the Gestalt context, *vegetation* and *man-made structures* are the physical elements considered within the landscapes. The methodology is designed to be broad-based, including a wide-variety of landscape types, which explains the very basic physical attributes selected. To introduce an experimental variable to the Gestalt features in the landscape scene, the proximal and similar configuration of vegetation and man-made elements will be classified as *not discernable*, *discernable*, and *highly discernable*. This introduces a quantifiable Gestalt scale necessary for testing the hypothesis. The method for classifying the photographs followed the analytical approach of Herzog and Leverich (2003), relying on expert opinion. The final variable measures the location of the physical configuration of vegetation and man-made structures based on its presence in the *foreground* or the *background*. Table 3.3 summarizes the variables and their attributes.

Table 3.3

The Four Independent Variables and Attributes Testing the Hypothesis

Variables	**Attributes**	**Definitions**
Landscape element type		
	Vegetation	Physical elements that are plant like
	Man-made structure	Physical elements that are constructed by humans
Landscape element location		
	Foreground	Vegetation or man-made structure noticeable near the observer
	Background	Vegetation or man-made structure noticeable in the back or behind the chief object of contemplation

Table 3.3 continued

Discernibleness		
	Not discernable	The Gestalt pattern in question is not recognizable in the visual landscape scene
	Discernable	The Gestalt pattern in question is recognizable in the visual landscape scene
	Highly discernable	The Gestalt pattern in question is highly recognizable in the visual landscape scene

The literature survey revealed that a large number of landscape variables have been tested (Anderson et al., 1979; Kaplan et al., 1998; Sevenant and Antrop, 2008; Herzog and Leverich, 2003; Patsfall et al., 1984). Moreover, previous studies indicated that the configuration of physical elements may be a reliable indicator of preference (Kaplan et al., 1998), however previous research has not specifically measured landscape scenes through the Gestalt framework. The primary and secondary independent variables are selected to test the hypothesis, thereby determining if Gestalt grouping arrangements are reliable predictors of landscape preference. Table 3.4 illustrates the variable scheme for the current study.

Table 3.4

Landscape Photographs Needed to Measure all Variables

Proximity			**Similarity**			**Proximity/ Similarity**		
Vegetation			Vegetation			Vegetation		
	Background			Background			Background	
		Not discernable			Not discernable			Not discernable
		Discernable			Discernable			Discernable
		Highly discernable			Highly discernable			Highly discernable
	Foreground			Foreground			Foreground	
		Not discernable			Not discernable			Not discernable
		Discernable			Discernable			Discernable
		Highly discernable			Highly discernable			Highly discernable
Man-made			Man-made			Man-made		
	Background			Background			Background	
		Not discernable			Not discernable			Not discernable
		Discernable			Discernable			Discernable
		Highly discernable			Highly discernable			highly discernable
	Foreground			Foreground			Foreground	
		Not discernable			Not discernable			Not discernable
		Discernable			Discernable			discernable
		Highly discernable			Highly discernable			Highly discernable

Using a Survey to Collect Visual Preference Rankings

Testing landscape visual preference for a general population has received much scholarly attention, however a single best data collection method has yet to emerge. Recent research methods include site visits with questionnaires (Sevenant and Antrop, 2008), slide shows with questionnaires (Tveit, 2008; Acar and Sakici, 2008; Herzog and Leverich, 2003), Internet-based survey (Ode et al. 2009) and photographic paper survey (Natori and Chenoweth, 2008). The Scenic Best Estimation model, a common visual assessment tool, measures landscape preference by showing photographic slides to a captive population in a classroom setting (Daniel and Boster, 1976). Although this method is reliable, it is difficult to employ without access to a captive population like a classroom of students. Past slide show surveys utilize student populations induced by research participation credits (Daniel and Boster, 1976). Researchers have even made participation and completion of this preference research a mandatory requirement in coursework (Herzog and Leverich, 2003). Because this type of survey administration requires undue influence, a slide show survey will not be used in this study. Moreover, the web-based survey was not an option to researchers until recent years (Andrews et al., 2003).

Web-based Survey

Precedents for web-based visual preference surveys prior to 2000 are difficult to find. This is due to the fact that electronic surveys only date back to 1986 (Andrews et al., 2003). Before 1986, paper-based methods were the only means of survey. In 1986, the first asynchronous email survey was used, eight years later, in 1994, the first synchronous Web-based survey started (Andrews et al., 2003). Literature suggests that digital surveys are becoming more common because they provide strong advantages to paper mail-based survey in speedy distribution and response cycles, and provide nearly the same content results as mail-based surveys (Andrews et al., 2003). Not only do web-based surveys allow speedy distribution and response, they allow users to respond on their own time and manner. Issues with slide show surveys, for exasmple how long a viewer should be exposed to the photograph are not problematic in digital surveys because they are determined by users (Daniel and Boster, 1976). At the same time, digital surveys are now able to ask nearly all questions that a paper survey can ask including Likert-scale questions and open-ended questions (Andrews et al. 2003). In sum, digital, web-based surveys provide the following advantages to mail-based or self-administered surveys: low-cost, quick distribution, transferable data, and editing options (Andrews et al. 2003). For these reasons, the digital survey is selected as the data collection method for the current study.

Considerations for a Web-based Survey

Andrews et al. (2003) identified six important factors for web-based surveys:

1. support multiple platforms and browers (Yun and Trumbo, 2000)
2. prevent multiple submissions (Yun and Trumbo, 2000)
3. have the ability to present questions in a logical or adaptive manner, if needed (Kehoe and Pitkow, 1996)
4. provide multiple opportunities for saving the work in a long questionnaire (Smith, 1997)
5. collect both quantified selection option answers and narrative type question answers (Yun and Trumbo, 2000)

6. provide feedback "thank-you" upon completion of the survey (Smith, 1997)[11]

Social scientist Andrews et al. also contends that web-based survey are superior to email survey because they fulfill more of these requirements, so the web-based software QuestionPro™ is selected as the primary data collection method for the current research (2003). Of the aforementioned criteria, the web-based preference survey meets all but criterion 4. Criterion 3 does not apply, because an adaptive question is not needed in this survey. Additionally, criterion 4 is also unnecessary, because previous research indicates that preference surveys should be brief with an upper limit of 100 questions (Daniel and Boster, 1976). Furthermore, the previous section determined that only 36 scenes are needed to test the hypothesis completely. QuestionPro™ was selected amongst many available online software servers because it provided the best combination of cost, ease of use, survey design options, data collection options, and data report options.

Reliability, Validity, and Data Analysis Method

Reliability: Cronbach's Alpha

To test the internal reliability of the data, Cronbach's Alpha will measure the correlation of the items making up the scale (Pallant, 2007). Cronbach's Alpha is a commonly used reliability coefficient used in social science contexts. The value from the Cronbach's Alpha, from 0 to 1, will determine if the preferences scores are reliable (Pallant, 2007). The closer to 1 a set of variables scores, the better that set of variables measures a one-dimensional construct. Normally, a score of .7 or higher is necessary to

[11] The list is a direct quotation from Andrews, D., Nonnecke, B., Preece, J. (2003). Electronic survey methodology: A case study in reaching hard to involve Internet Users. *International Journal of Human-Computer Interaction*. 16, 2, 185-210. p. 3. Additional authors listed in BIBLIOGRAPHY.

draw conclusions from the data set (preference scores) (Pallant, 2007). Tveit (2008) employed a similar method to measure intraclass reliability for respondents in visual preference research.

The External Validity of a Student-heavy Population

The purpose of this research is to determine if visual preference is positively correlated to the Gestalt grouping of landscape elements. The basis for the Gestalt hypothesis is that visual perception is a fundamental element of human cognition; therefore the Gestalt hypothesis applies to a general population—all those who are capable to perceive.

Many researchers have tested whether student populations are valid indicators of a general population. The studies have yielded contradictory results. Tveit (2008) found that preference for student population and public groups to be different, warning professional to be careful how they reflect preferences to a wide audience. Likewise, Zube et al., (1983) found that age difference affects preferences. Conversely, Daniel and Boster (1976) demonstrate that student populations are a good representative of the general population. Daniel and Vining (1983) noted the importance of students to developing and testing the in the SBE method. Moreover, an overwhelming number of recent landscape visual preference studies measured undergraduate visual preference translating the data into general landscape predictors. Sevenant and Antrop (2008) assessed cognitive factors of aesthetic beauty with 102 undergraduate students (average age 20) to determine how cognitive factors affect visual predictors generally. Others, too, including Ode et al. 2009 (57% population under 30 years of age), Acar and Sakici

(2008) (85% population under 30 years of age), and Herzog and Leverich (2003) (100% population undergraduate students) use student-heavy populations to determine generalities about visual preference.

Data Analysis Method

Data analysis will employ a combination of multivariate statistical methods designed to measure the variance of mean scores with SPSS 16 software. The results of the preference survey will be analyzed as mean scores for individual landscape scenes. Each scene will have an average population preference score of 1 through 5. Using ANOVA (two-way between groups analysis of variance) techniques, two or more groups will be compared using the mean scores (Pallant, 2007). ANOVA is a two-way analysis tool where the impact of one or more independent variables is measured against the dependant variable—in this case, the preference responses (Pallant, 2007). For example, ANOVA will test whether increasing proximity discernibleness (independent) results in an increase in preference score (dependant variable). A two-way between groups ANOVA can also measure the significance of the Gestalt variables, testing whether proximity or similarity is a better measure of visual preference in a landscape scene. Performing an ANOVA will verify the significance and the effect of the four independent variables on visual preference.

The purpose of the data analysis portion of this research is to answer the hypothesis: does increasing Gestalt characteristics within a landscape scene result in higher mean preference scores? However, during this process, one or more dependant variables may emerge as more reliable predictors of preference than other dependant variables. In other words, vegetative proximity may have a higher mean preference score than man-made proximity. Because of the research design, the ANOVA method will determine corollary results in the process of answering the hypothesis.

Methods Conclusion

Varying approaches are used to conduct visual preferences research and analyze visual preference data. There is not a superior method to gather preference data, yet there are certain methodological questions that provide the foundation for visual preference research.

How to Represent a Landscape Scene?

A review of literature found that photographs are frequently used to represent landscapes (Daniel and Boster, 1976; Schroeder and Anderson, 1984; Hull and Stewart, 1992; Patsfall et al.; 1984; and Kane, 1981; Acar and Sakici, 2008; Natori and Chenoweth, 2008; and Herzog and Leverich, 2003). As result, this study will represent landscapes through the medium of digital photography.

How to Categorize a Landscape Scene?

Classifying a landscape scene into quantifiable preference variables is determined by the research hypothesis. In past studies, researchers regularly modify landscape variables to fit their visual preference hypothesis. As a result, an array of visual predictors have been studied including, physical elements (Anderson et al., 1979; Amir and Gidalizon, 1990), cognitive attributes (S. Kaplan, 1979; Herzog and Leverich, 2003), and perceiver characteristics (Tveit, 2008; Zube et al., 1983). This research, measuring

Gestalt perceptual clues, will measure the effects of *proximity* and *similarity* in a landscape scene.

How to Collect Responses from a Landscape Scene?

Technological advancements provide opportunities for data collection that were previously unavailable to visual preference researchers in the mid-to-late 20^{th} century (i.e. Appleton, 1975; Daniel and Bolster, 1976, Ulrich, 1983; S. Kaplan, 1979). Researcher Andrews et al. determined that web-based surveys provide accurate results with much faster distribution and response rates than paper surveys (2003). Furthermore, QuestionPro™ survey software can record the Likert-scaled responses needed to measure preference. As a result, a web-based survey, accessed by email invitation is the data collection method utilized in this visual preference study.

How to Analyze Responses from a Landscape Scene?

Determining whether highly organized landscapes (i.e. highly Gestalt scenes) are preferred over indiscernible Gestalt scenes is the central purpose of this research. The mean preference scores of the 36 coded landscape photographs, in conjunction with simple statistical analysis can answer this question. To determine which landscape variables are preference indicators requires a more thorough multivariate statistical analysis.

Table 3.5

Summarizing the Methodology for the Visual Preference Survey

How to represent the landscape scene?	Digital photograph *Acar and Sakici (2008), Natori and Chenoweth (2008), and Herzog and Leverich (2003)*
How to categorize the landscape scene?	Independent variable factorial design *Natori and Chenoweth (2008)*
How to collect responses from the landscape scene?	Web-based survey *(Ode et al., 2009)*
How to analyze responses from the landscape scene?	SPSS 16 and two-way between groups ANOVA

The subsequent chapter gives greater details of the visual landscape preference survey. Using the methods established in this chapter, the STUDY chapter gives specific details of the landscape photographs, landscape scene coding, survey format, survey question order, and survey timeline for the research.

CHAPTER IV

THE STUDY

Introduction

This chapter relies on the findings in the METHODS chapter to present a detailed description of the landscape photographs, landscape scene coding, survey format, survey question order, and survey timeline for the visual preference web-survey. The METHODS chapter concludes that visual preference research is administered in a variety of ways with few ground rules providing the basis for reliability. In order for this research to withstand reliability tests, the visual preference method must be replicable. This chapter goes one step further than the METHODS chapter to recount the specific dates, times, and schedule of the landscape photographs and the web-based QuestionPro™ survey. Following this chapter is the RESULTS AND ANALYSIS chapter.

Landscape Scene Coding

The METHODS chapter specifies that four independent variables—Gestalt variable, landscape element type, landscape element location, and discernibleness—will test whether scenes containing high levels of *proximity* or *similarity* are preferred more than scenes with low Gestalt characteristics.

In order to perform systematic comparisons of the visual landscape to test the Gestalt hypothesis, the aforementioned variables must be indentified in the landscape photographs. Although some scenes may contain more than one variable (i.e. a scene testing proximal *vegetation* may contain some *man-made structure*, etc), the visual scene will clearly focus on the variable being examined; superfluous variables may be visible, but will be negligible in the total scene.

Using a basic coding system, each of the 36 scenes is classified with a unique variable combination. The letter S, P, or SP denotes the variable *similarit*y, *proximity*, or *similarity* and *proximity*. In the second column, a one or two indicates the landscape element type as either *vegetatio*n (1) or *man-made* (2). The third delineation, landscape element location, is also measured numerically. One indicates *foreground* and two indicates *background*. Finally, *discernibleness*, the last value, is measured on a 1-3 numeric scale with one designated as *not discernable* and three as *highly discernable*. For example P112 is a landscape scene with vegetative physical elements in the foreground that are organized in discernable proximity. A second example, SP223, is a visual scene with man-made elements in the background that are organized in highly discernable proximity. Table 4.1 lists variable codes for all 36 scenes, assigning a numerical value 1-36 to each landscape scene.

With the guideline for the landscape scenes, the next section explains the procedural steps of the landscape photographer during this study.

Table 4.1

Format of Visual Preference Survey and Landscape Photographs

Image No.	Variable code	Gestalt variable	Landscape element type	Landscape element location	Discernibleness
1	*p111*	Proximity	Vegetation	foreground	not discernable
2	*p112*	Proximity	Vegetation	foreground	discernable
3	*p113*	Proximity	Vegetation	foreground	highly discernable
4	*p211*	Proximity	man-made structure	foreground	not discernable
5	*p212*	Proximity	man-made structure	foreground	discernable
6	*p213*	Proximity	man-made structure	foreground	highly discernable
7	*p121*	Proximity	Vegetation	background	not discernable
8	*p122*	Proximity	Vegetation	background	discernable
9	*p123*	Proximity	Vegetation	background	highly discernable
10	*p221*	Proximity	man-made structure	background	not discernable
11	*p222*	Proximity	man-made structure	background	discernable
12	*p223*	Proximity	man-made structure	background	highly discernable
13	*s111*	Similarity	Vegetation	foreground	not discernable
14	*s112*	Similarity	Vegetation	foreground	discernable
15	*s113*	Similarity	Vegetation	foreground	highly discernable
16	*s211*	Similarity	man-made structure	foreground	not discernable
17	*s212*	Similarity	man-made structure	foreground	discernable
18	*s213*	Similarity	man-made structure	foreground	highly discernable
19	*s121*	Similarity	Vegetation	background	not discernable
20	*s122*	Similarity	Vegetation	background	discernable
21	*s123*	Similarity	Vegetation	background	highly discernable
22	*s221*	Similarity	man-made structure	background	not discernable
23	*s222*	Similarity	man-made structure	background	discernable
24	*s223*	Similarity	man-made structure	background	highly discernable
25	*sp111*	Similarity/proximity	Vegetation	foreground	not discernable
26	*sp112*	Similarity/proximity	Vegetation	foreground	discernable
27	*sp113*	Similarity/proximity	Vegetation	foreground	highly discernable
28	*sp211*	Similarity/proximity	man-made structure	foreground	not discernable
29	*sp212*	Similarity/proximity	man-made structure	foreground	discernable
30	*sp213*	Similarity/proximity	man-made structure	foreground	highly discernable
31	*sp121*	Similarity/proximity	Vegetation	background	not discernable
32	*sp122*	Similarity/proximity	Vegetation	background	discernable
33	*sp123*	Similarity/proximity	Vegetation	background	highly discernable
34	*sp221*	Similarity/proximity	man-made structure	background	not discernable
35	*sp222*	Similarity/proximity	man-made structure	background	discernable
36	*sp223*	Similarity/proximity	man-made structure	background	highly discernable
KEY	scene code	proximity=p; similarity=s; proximity/similarity=sp	vegetation=1; man-made structure=2	foreground=1; background =2	not discernable=1 discernable=2 highly discernable=3

Landscape Digital Photograph Details

The landscape photographs in the visual preference survey were captured within 50 miles of Starkville, Mississippi on the 1st day of April 2009. Weather conditions were sunny to partly cloudy with a high temperature reaching 68º Fahrenheit. An 8-megapixel Kodak P880 wide-angle digital SLR camera was used to take the landscape photographs. Images were captured with a 20-mm lens; greater than the 50-mm recommend by Shuttleworth (1980) and Nassauer (1983). The photographs were taken throughout the course of the day from 11:00 am until 4:30 pm in the counties of Oktibbeha, Winston, Noxubee, and Lowndes counties, Mississippi. Figure 4.1 illustrates the location of the 36 images used in the visual preference survey.

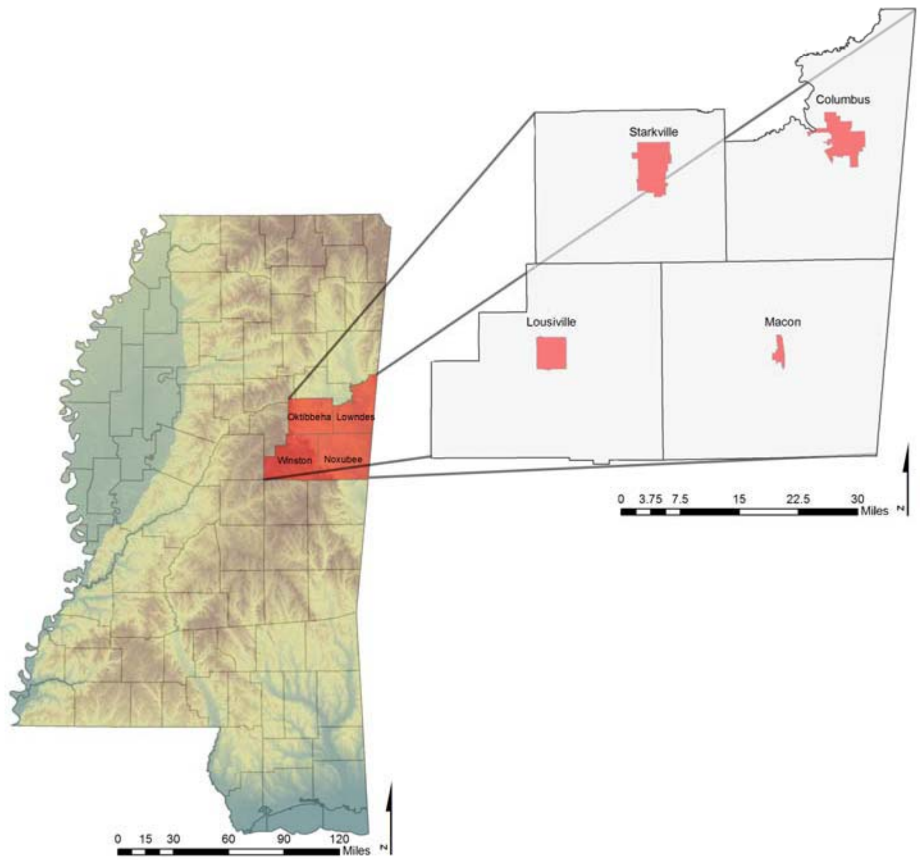

Figure 4.1 The Location of Landscape Photographs Used in the Survey[12]

Because studies have demonstrated a strong correlation between visual preference and memory associations of landscapes (Kyle et al., 2004), the photographs in this study were taken outside the campus of Mississippi State University. Moreover, the majority of the landscape scenes were taken more than 20 miles from Mississippi State University. Additionally, major landmarks and places of interest were avoided so as not to introduce visual preference bias to the study. All photographs were taken at eye level, a height of approximately 5 1/2 feet, and

[12] Image created by author using ArcGIS. MARIS. Mississippi Automated Resource Information System. www.maris.state.ms.us/ Accessed: 6/15/09.

at an angle perpendicular to the ground slope as recommended by Daniel and Boster (1976). A total of 307 digital photographs were taken on April 1st 2009, from which 36 scenes were selected by expert decision to best evaluate the varying degrees of attributes relevant to the visual preference variables.

Landscape Visual Preference Survey Details

As mentioned in the METHODS chapter, the Andrews et al. (2003) method provided the foundation of web-based survey design, development and implementation. The visual preference survey was arranged in the following chronological page-order: one introductory remark (Figure 4.2), eight demographic questions, one explanatory remark (Figure 4.3), 36 individual preference questions (Figure 4.4), and two follow up questions.

In order to reduce user distractions, the QuestionPro™ survey was designed with minimal graphic effects. The survey had a solid navy blue background color, a san serif font—*helvetica*, and a small green percent completion bar in the top center of the screen.

The Andrews et al. method recommends inviting potential survey participants via email (2003). On Thursday the 23rd of April 2009, at approximately 3:00 pm CST, an email invitation containing a link to the url site *www.landscapepreferencesurvey.questionpro.com* was sent to undergraduate students, graduate students, and faculty members of Mississippi State University. The total population receiving the email was over 20,000. The email gave a short description of the study, encouraging participation with a $100 American Express™ gift card (See Appendix B). The purpose of the $100 lottery-type incentive was to increase number of survey responses, and decrease number of survey dropouts. Cash incentives and lottery-based prizes have shown to significantly increase response rates, as much as twice as those motivated by altruistic reasons (Andrews et al. 2003). The email invitation also indicated that the survey would take 10 minutes or less to complete, as research indicates that those who know how long a survey will take are more likely to accept the invitation (Andrews et al. 2003). Recipients following the url were directed to the first page of the survey, and the consent form (Figure 4.2).

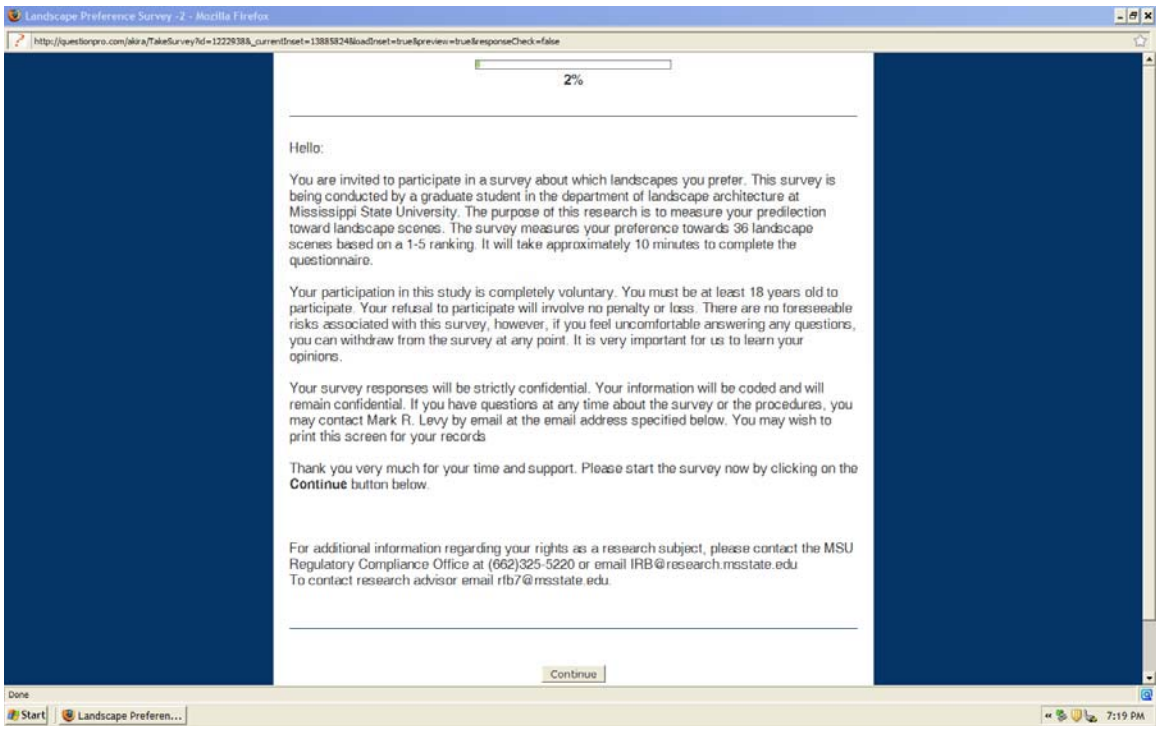

Figure 4.2 The Consent Screen to the Landscape Preference Survey

Because the preference study utilized Mississippi State email listserve as a recruitment channel, Mississippi State University's Institutional Review Board (IRB) required a consent screen to ensure that potential respondents were aware of any risk associated with the survey.

Clicking a small *continue* button in the bottom center of the survey screen indicated that the subject had read, understood, and accepted the terms and conditions of the survey, and had voluntarily participated.

Following the consent screen, nine demographic questions were asked of the survey participants. Although personal questions generally have a negative effect on attrition rates, participants of web-based surveys respond much more favorably to demographic questions placed at the beginning of the survey (Frick et al., 1999). While determining personal characteristics of the perceiver is not the primary purpose of the visual preference survey, demographic questions are necessary for post hoc analysis of reliability. The personal questions were designed to be basic and non-invasive, with multiple choice answers as opposed to open-ended text responses. Examples include age, sex, race, income, birthplace, and profession (See RESULTS).

After completing the demographic portion of the survey, participants were given brief instructions prior to ranking the landscape photographs. The directions instructed participants to focus on the landscape settings and not the photographic quality of the image. Further, participants were asked to rank each scene independently, not to compare two or more scenes. The final sentence of the instruction page emphasized that there are no right or wrong answers.

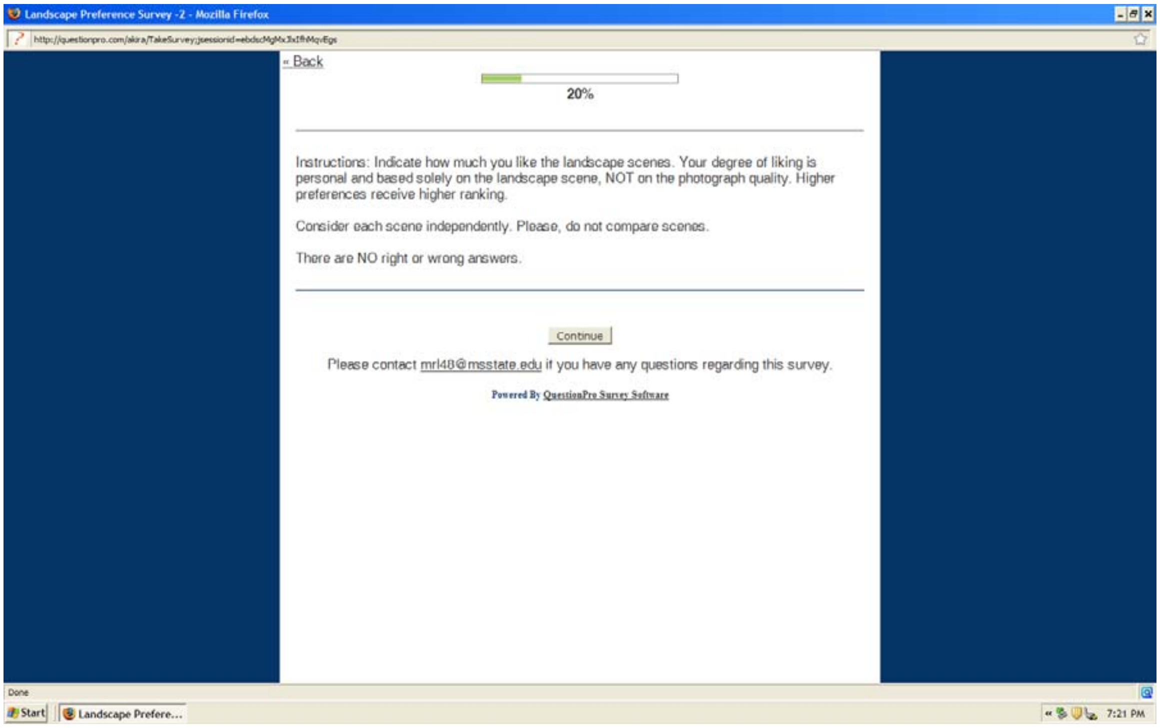

Figure 4.3 Instruction Page for the Preference Survey that Describes How to Respond to the Photograph Content not the Photograph Quality

Questions 10 through 46 of the survey were the single landscape scenes designed to test the hypothesis. Each photograph was edited in Adobe Photoshop CS2™ to be of uniform size and shape. The image content was not altered in any way. Landscape scenes appearing in the survey were approximately 3.4” by 2.3” with a resolution of 130 pixels per inch, translating to an approximate size of 2.6” by 4.6” on an average computer screen. Centered beneath each scene a single-line question asked, *Please indicate how much you like the landscape scene?* Responses were measured by a 1 to 5 radio-style (choose one) graphic. Next to choice 1 a phrase in parenthesis explained, “*not at all*,” next to choice 3 a single word in parenthesis explained, "*neutral*," and finally next to choice 5 a phrase explained "*very much*."

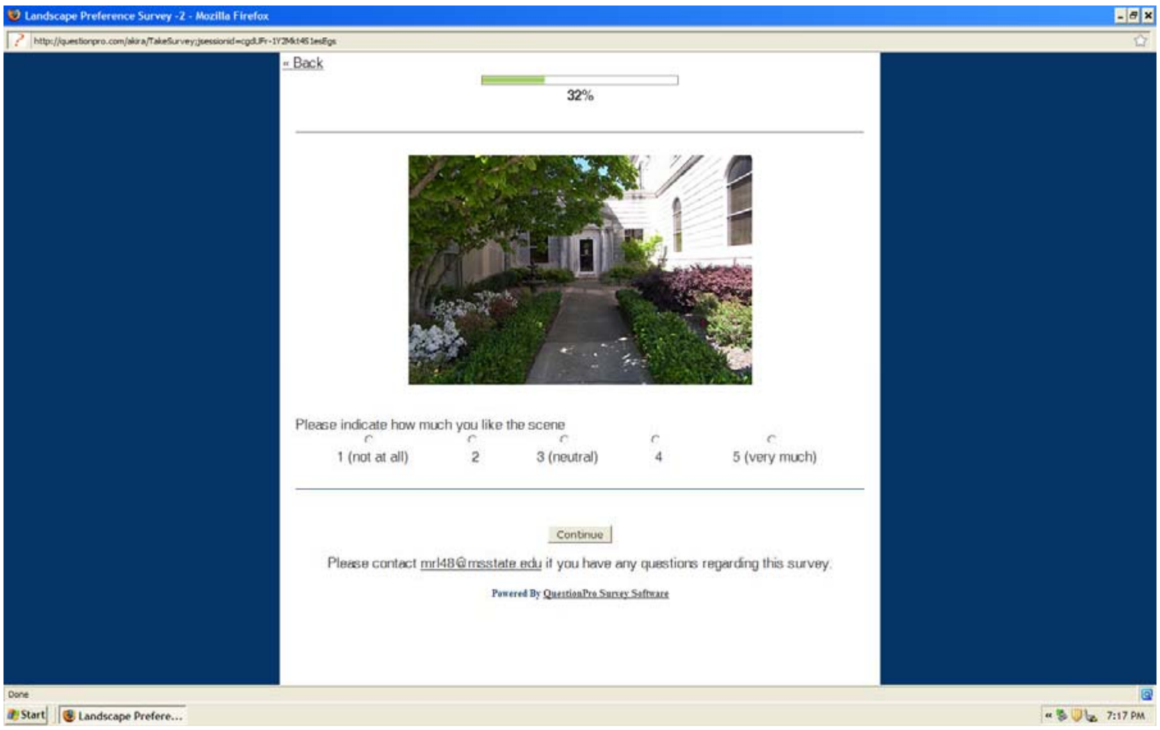

Figure 4.4 A Single-scene Visual Preference Survey Page with Likert-scale 1-5 Visual Preference Options

Likert-scale analysis is the most commonly used response method in visual preference surveys, as originally established in the Scenic Best Estimation method (Daniel and Boster, 1976). There is not a generally accepted scale range; however 1-5 (i.e. A-E) or 1-6 (A-F) are commonly used (Herzog and Leverich, 2003; Tveit, 2008).

The final two pages of the survey thanked respondents, asked for an email address, and provided a comment box for open-ended responses. Before the email invitation was sent to the entire research population, a pilot survey was sent to seven subjects as a pretest. After completing the pilot survey, the reviewers stated opinions and concerns to improve the survey and point out any errors which are extremely common in web-based surveys (Andrews et al., 2003).

Landscape Photograph Survey Order

Following the methods of Natori and Chenoweth (2008) and Herzog and Leverich (2003), the landscape scenes were sorted in random order by the researcher. Since each landscape scene was coded with a number (1-36) and a variable code (*e.g. p111,* refer to Table 4.2), it was possible for a random number generator to ensure that landscape scene were presented in random order. The scene order did not differ for individual participants; each respondent viewed an identical survey. The Table 4.2 lists the order of the 36 landscape scenes used in the survey.

Table 4.2

Landscape Photograph Survey Order, Image Type, and Question Type

Survey question number	Image number	Image type	Question type	Survey question number	Image number	Image type	Question type
1-10	NA	NA	demographic	29	27	Sp113	individual
11	28	Sp211	individual	30	13	S111	individual
12	25	Sp111	individual	31	31	Sp121	individual
13	18	S213	individual	32	20	S122	individual
14	4	P211	individual	33	14	S112	individual
15	10	P221	individual	34	15	S113	individual
16	3	P113	individual	35	6	P213	individual
17	21	S123	individual	36	19	S121	individual
18	12	P223	individual	37	34	Sp221	individual
19	16	S211	individual	38	30	Sp213	individual

Table 4.2 continued

Survey question number	Image number	Image type	Question type	Survey question number	Image number	Image type	Question type
20	33	Sp123	individual	39	5	P212	individual
21	32	Sp122	individual	40	1	P111	individual
22	24	S223	individual	41	22	S221	individual
23	9	P123	individual	42	11	P222	individual
24	26	Sp112	individual	43	35	Sp222	individual
25	2	P112	individual	44	36	Sp223	individual
26	8	P122	individual	45	7	P121	individual
27	17	S212	individual	46	29	Sp212	individual
28	23	S222	individual				

Survey Timeline

The test population received the email invitation linked to the landscape preference survey as a Mississippi State Announcement from the Mississippi State Information Technology Systems server at approximately 3:00 CST on May 15, 2009. The web-based survey was accessible to the population 24 hours a day from this date until 5:00 pm May 29, 2009. To prevent respondents from completing the survey multiple times (i.e. “ballot stuffing”) as recommended by Andrews et al. (2003), a QuestionPro™ device was enabled allowing users from the same IP address one survey submittal.

Conclusion

An investigation of visual preference literature reveals that survey administration and collection methods vary widely. Under the general term *visual preference research*, investigators regularly modify established methodology to best test their hypothesis. Moreover, technological advances have made certain techniques, including web-based surveys, available to researchers only in recent years (Andrews et al., 2003).

The web-based visual preference survey adhered to the principles outlined by Andrews Et al., (2003). QuestionPro™, the web-based survey software, provided the required tools to display the 36 landscape photographs, and measure Likert-scaled preference responses similar to the methods of Herzog and Leverich (2003), Tveit (2008) Natori and Chenoweth (2008), Acar and Sakici (2008), and Ode et al.(2009). Preference ranking instructions and graphic illustrations were minimal, mimicking the techniques of Herzog and Leverich (2003), Tveit (2008), and Ode et al.(2009). In sum, the contextual elements of the survey (i.e. questions, order, ranking scheme), adhered closely to the slide show and paper-based questionnaire methods of Herzog and Leverich (2003), Tveit (2008), Acar and Sakici (2008), and Natori and Chenoweth (2008). The web-based survey appears only in the most recent literature, Ode et al. (2009), suggesting internet-based preference surveys may emerge as a common technique in future studies.

Literature points to data processing as one of the greatest advantages to web-based survey software (Andrews et al. 2008). The following section exhibits the results for this visual preference study, as well as the statistical analysis that will answer the hypothesis.

CHAPTER V

RESULTS, DISCUSSION, AND CONCLUSIONS

Introduction

This chapter conveys the results of the visual preference survey, and draws conclusions from the survey data. The RESULTS AND DISCUSSION chapter consists of five sections: respondent information, validity and reliability, mean preference analysis, landscape variable analysis, and hypothesis analysis. Separating the RESULTS chapter into sections simplifies the large quantity of data into manageable themes.

The respondent information section gives the total number of responses, dropout/completion rate, respondents demographic, and average completion time of the visual landscape preference survey. This first section does not involve synthesis, but instead a listing of the respondent's raw data.

In the second section, validity and reliability are reported. Validity cannot be tested mathematically. The primary concern of validity for this research is the application of the results to a general population, which is discussed in the second section. As mentioned in the METHODS chapter reliability is measured with Cronbach's Alpha coefficient. The result of the Cronbach's Alpha is listed in the second section.

The third section, mean preference analysis, lists the visual preference scores for the 36 scenes from the total population. Because some scenes have higher completion rates than others, the total number of responses for each scene is included in this section. From this data, general trends may be gleaned, however further statistical analysis is needed to answer the hypothesis definitively. The final two sections delve into two-way between groups analysis of variance (ANOVA). The two-way ANOVA gives definite conclusions about each of the four independent variables, specifically the Gestalt variable.

Unless otherwise noted, all graphs or charts are produced with SPSS™ 16 software. SPSS 16™ software is the primary statistical analysis tool, although Microsoft EXCEL™ is also used to process the raw data from the QuestionPro™ data reports.

Results

Response Rates

As previously mentioned, the email invitation was sent to the undergraduate, graduate, and faculty populations of Mississippi State University, or a combined estimate of 20,000 people. Approximately 15%, or 2,993 individuals, choose to follow the landscape preference survey url to the QuestionPro™ server to view the survey. 2,147 individuals started the survey and 1,743 respondents completed the survey (n=1,743), or an 8.72% response rate. The completion rate for the survey was 81.47%. Although over 80% of those who began the survey completed it, some participants chose not to answer all the questions. The consent screen clearly stated that one may skip a question without being penalized, however one must complete the survey to be eligible for the $100 gift card. Figure 5.1 displays the rate of missing value for each question.

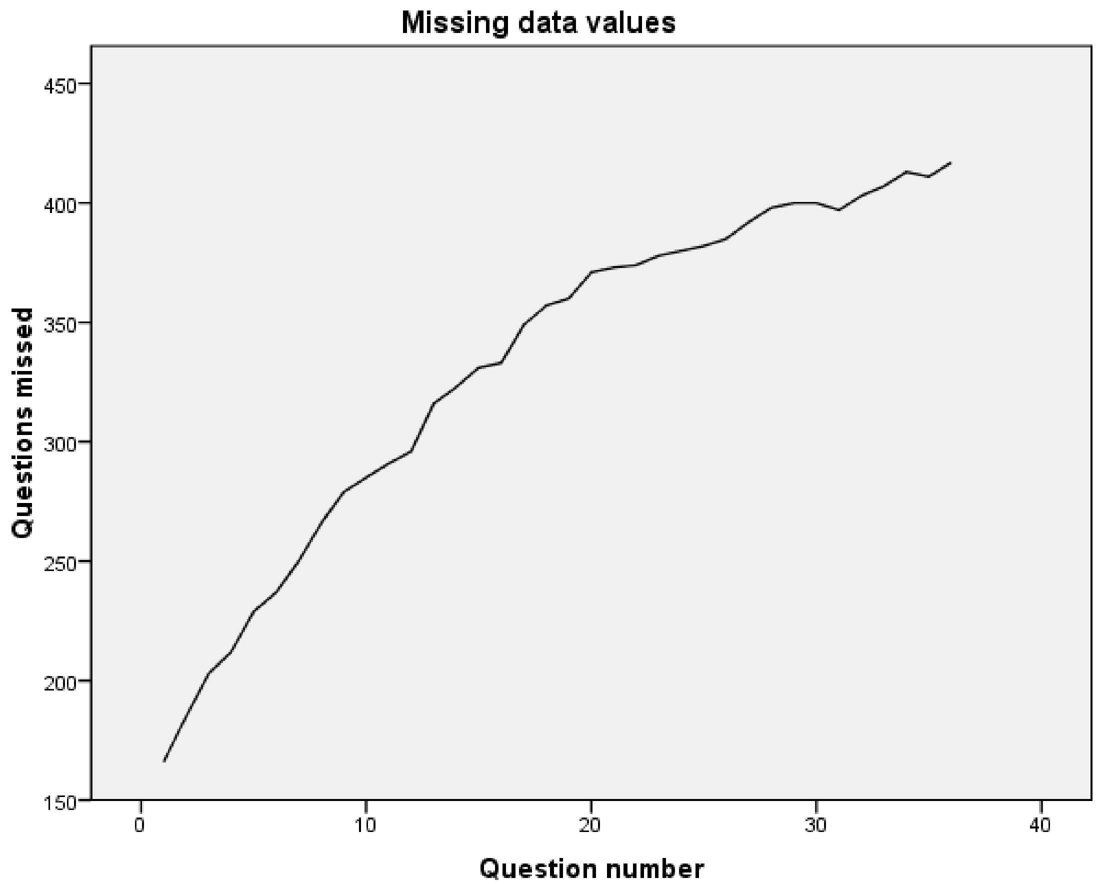

Figure 5.1 The Number of Questions Missed per Question Number

The trend in Figure 5.1 illustrates that dropout rates increased as participants progressed in the survey. Even though the question did not get more difficult during the survey, respondents chose to dropout as the completion time increased. Research indicates higher attrition rates on long surveys, or surveys that seemed irrelevant to the participants (Andrews et al., 2003) The average completion time for the survey was 11 minutes. Survey time ranged from less than one minute to nearly 3 hours.

Demographic Profile

Gender Characteristics

Figure 5.1 clearly illustrates the demographic data did not suffer high dropout rates. The difference between male and female participants was less than 1%. Six more females (1,022) started the survey than males (1,016).

Age Range

With a large majority of the email invitations being sent to students of Mississippi State University, it is not surprising that the age makeup was dominated by individuals under the age of 30. 76.34% of the participants were age 18-30. A far less, 10.16% were age 31-40, and 6.77% and 6.73% of the participants were 41-50 and over 50, respectively. Because such a large percentage of participants were in the 18-30 age range, validity is further examined in the next section of this chapter. (Refer to Figure 5.2).

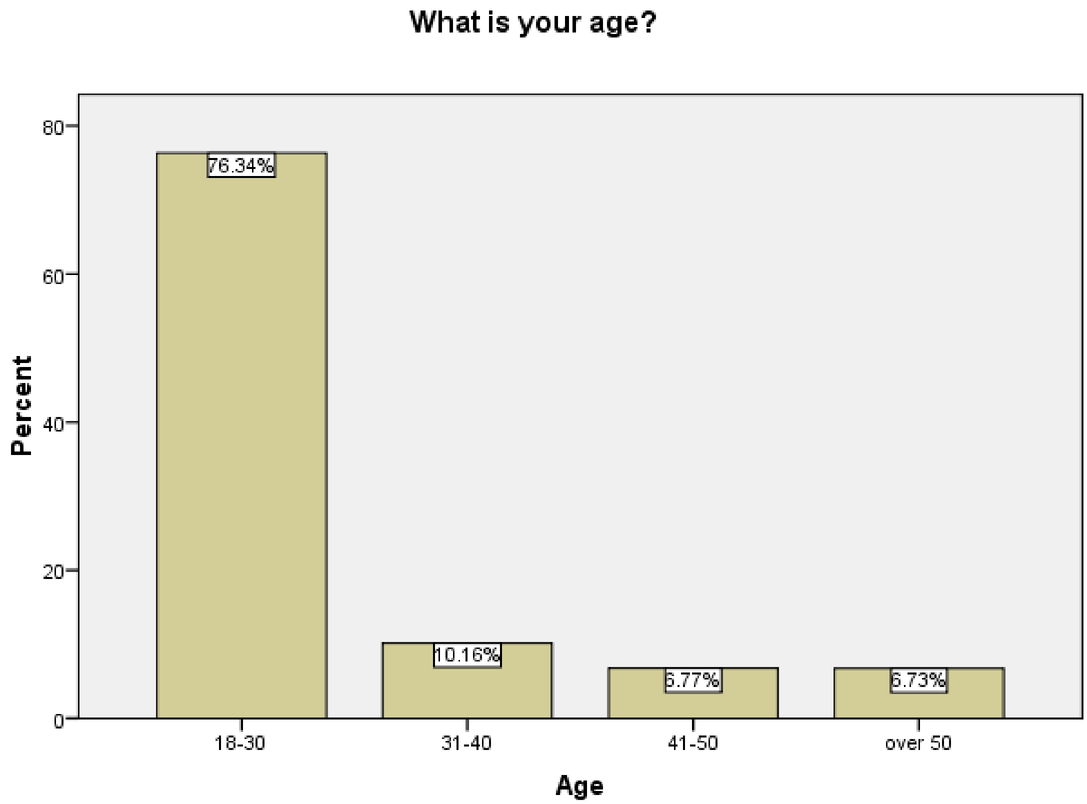

Figure 5.2   Survey Participants' Age Range

Race

The racial makeup summary for the visual preference survey revealed that the majority of the participants were *whites*—a rate of nearly 70%. With 316 respondents, *white, non-Hispanics* was the second highest racial demographic. *African-American*, *Asian-Pacific Islander*, *Hispanic*, and *Native American* followed with 7.96%, 5.24%, 1.29%, and .40% individuals, respectively (refer to Figure 5.3).

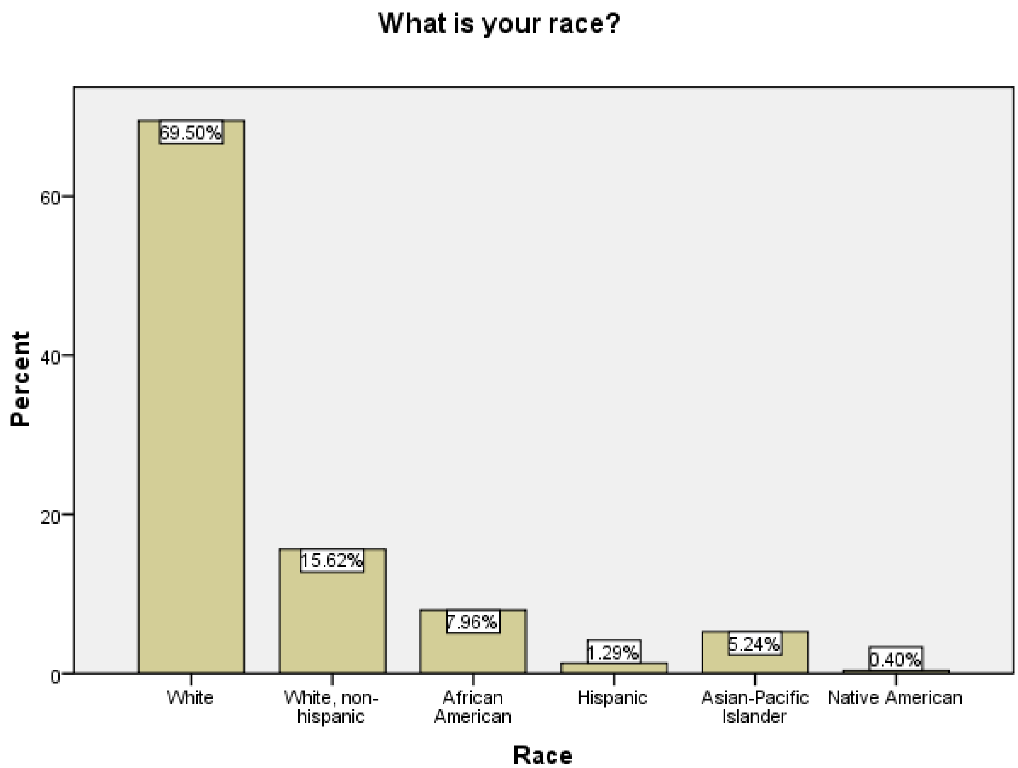

Figure 5.3   Survey Participants' Race

Ethnic Background

One of the advantages of administering a web-based survey to students at a major university is accessibility to diverse ethnic populations. Though the majority of respondents hailed from the United States, nearly 10% of participants were born outside the United States. Countries with the highest participation beside the United States were India (2.1%), China (1%), Canada (.4%), and Turkey (.3%). In all, individuals from 49 countries worldwide participated in the visual preference survey. Most of the surveys were completed within the United States, however some of the surveys were completed from international locations (e.g. Canada).

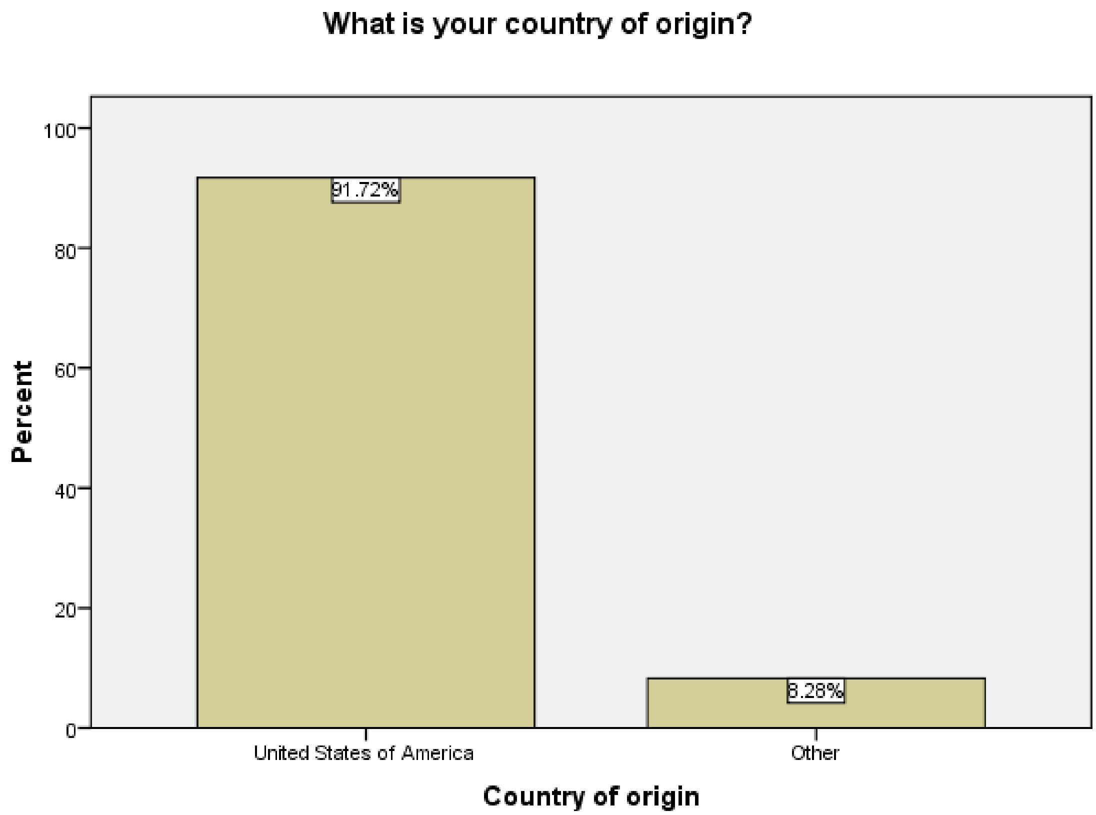

Figure 5.4 Survey Participants' Ethnicity

Education level

The education profile for the landscape preference survey reveals that most participants had some college education, and nearly a quarter of individuals had received a post-baccalaureate degree (23%). 44.53% or 896 individuals were currently attending college, while a combined 27.19% of individuals had either complete a 4-year college degree or received a post-baccalaureate degree. 12.48% of subjects starting the survey had received a masters' degree, 10.83% a doctoral degree, and 1.24% a professional degree (e.g. MD, JD). Only 3.7% or 75 individuals claimed *high school/GED* as their highest level of education. Figure 5.5 shows the education level percentages for survey respondents.

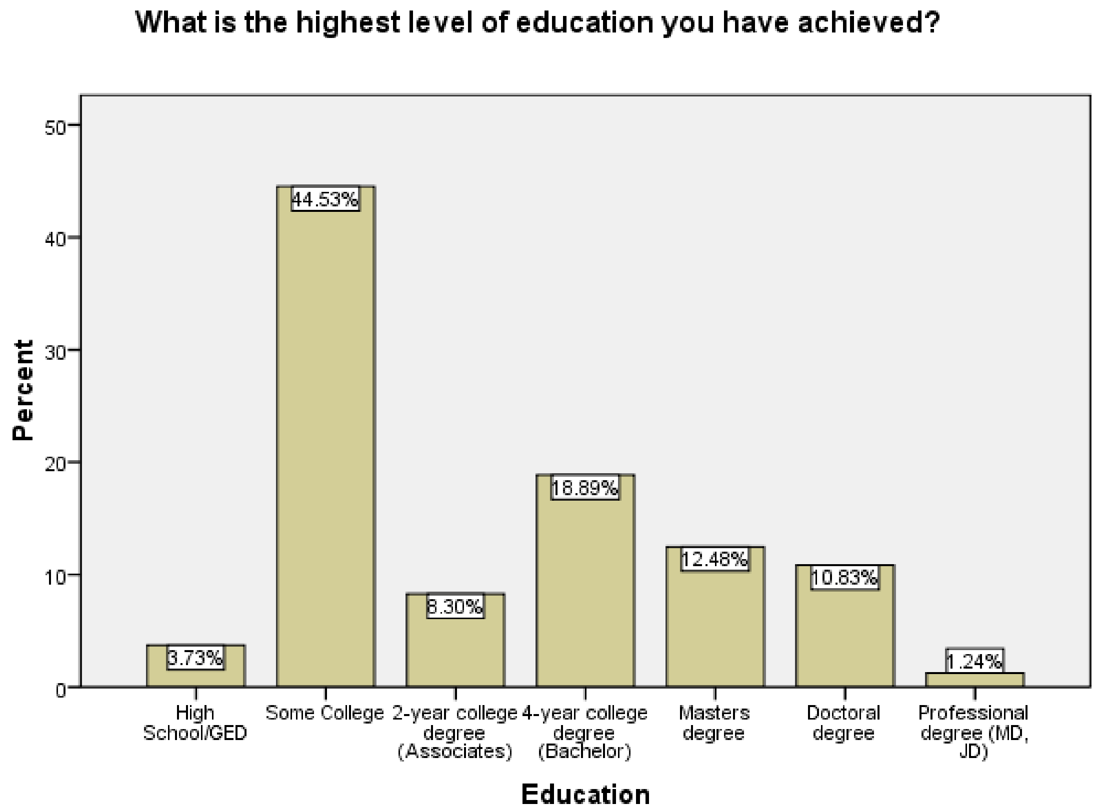

Figure 5.5 Survey Participants' Education Level

Professional Expertise

Because several previous studies (e.g. Daniel and Vining's *formal-aesthetic model* (1983) concentrated on expert opinion to evaluate visual landscape preference, this research gathered statistics on participants' job background. When asked if survey respondents are working in or pursuing a profession related to planning, design, or management, 30.90% of individuals responded *yes* to the question, while 69.10% of individuals responded *no*. This statistic demonstrates that the landscape visual preference survey was not aimed at design professionals, therefore does not fall into Daniel and Vining's expert paradigm. Below are the results from the professional background question.

Annual Income

The yearly income figures for the survey suggest that the majority of respondents are full-time students making less than $10,000. 54.98%, of individuals claimed less than $10,000, 27.84% and 12.58% of individuals claimed $10,000-49,999 and $50,000-99,999, respectively. In the $100,000-250,000 yearly income level, 85 individuals participated, while only 8 individuals making more than $250,000 completed the survey (refer to Figure 5.6).

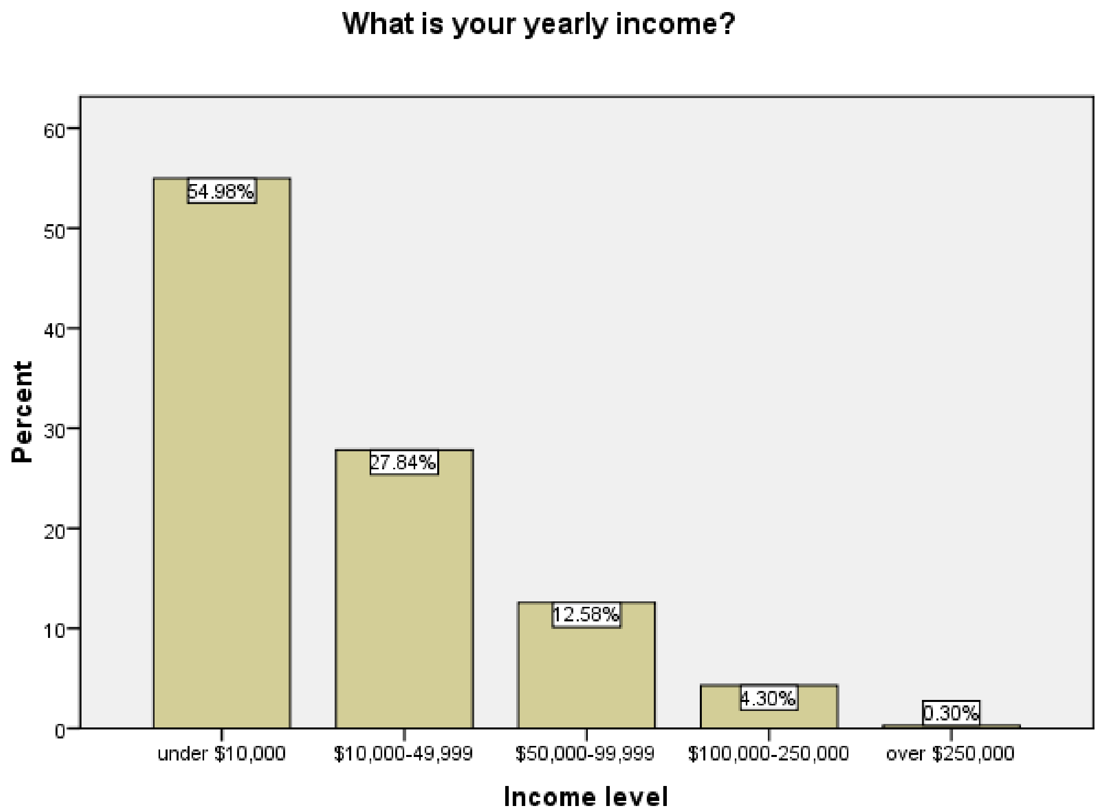

Figure 5.6 Survey Participants' Annual Income Level

Residence Population

The final demographic question asked subjects the size of the city/town they currently resided in. 64.18% of individuals resided within a population core of 10,000-49,999. The second highest response, 13.24%, resided in a city with a population under 10,000 people. The population ranges individuals varied widely, however a significant portion (8.00%) claimed to not know the population of their home residence. With a combined 86.46% of individuals residing in cities/towns under 100,000 people, it is safe to classify survey respondents as a predominately rural population (refer to Figure 5.7).

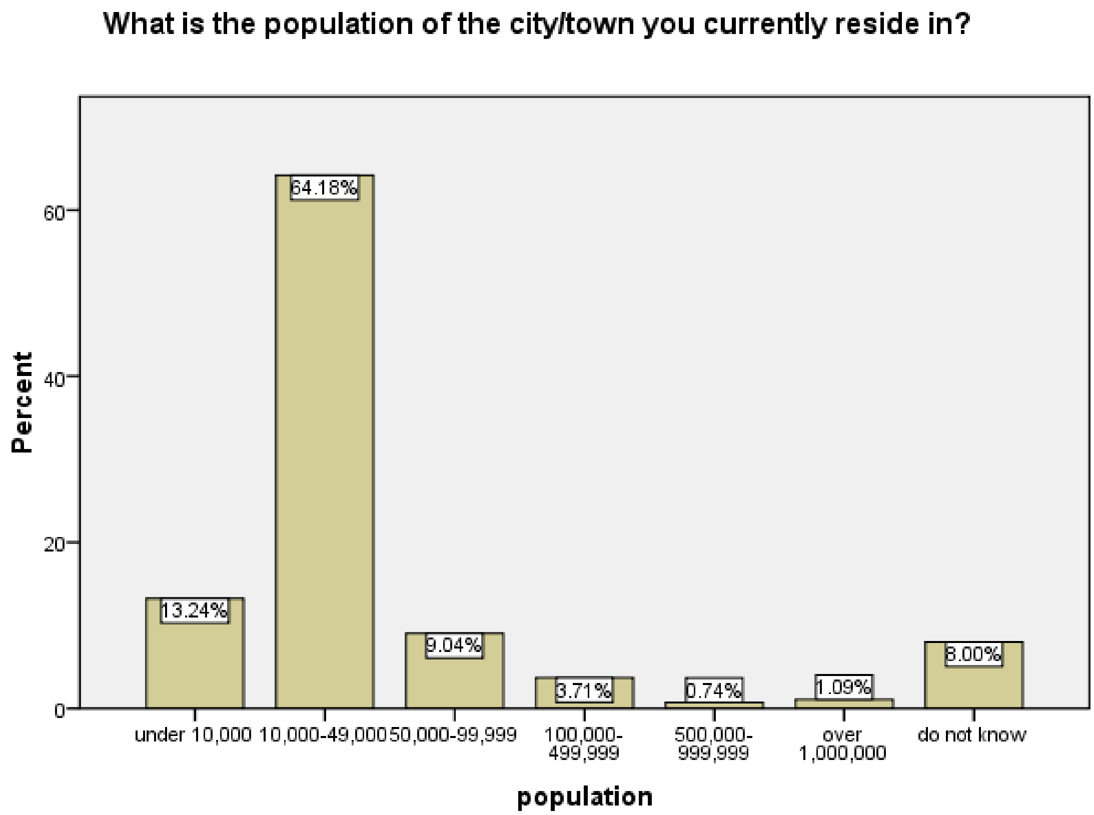

Figure 5.7 Survey Participants' Residence Population

Validity

Demographic data was collected to assess the internal and external validity of the data set. Internal validity examines possible explanations for the results from within sample of data (Altmann, 1974). External validity examines the generality of the conclusions based on the results (Altmann, 1974). Typically, laboratory research has emphasized internal reliability, while observational studies have emphasized external validity (Altmann, 1974). Not withstanding, the conclusions in this research are primarily focused on the external validity (the generality) of the results, specifically the application of preference scores from a sample population to a very general population. Because there are no clear statistical or mathematical methods to measure external validity, intuitive methods are required (Pallant, 2007). The METHODS section revealed that many visual preference researchers (Sevenant and Antrop, 2008; Ode et al., 2009; Acar and Sakici, 2008; and Herzog and Leverich, 2003) have used student-heavy data to draw conclusions about a general population. Moreover, Daniel and Vining (1983) found that a visual assessment method's reliability is critical to its validity, and reliability can be measured mathematically.

Internal Reliability: Cronbach's Alpha

Cronbach's alpha is a measure of internal reliability commonly used in social science fields (Pallant, 2007). Cronbach's alpha is a coefficient testing the intercorrelation of the Likert-scale preference responses (dependant variable) from the preference survey. The Cronbach's alpha calculated for this survey is .880 (Figure 3.8). .880 is considered a "good" statistic for internal reliability.

Table 5.1

"Good" Statistics for Cronbach's Alpha for Reliability

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.880	.885	36

Preference Scores for the Landscape Scenes

General

Mean preference scores were calculated for each of the 36 landscape scenes. The photograph with the lowest preference score, 1.69, was the first landscape scene in the survey, SP211. The highest mean preference score, 4.66, was the landscape scene containing discernable similarity/proximity of vegetative landscape elements in the foreground (SP112).

Figure 5.8 Landscape Scene in the Visual Preference Survey
Receiving the Lowest Mean Preference Score

Figure 5.9 Landscape Scene in the Visual Preference Survey Receiving the Highest Mean Preference Score

The standard deviation for the survey ranged from .708 for scene P113 to 1.238 for scene SP121. Standard deviation measures how tightly the individual responses are clustered around the mean. Therefore, the smaller the standard deviation for a landscape scene; the higher percentage of preference responses were similar.

Figure 5.10 Landscape Scene in the Visual Preference Survey
Receiving the Lowest Standard Deviation

Figure 5.11 Landscape Scene in the Visual Preference Survey
Receiving the Highest Standard Deviation

The mean preference scores for each photograph are listed in Table 5.2 with median, mode, standard deviation, and variance. To illustrate that mean preference scores did not falter as the survey progressed, Figure 5.12 reveals the mean preferences scores per question order.

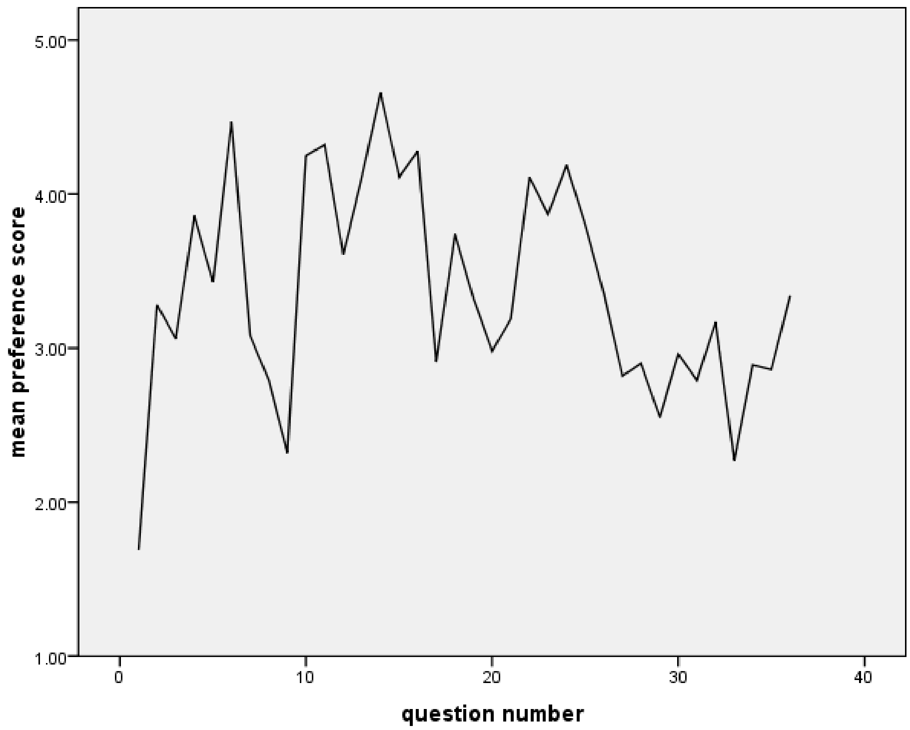

Figure 5.12 Mean Preference Score per Survey Question

Table 5.2

Mean Preference Score for Landscape Scenes in Survey Question Order

	Valid	Missing	Mean	Median	Mode	Std. Deviation	Variance		Valid	Missing	Mean	Median	Mode	Std. Deviation	Variance
sp211	1983	166	**1.69**	1.00	1	.812	.659	sp113	1789	360	**3.32**	3.00	3	.910	.829
sp111	1964	185	**3.28**	3.00	4	1.061	1.126	s111	1778	371	**2.98**	3.00	3	1.205	1.453
s213	1946	203	**3.06**	3.00	3	.970	.941	sp121	1776	373	**3.19**	3.00	3	1.238	1.533
p211	1937	212	**3.86**	4.00	4	.935	.874	s122	1775	374	**4.11**	4.00	4	.858	.737
p221	1920	229	**3.43**	4.00	4	1.067	1.139	s112	1771	378	**3.87**	4.00	4	.915	.838
p113	1912	237	**4.47**	5.00	5	.708	.502	s113	1769	380	**4.19**	4.00	5	.840	.706
s123	1899	250	**3.08**	3.00	3	1.166	1.361	p213	1767	382	**3.80**	4.00	4	1.029	1.059
p223	1883	266	**2.79**	3.00	3	1.025	1.052	s121	1764	385	**3.35**	3.00	3	.964	.929
s211	1870	279	**2.32**	2.00	1	1.143	1.307	sp221	1757	392	**2.82**	3.00	3	1.078	1.161
sp123	1864	285	**4.25**	4.00	5	.826	.683	sp213	1751	398	**2.90**	3.00	3	1.066	1.135
sp122	1858	291	**4.32**	4.00	5	.766	.587	p212	1749	400	**2.55**	3.00	3	1.086	1.179
s223	1853	296	**3.61**	4.00	4	.905	.820	p111	1749	400	**2.96**	3.00	3	1.151	1.325
p123	1833	316	**4.11**	4.00	4	.819	.672	s221	1752	397	**2.79**	3.00	3	1.052	1.106
sp112	1826	323	**4.66**	5.00	5	.605	.366	p222	1746	403	**3.17**	3.00	3	1.000	1.001
p112	1818	331	**4.11**	4.00	4	.883	.781	sp222	1742	407	**2.27**	2.00	2	.952	.906
p122	1816	333	**4.28**	4.00	5	.808	.654	sp223	1736	413	**2.89**	3.00	3	.949	.900
s212	1800	349	**2.91**	3.00	3	1.191	1.419	p121	1738	411	**2.86**	3.00	3	1.110	1.232
s222	1792	357	**3.74**	4.00	4	.949	.900	sp212	1732	417	**3.34**	4.00	4	1.102	1.214

Table 5.3

Mean Preference Score for Landscape Scenes in Scene Order

	Valid	Missing	Mean	Median	Mode	Std. Deviation	Variance		Valid	Missing	Mean	Median	Mode	Std. Deviation	Variance
p111	1749	400	**2.96**	3.00	3	1.151	1.325	s121	1764	385	**3.35**	3.00	3	.964	.929
p112	1818	331	**4.11**	4.00	4	.883	.781	s122	1775	374	**4.11**	4.00	4	.858	.737
p113	1912	237	**4.47**	5.00	5	.708	.502	s123	1899	250	**3.08**	3.00	3	1.166	1.361
p211	1937	212	**3.86**	4.00	4	.935	.874	s221	1752	397	**2.79**	3.00	3	1.052	1.106
p213	1767	382	**3.80**	4.00	4	1.029	1.059	s223	1853	296	**3.61**	4.00	4	.905	.820
p121	1738	411	**2.86**	3.00	3	1.110	1.232	sp111	1964	185	**3.28**	3.00	4	1.061	1.126
p122	1816	333	**4.28**	4.00	5	.808	.654	sp112	1826	323	**4.66**	5.00	5	.605	.366
p123	1833	316	**4.11**	4.00	4	.819	.672	sp113	1789	360	**3.32**	3.00	3	.910	.829
p221	1920	229	**3.43**	4.00	4	1.067	1.139	sp211	1983	166	**1.69**	1.00	1	.812	.659
p222	1746	403	**3.17**	3.00	3	1.000	1.001	sp212	1732	417	**3.34**	4.00	4	1.102	1.214
p223	1883	266	**2.79**	3.00	3	1.025	1.052	sp213	1751	398	**2.90**	3.00	3	1.066	1.135
s111	1778	371	**2.98**	3.00	3	1.205	1.453	sp121	1776	373	**3.19**	3.00	3	1.238	1.533
s112	1771	378	**3.87**	4.00	4	.915	.838	sp122	1858	291	**4.32**	4.00	5	.766	.587
s113	1769	380	**4.19**	4.00	5	.840	.706	sp123	1864	285	**4.25**	4.00	5	.826	.683
s211	1870	279	**2.32**	2.00	1	1.143	1.307	sp221	1757	392	**2.82**	3.00	3	1.078	1.161
s212	1800	349	**2.91**	3.00	3	1.191	1.419	sp222	1742	407	**2.27**	2.00	2	.952	.906
s213	1946	203	**3.06**	3.00	3	.970	.941	sp223	1736	413	**2.89**	3.00	3	.949	.900

Tables 5.2 and 5.3 illustrate that the mean preference scores did not vary widely within the 1-5 range. Only one of the scenes, SP211, had a ranking below 2. None of the 36 scenes had a ranking higher than 4.66. The average mean preference score for the entire survey was only slightly above 3 at 3.37.

Gestalt Variable

Analysis of the individual Gestalt variables on the preference did not reveal an overwhelming preference for a specific Gestalt grouping principle (i.e. similarity, proximity, and similarity/proximity). P*roximity* (n=12)[13] received the highest average mean preference score of 3.53. S*imilarity* (n=12) followed with an average mean preference score of 3.33. S*imilarity/proximity* (n=12) received the lowest score at 3.24.

Both s*imilarity* and s*imilarity/proximity* fell below the overall survey average of 3.3, however this statistic is slightly misleading because one or more of the Gestalt variables was classified as *not-discernable*. One way to verify the impact of the Gestalt variable on the visual preference is to consider which Gestalt variable received the highest preference at the same level of discernibleness within a scene. As Table 5.4 illustrates *similarity/proximity* had the highest variance of the Gestalt variables at .726, followed by *proximity* at .429 and *similarity* at .330.

[13] N refers to the number of scenes within the survey testing the variable. The total N for each variable totals 36 for each independent variable. E.g. Proximity (n=12)+similarity (n=12)+similarity/proximity (n=12)=(n=36).

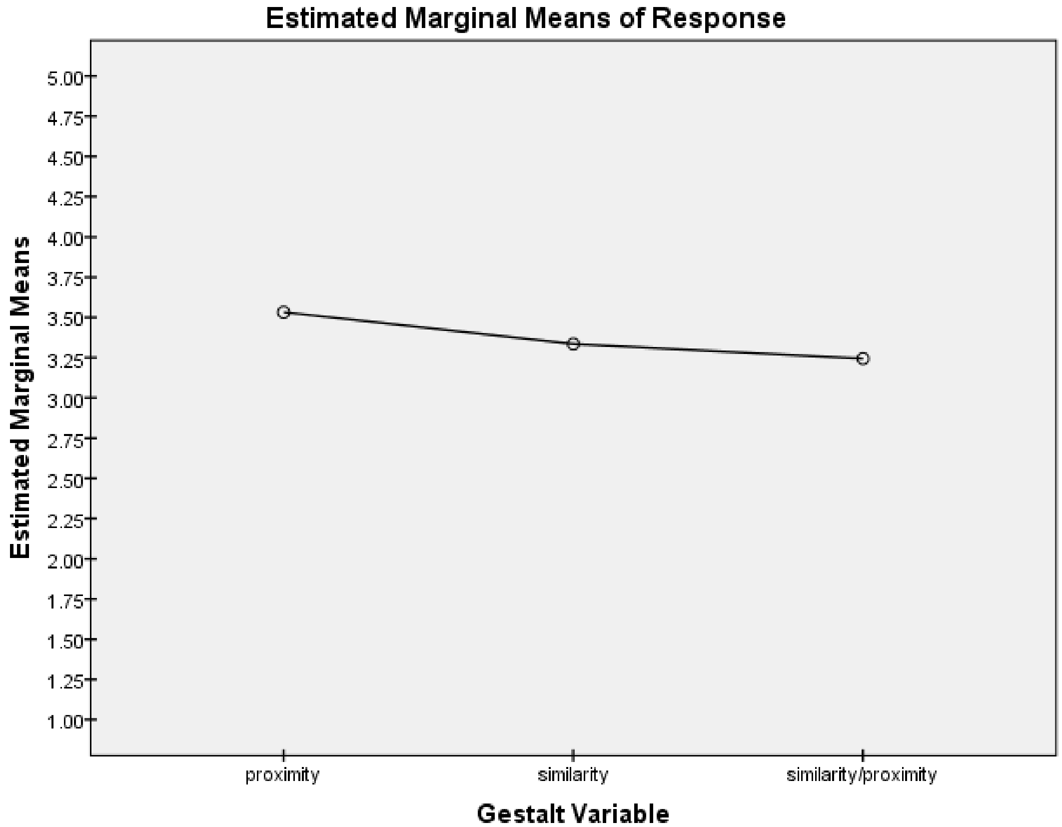

Figure 5.13 Average Mean Preference Scores for the Gestalt Variable

Table 5.4

Gestalt Grouping Principles Average Means, Standard Deviations, and Variances

		Proximity	Similarity	Sim./prox.
N	Valid	12	12	12
	Missing	24	24	24
	Mean	3.53	3.33	3.24
	Std. Deviation	.65519	.57464	.85179
	Variance	.429	.330	.726

Discernibleness Variable

Discernibleness proved to be both an interesting and complicated indicator of visual preference in a landscape scene. Generally, the discernable variable had lower variances than other independent variables Scenes coded *highly discernable* in the survey had an average mean preference score of 3.54, with a standard deviation of .61. The average mean preference score for *discernable* and *not discernable* was 3.61 and 2.96, respectively. The purposes of classifying scenes with a level of discernibleness was to see if increasing the level of Gestalt organization in a landscape scene resulted in a corollary increase in visual preference. Based on these results, there is a distinct preferential difference in scenes where the Gestalt grouping of landscape elements are not visible and those scenes where the Gestalt grouping of landscape elements are visible. However, the scenes containing the highest level of Gestalt ranked slightly lowered than scenes where Gestalt was visible, but not highly visible. Table 5.5 denotes the mean, standard deviation, and variance for mean preference score by category.

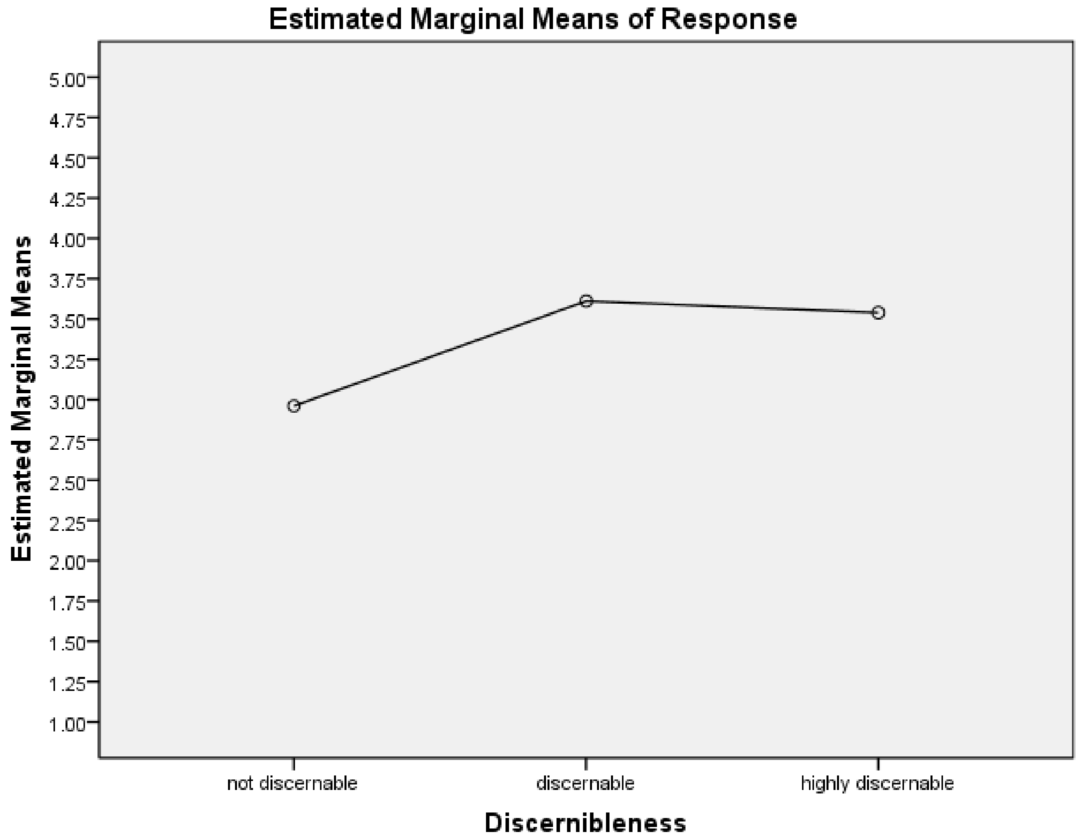

Figure 5.14 Average Mean Preference Scores for the Discernibleness Variable

Table 5.5

Discernibleness Average Means, Standard Deviations, and Variances

		Not disc.	Disc.	High disc.
N	Valid	12	12	12
	Missing	24	24	24
	Mean	2.96	3.61	3.54
	Std. Deviation	.55757	.75773	.60857
	Variance	.311	.574	.370

Landscape Element Type Variable

Of all the average mean preference factors, *vegetation* received the highest score at 3.74. The preference ranking reveals that *vegetation* received consistently higher preference rankings than other attributes which is consistent with the research of Kaplan and Kaplan (1982), Kaplan et al. (1998), and Ulrich (1983). *Man-made structures* (n=18) received an average mean preference score of 3.00. The .74 difference in mean preference score is the largest discrepancy between any factors.

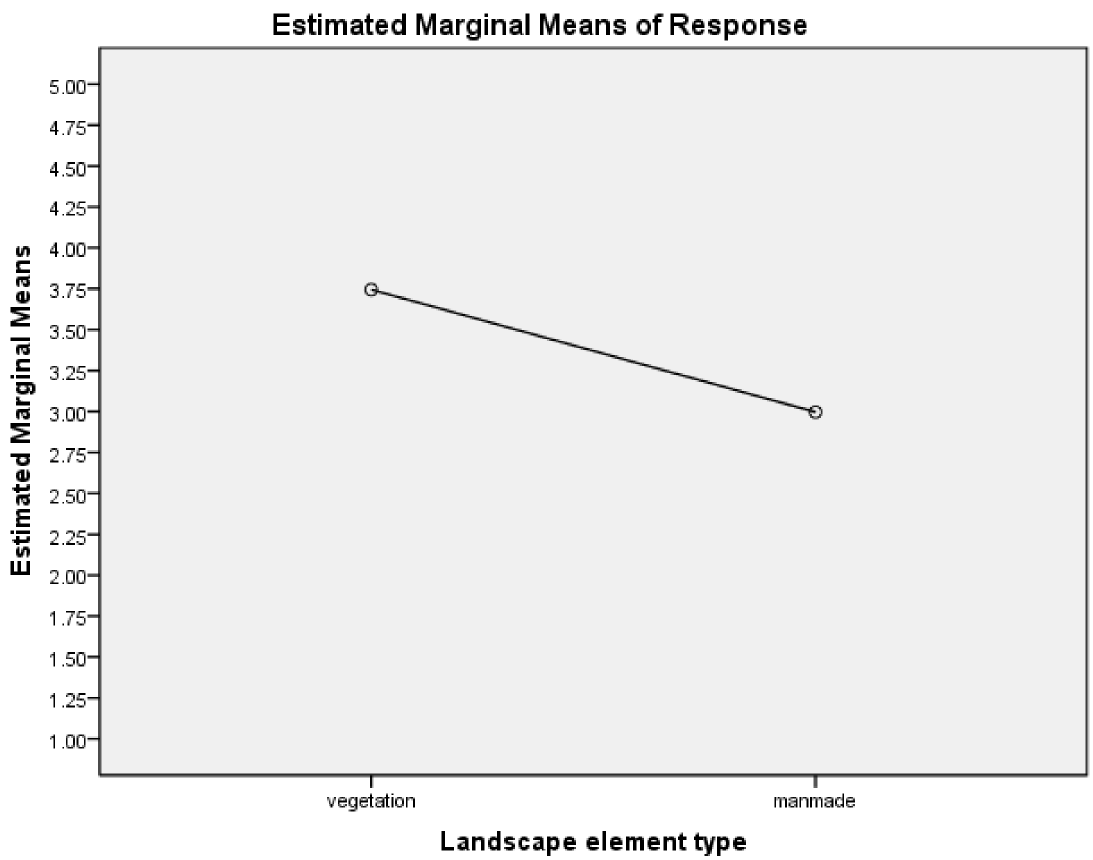

Figure 5.15 Average Mean Preference Scores for the Landscape Element Type Variable

Table 5.6

Landscape Element Type Average Means, Standard Deviations, and Variances

		Vegetation	Man-made
N	Valid	18	18
	Missing	18	18
	Mean	3.7439	2.9967
	Std. Deviation	.60078	.57888
	Variance	.361	.335

Landscape Element Location Variable

Foreground and *background* were the most statistically similarity average means with a difference in the hundredths. *Foreground* (n=18) received and average mean preference score of 3.35 while *background* (n=18) received an average mean preference score of 3.39. Researchers Kaplan et al. (1998) concluded that scenes with large-expanses of undifferentiated landcover are low in preference because the perceiver does not have an immediate object to focus his or her attention. Ulrich (1983) calls this concept the focality of a scene. Generally, scenes lacking focality are lower in preference than scenes where a focal point is located at a closer range. The *background* scenes in this study have visible objects within 50 to 100 feet range.

Table 5.7

Landscape Element Location Average Means, Standard Deviations, and Variances

		Foreground	Background
N	Valid	18	18
	Missing	18	18
	Mean	3.35	3.39
	Std. Deviation	.77529	.62413
	Variance	.601	.390

Analysis

Why Perform an Analysis of Variance?

Mean preference scores give an indication of which independent variables are visually preferred, but without performing a two-way between groups analysis of variance (ANOVA) it is impossible to determine if the independent variables have a significant effect on the dependant variable. In other words, the ANOVA explains whether the results listed in the previous section are statistically significant results. If the four independent variables are considered statistically significant, it is safe to conclude exactly how each independent variable affects visual preference. If the main effects of the four independent variables are not significant ($p>.05$) then the results for the survey remain inconclusive.

The initial findings are important indicators of visual preference; however, analyzing mean preference scores without verifying their significance does not give definitive proof regarding the Gestalt hypothesis. Analyzing the independent variables' effect on visual preference responses with a two-way ANOVA is necessary to accept or reject the hypothesis.

Univariate Statistical Analysis: Two-Way between Groups Analysis of Variance (ANOVA)

Analysis of variance (ANOVA) compares the mean scores of two or more groups (Pallant, 2007). ANOVA is particularly applicable to this research because it measures the differences between variances of independent variables with many levels, and it measures individual and joint effects of two or more independent variables (i.e. factors). The dependant variable for all ANOVA analysis is the respondents' scores. The four independent variables are the *Gestalt* variable (GVar), *vegetation/man-made* variable (StrVar), *foreground/background* variable (GroVar), and the *discernibleness* variable (DisVar). The results of the two-way ANOVA are summarized in Tables 5.8 and 5.9 below.

Table 5.8

Levene's Test of Equality of Error Variances

Dependent Variable: Response			
F	df1	df2	Sig.
87.902	35	65379	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + GVar + StrVar + GroVar + DisVar + Gvar * StrVar + Gvar * GroVar + Gvar * DisVar + StrVar * GroVar + StrVar * DisVar + GroVar * DisVar + Gvar * StrVar * GroVar + Gvar * StrVar * DisVar + Gvar * GroVar * DisVar + StrVar * GroVar * DisVar + Gvar * StrVar * GroVar * DisVar

Table 5.9

Results from the Test of Between-Subject Effects (ANOVA)

Dependent Variable: Response						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	31191.015[a]	35	891.172	917.059	.000	.329
Intercept	742013.914	1	742013.914	763568.451	.000	.921
Gvar	946.851	2	473.426	487.178	.000	.015
StrVar	9132.737	1	9132.737	9398.031	.000	.126
GroVar	30.097	1	30.097	30.971	.000	.000
DisVar	5534.790	2	2767.395	2847.784	.000	.080

Interpreting the Results of the ANOVA

The Levene's Test of Equality of Variance (Table 5.7) tests whether the basic assumptions of analysis of variance for this model are valid (Pallant, 2007). The two-way ANOVA performed in this study uses a significant value of .05 (p=.05) throughout. As Figure 4.1 illustrates, the significance level for every independent variable is significant (.00<.05) indicating variance across the dependent variable (responses) is not equal. Even when tested at a stricter confidence level of .01, the independent variables violated the homogeneity of variance. This violation is likely due to the difference in sample sizes between independent variables and should not be considered a problem for this study because analysis of variance are robust to violations provided the groups sizes are similar (Pallant, 2007).

Table 5.8 the *Tests of Between Subject Effects* yields similar significance results (Sig=.00) as the Levene's test. The two-way ANOVA reveals that every independent variable is significant as all p-values are under .05. Even when tested with a stricter confidence value ($p<.01$) all the independent variables can be considered significant. This signifies that the independent variables (GVar, StrVar, GroVar, and DiscVar) significantly affect preference response (dependant variable), so conclusions concerning the Gestalt organization can safely be interpreted.

Discussion

Gestalt Variable

Multiple comparison of the Gestalt variable indicates that the *proximity* of landscape elements to one another in a landscape scene results in higher preference than *similarity* and *similarity/proximity* of landscape elements in a landscape scene. This outcome should not be surprising to a student of visual perception, because proximity was the first recognized Gestalt grouping principle, and possibly the strongest (See Wertheimer's illustration in "the dot essay," Figures 1.1, 1.2, and 1.4).

As noted by Wertheimer, proximity of landscape elements is chiefly concerned with the distance between objects, not similar forms of objects. The law of proximity states that individual objects are perceived as groups as distance between the objects decrease (Wolfe et al., 2006). Consequently, as proximity increases within a landscape scene, the scene becomes easier to understand. In a landscape scene, proximity of objects results in the highest visual preference, because scenes with high proximity are easiest to interpret and understand. The Gestalt rule of *Pragnanz* (i.e. meaningfulness) states that humans will perceive the simplest patterns requiring the least amount of cognitive effort (Zimbardo et al., 2003). The organization appearing the most stable will be perceived as the “best” (Murphy, 1949). The results of this visual preference survey, then, verify the original claims of Gestaltists. The independent variable of *proximity*—the simplest, most orderly, stable, and easy to perceive—results in the highest visual preference amongst the three Gestalt grouping principles tested.

Similarity (3.33 preference score), the second grouping principle recognized by Gestaltists and the second factor of the Gestalt variable (GVar) tested, resulted in a slightly lower preference score than *proximity* (3.53 preference score), but higher than the combination of *similarity/proximity* (3.24 preference score). Again this result corroborates the Gestalt hypothesis that easy to understand scenes are the most meaningful.

Figure 5.16 Highest Ranked Proximity Scene in the Visual Preference Survey

Figure 5.17 Highest Ranked Similarity Scene in the Visual Preference Survey

Figure 5.18 Highest Ranked Similarity/Proximity Scene in the Visual Preference Survey

Figures 5.16, 5.17, and 5.18 illustrate how scenes measuring *similarity* (5.17) and *similarity/proximity* (5.18) are slightly more complex than *proximity* (5.16). As perceptual understanding becomes more challenging from *proximity* to *similarity* to *similarity/proximity*, the figures become more difficult to interpret. Based on the law of *Pragnanz*, as a figure become more difficult to interpret, it is perceived as less meaningful (Murphy, 1949). The cognitive effect of a less meaningful configuration is a less preferred scene. In sum, scenes measuring *proximity* received the highest preference scores, because they were easiest to comprehend.

The next section, discussing the *discernibleness* variable, directly answers the hypothesis—does increasing level of Gestalt result in an increased visual preference?

Discernibleness

Discern, the root word of discernibleness, means "to recognize as distinct" (Oxford English Dictionary Online, 1989). It should be noted that recognition, one step further in the cognition process than perception, requires some understanding. In this study, the object meant to be recognized is actually a group of landscape objects that are arranged as Gestalt patterns. For example, a landscape classified as a *highly discernable* scene should contain more visually distinguishable patterns of Gestalt grouping than a landscape classified as *not discernable*. In this visual preference study, three levels of discernibleness tested the organization of landscape scenes. Landscapes classified as *not discernable* received a very low 2.96 preference score. *Discernable* scenes, the highest visual preferred landscapes, received a 3.61 preference score. Finally, *highly discernable* scenes generated a 3.54 mean preference score. The outcome is summarized as *discernable>highly discernable>not discernable*.

Based on the strictest interpretation of the hypothesis, this outcome fails. In order to accept the hypothesis the outcome must be *highly discernable>discernable>not discernable*.

Just because the hypothesis was rejected, however, does not render the findings of this study useless. Based on the results of the *discernibleness* variable, three general explanations are deduced. The first two possible explanations are theoretical and the last practical. These three explanations are the 1.) threshold of discernment effect, 2.) the outlier effect, or 3.) the indistinguishable factors effect.

The Threshold of Discernment Effect

First, the large gap (.58) between the bottom two levels—not *discernable* landscapes and the *highly discernable* landscapes—indicates that there is a threshold of discernment that related to visual preference. The inconsistency between the preference scores within the three levels of *discernibleness* supports this notion. Consider the .58 gap between the *not discernable* and d*iscernable*, and a .07 gap between d*iscernable* and h*ighly discernable*.

Table 5.10

Difference in Preference Scores within Discernibleness Variable Factors

Classification	Mean Preference	Difference
Not discernable	2.96	-.58
Discernable	3.61	--
Highly discernable	3.54	-.07

The large difference in preference between *not discernable* and *discernable* is not present between *highly discernable* and *discernable*. Consequently, one conclusion is that a visual scenes with no discernable Gestalt patterns is very different from a visual scene with *any* discernable patterns, however a visual scene with *some* discernable Gestalt patterns is not altogether different than a landscape scene with *high* Gestalt patterns. This conclusion can be called the threshold effect, because it suggests a strong threshold between two levels, not a graduated increase in visual preference amongst three levels. Figure 5.21 illustrates the leap or "threshold" in preferences between *not discernable* and *discernable*, and the plateau of preference scores from *discernable* to *highly discernable*.

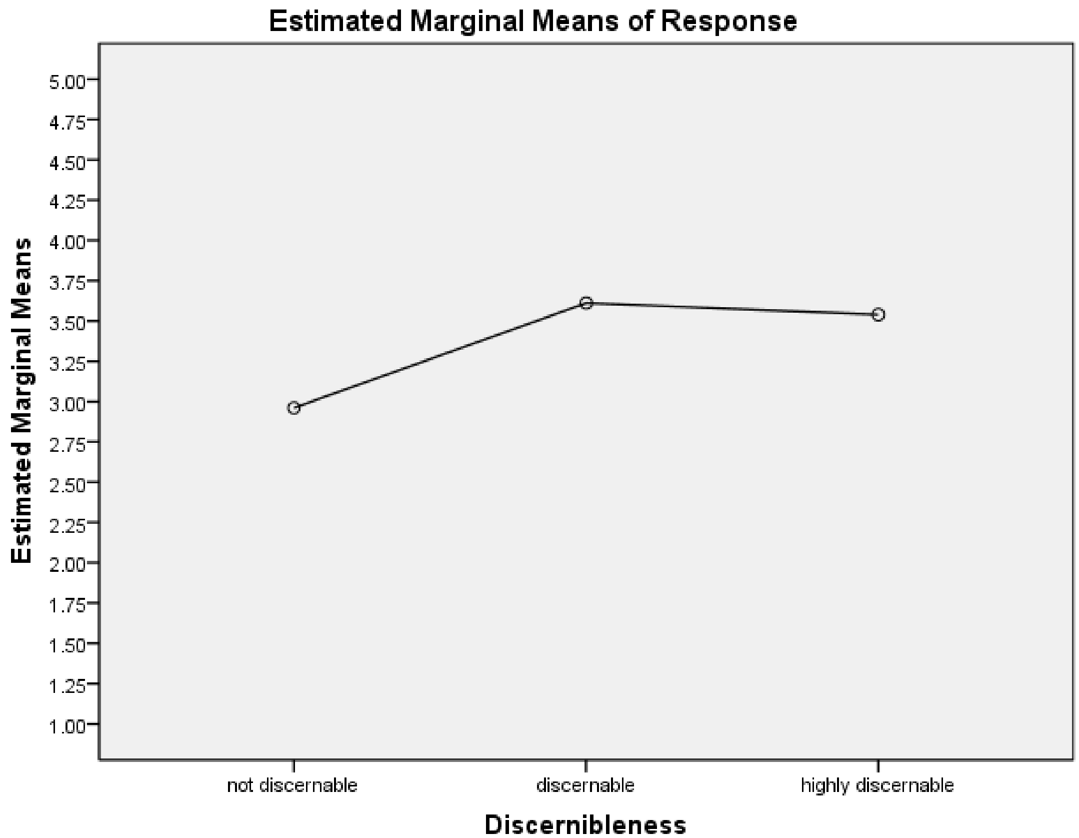

Figure 5.19 The Threshold Effect

The Outlier Effect

The second conclusion, a very stringent interpretation of the results, is that both *not discernable* Gestalt scenes and *highly discernable* Gestalt scenes are less preferred than *discernable* Gestalt scenes. Ignoring the overwhelming difference between preference score variance between the three factors, this proves to be true. This explanation is based on the notion that scenes which lack focality are not highly preferred just as scenes that provide too many stimuli are not highly preferred. In this supposition visual preference is a continuum from indiscernible because of no objects to perceive to incomprehensible because of too many objects to perceive. This view is supported by the Gestalt rule of *Pragnanz* which says the least amount of meaningful objects results in the best visual scene. Too few objects in the visual landscape equal low preference; at the same time, too many objects in the landscape, in spite of their Gestalt organization, equal low preference. This theory can be called outlier effect of visual preference.

The Indistinguishable Factors Effect

The final explanation for this outcome is a practical limitation of the survey—there is indistinguishable difference between the factors of *discernable* and *highly discernable* within the independent variable. In other words, *discernable* and *highly discernable* landscape photographs are distinguishable from *not discernable*, but the difference between *discernable* and *highly discernable* landscape photographs is so miniscule that the two scenes are indistinguishable. This conclusion is supported by the threshold of discernment effect, but severely diminishes the outlier effect theory which requires three factors. Based on the statistical analysis, particularly the diminutive variance between *discernable* and *highly discernable*, this explanation is the most rational.

Even though the hypothesis fails to meet the strictest interpretation of the established criteria, there is evidence that increasing the level of Gestalt in a landscape scene results in higher preferences. This research finds a perceptual threshold between *not discernable* scenes and *discernable scenes*, with the possibility that extremely complex scenes (i.e. *highly discernable*) are less preferred because of their visual confusion. This theory, though intuitive, is statistically validated by the results of the visual preference survey in this research.

Landscape Element Type Variable

The secondary variable—landscape element type—yielded significant results. The largest gap between any two factors of a single variable was the .78 difference between vegetative scenes and man-made scenes. Moreover, vegetation was the most preferred factor in any variable at 3.74. .78, slightly over three-quarter of one point difference between *vegetation* and *man-made structure*, is a substantial variance in a 1-5 scale. The *man-made* factor of the landscape element type variable tied *not discernable* for lowest visual preference factor—2.96. This result verifies what researchers have previously concluded—humans much prefer natural scenes to man-made scenes (Ulrich, 1983; Kaplan et al. 1998). Ulrich (1983) states that "one of the most clear-cut findings in the experimental literature on environmental aesthetics is the consistent tendency for North American and European groups to prefer natural scenes over built views." Additionally, Ulrich (1983) points out that even "unspectacular" and "subpar" natural scenes consistently outscore urban views in aesthetic preference. In sum, the heavily researched view that people react very differently to man-made and natural structures (Ulrich, 1983) is empirically supported in the results of this study.

Table 5.11

Difference in Preference Scores within Landscape Element Type Factors

Classification	Mean Preference	Difference
Vegetation	3.74	+.78
Man-made structure	2.96	-.78

Landscape Element Location Variable

The results from the ANOVA verify that the position of landscape elements in a scene does significantly affect preference; however because the difference in preference score was so miniscule it is difficult to understand how large the effect is. Both *foreground* and *background* scenes had preference scores hovering around the overall average preference of the survey. In scenes where the landscape element type appeared in the *foreground* preference scores were .02 worse than the average preference score for the survey. *Background*, only slightly preferred to *foreground*, scored .02 better than the 3.37 overall mean preference for all landscape scenes. Patsfall et al. (1984), studying the scenic beauty of vegetation in the foreground, middleground, and background, concluded that the nature of the impact of the landscape element location is complex. Patesfall et al. (1984) found that foreground vegetation was a significant indicator of visual preferences, but admitted the differential effects of foreground vegetation are not fully understood. Additionally, researchers have been leery to make recommendations for visual management based on the location of vegetation within a scene (Patesfall et al., 1984). Although the landscape element location variable significantly affected preference responses, further research is necessary to make definitive statements about the location of landscape elements related to preference.

Table 5.12

Difference in Preference Scores within Landscape Element Location Factors

Classification	Mean Preference	Difference
Foreground	3.35	-.04
Background	3.39	+.04

Summary

The two-way between groups analysis of variance demonstrated that the independent variables of *Gestalt*, *landscape element type*, *landscape element location*, and *discernibleness* all have significant effects on visual preference response. Determining that these independent variables are indicators of preference was accomplished by comparing the factors within the variables (ANOVA).

Within the Gestalt variable, *proximity* ranked highest followed by *similarity* and *similarity/proximity*, respectively. The preference order of these factors adhered to the principles outlined by Gestalt founder Wertheimer in his essay, "Laws of Organization in Perceptual Form (1923)." The results of the study firmly support the Gestalt concept of *Pragnanz* or meaningfulness. The implications for design disciplines are discussed broadly in the final section titled "Conclusions."

Results from the *discernibleness* variable demonstrated that visual preference and Gestalt organization of landscape objects are correlated, but the hypothesis was rejected because increasing the discernibleness of a Gestalt arrangement did not causally affect visual preference. *Highly discernable* scenes were preferred less than *discernable* scenes. This outcome leads to the development of three conclusions: the threshold theory, the outlier effect, and indistinguishable factors effect. The threshold theory is based on the inordinate difference in preference responses between the *not discernable* and the *discernable* factors, and the *discernable* and *highly discernable* factors. In other words, once landscape element grouping reaches discernment, the complexity of the scene does not affect preference. There is no intermittent level of satisfaction; a scene reaches a point close to recognition, or it is immediate recognized and preferred based on the organization of landscape elements into groups. There is no gray area—either black or white.

The outlier theory maintains that humans prefer neither landscape scenes with indistinguishable landscape elements nor landscape scenes with multifarious landscape elements that appear organized. In this research, one third of the scenes represented indiscernible Gestalt characteristics, one third *discernable* gestalt characteristics, and one third *highly discernable* Gestalt characteristics. While the *highly discernable* scenes were much preferred to the indiscernible scenes, preference for the *discernable* scenes over the *highly discernable* scene leads to the inference that some landscape are so organized as to appear complex. The outlier theory is also based on the Gestalt concept of *Pragnanz*.

There is also some evidence (interaction effect) that the *discernable* factors were not so different as to appear as distinct levels. This notion is supported by the large variance between factors within the *discernibleness* variable. *Discernable* and *highly discernable* yielded similar responses (slightly favored *discernable*); overall, however, respondents favored *discernable* and *highly discernable* far more than *not discernable*. Confusion between the two highest discernable factors of Gestalt organization resulting in *highly discernable* being less preferred than *discernable* is called the indistinguishable factor effect.

Participants' highest visual preference was the independent variable of landscape element type, namely *vegetation*. Not only did *vegetation* yield the strongest preference scores as an independent variable, it also resulted in the highest variance between its second factor *man-made elements*.

Landscape element type did not reveal strong differences in visual preference, nor did *foreground* or *background* prove to have a large effect on visual preference (low partial eta).

The final section examines this study in a broad context, shifting the focus from the quantitative data of the visual preference study to the application of Gestalt theory to the field of landscape architecture.

Conclusions

As for the predictive power of Gestalt patterns, this study confirms that measuring the landscape in terms of the fundamentals of visual perception is, indeed, a legitimate approach to determining visual preference for a landscape scene. Still, an even broader issue resonates: "What does this mean for landscape architects and designers?" Although, understanding visual perception and preference in landscapes scenes is the main task of this research, not applying this research with a broad stroke to the field of landscape architecture would render it incomplete.

Over a half century ago, Gestaltists claimed that Gestalt theory would transcend its immediate field into biology, physics, sociology, and the arts (Arnheim, 1943). Not that architects have fully grasped the Gestalt concept, but the Bauhaus movement illustrates, at the very least, an interest in the concept of wholeness (Arnheim, 1961). Artists and graphic designers, too, have seized Gestalt principles in practice of their profession. Application of Gestalt principles in landscape architecture is lacking though.

During the LITERATURE REVIEW study very few researchers mentioned Gestalt theory as a viable method for evaluating the landscape. Graduate student Ying Zhang in her 2006 study of preference in campus open space says, "the Gestalt psychology theory offset a strong foundation for the cognitive theory. The theory views the landscape as a whole when people perceive landscape. The key point of this theory is the idea of grouping. People perceive the landscape as a pattern, not separate items." Ulrich (1983) also mentions Gestalt theory stating that the "structural or organizational properties influence aesthetic preference is also prominent in Gestalt theory and in the literature of intuitive design and art where concepts of 'harmony' and 'composition' have long been emphasized" (p. 98-99). Furthermore, researcher Wohlwill (1980) called attention to the neglect of pattern perception research that would lead to a better understanding of the role of organization (Ulrich, 1983). In general, though, Gestalt theory is not prominently used to explain structural organization or visual perception in landscape preference theory. That is not to say that this research is exhaustive on the subject, but certainly the Gestalt concept is not a common term in visual preference research or the field of landscape architecture. Nonetheless, Gestalt theory forms the foundation for several landscape theories (Kaplan's Informational Model, cognitive theory, and psychophysical model) and basic design principles (unity, segregation, and balance). Unfortunately, though, Gestalt grouping principles have been loosely applied to landscape theory without systematically quantifying specific grouping principles in empirical research.

From a broad point-of-view, the intention of this study is to apply Gestalt psychology to the field of landscape architecture with a specific purpose. Strong empirical evidence suggests that, indeed, Gestalt theory is an applicable method to better understanding and improving the visual clarity of our landscapes.

Based on this study, five conclusions are drawn:

1. In spite a large body of research under the broad title visual preference research, indicators of visual preference are hardly understood (Antrop and Sevenant, 2008). More empirical evidence must be collected to understand the interrelationships of visual perception, landscape structure, and preference (Antrop and Sevenant, 2008). Instead of testing the applicability of a variety of landscape indicators in different contexts as has been suggested (Antrop and Sevenant, 2008), this study proposes using Gestalt grouping principles to develop an integrated framework for landscape assessment. Further, more resources must be utilized to apply Gestalt grouping principles of visual perception to visual preference research, visual resource management, and landscape theory.

2. There are obstacles and urgency to form a conceptual foundation for cognitive indicators (Sevenant and Antrop, 2008). Visual assessment paradigms and landscape theory suggest that a number of attributes affect visual preference, which makes formulating an integrated framework very difficult. The Gestalt hypothesis is not intended to dispute the findings of previous research, but to work in concert with previous studies to provide a broad and robust base to analyze and quantify landscape scenes. Proximity and similarity are not an inclusive set of preference indicators. On the contrary, this study proposes that the Gestalt configuration of landscape elements be conceptually incorporated into reliable predictive methods and applied broadly in future studies.

3. The latest findings in visual preference research (Coeterier, 1996) support the notion that a limited number of attributes are important to landscape perceivers and these attributes are the same for a wide variety of landscape types. Most of the studies conceptualizing general attributes affecting preference are based on landscape use. Tveit et al. (2006), for example, focuses on nine key concepts that affect user preference including stewardship, disturbance, and historicity. While this research agrees with the previous research of Sevenant and Antrop (2008), Tveit et al. (2006), Coetereir (1996) that preference is independent of user attributes, this research hypothesizes

that visual preference occurs prior to landscape use comprehension. The Gestalt theory proposes that preference is associated with the earliest state of cognition.

4. As applied in this visual preference survey, the Gestalt variables of proximity, similarity, and similarity/proximity have significant effect on preference response, and should be considered indicators of visual preference. The empirical evidence supports the Gestalt rule of *Pragnanz* or wholeness which states that the easiest to perceive landscapes are the most preferred landscapes. Preference scores for the Gestalt grouping principles are correlated to the original findings of Max Wertheimer as outlines in "the dot essay." Proximity ranked highest, followed by similarity, and similarity/proximity, respectively.

5. As people play an important role in shaping landscapes (Natori and Chenoweth, 2008), Gestalt principles should play a vital role in visual resource management. Understanding the perception of landscapes is not an exercise in futility; visual assessment theory is designed to preserve valuable and diminishing resources, and to create better environments to live, work, and play. A better understanding of perception and landscape preference is the best method to accomplishing these goals. As such, Gestalt theory should have a significant role in the future of visual resource management.

Limitations

Method

The method employed in this research does not follow the strict guidelines provided by researchers like Daniel and Boster's (1976) Scenic Best Estimation (SBE) method or the Visual Absorption Capability method (VAC) (Anderson et al., 1979). In this study various techniques were assimilated to accomplish the research goals in an accurate, yet timely fashion. As a result, the method employed in this research is more difficult to repeat which makes it more complicated to test validity and reliability.

Web-based Survey

The web-based survey resulted in a low drop-out rate (18.53%), however the overall response rate (8%) was very low for the entire population. According to user comments, some participants felt the survey 42-question survey was too time-consuming. In all likelihood, the completion rate would be higher with a shorter survey. Also, some users reported a problem with the QuestionPro™ software loading too slowly or shutting down. Participants' who involuntarily closed the QuestionPro™ survey were not allowed to complete the survey because of the "ballot-stuffing" device. Additionally, several survey methods recommended sending multiple contacts to the survey population including a pre-notice, survey thank-you/reminder, and replacement survey (Schaefer and Dillman, 1998). Due to the IRB requirements and the timeline, these steps were not achieved. Following these steps would have increased the overall response rate.

External Validity

In visual preference research, using a student population to represent the general population is a conflicting point. Tveit (2008) demonstrates a difference in visual preferences between students and the general population. Tveit (2008) cautions applying student preference data to a wider public. Zube et al. (1983) also found that age affects preference in landscape scenes. The survey population for this research was overwhelmingly young (18-30, 76.34%), white (69.50%), American-born (91.72%), and currently attending a university (*some college*, 44.53%). Although researchers (Ode et al., 2009; Sevenant and Antrop, 2008; Acar and Sakici, 2008; Herzog and Leverich, 2003) often draw conclusions about a general population from a student one, the validity of the research is immediately questioned. Additionally, even though some researchers (Daniel and Boster, 1976), argue that students are a good representation of the general public, general conclusions should not be drawn from the results of this survey. Better survey methods are required to test whether the Gestalt grouping elements are reliable in many cultural, social, and economic contexts.

Independent Variables

The interaction effect weakens the empirical results of the main effects as it implies that some of the factors may have been indistinguishable. The many levels within the independent variables was designed to test a range of specific preference indicators, but the interaction effect revealed some confusion and inconsistencies in the testing phase. The two-way between groups ANOVA confirms that more clear-cut photographs of proximity, similarity, and similarity/proximity would yield stronger results. Likewise, the statistical analysis confirmed the notion that there are many examples of Gestalt grouping in every landscape scenes, therefore testing an individual principle is difficult.

Reliability

Although the Cronbach's Alpha suggests high internal consistency, the Two-way between groups ANOVA failed Levene's Test of Equality of Error Variances indicating the variance of the responses is not equal across groups.

Future Research

Exploring the three independent variables of proximity, similarity, and similarity/proximity individually is a possible way to limit the confusion amongst independent variables. The multi-level variable and factor design should be revisited with a simple, single-variable design emphasizing one Gestalt grouping principle. Furthermore, some landscape structure control must be delineated to apply this method to a wide variety of landscape types. By naming a control landscape element, photographs measuring preference will be easier to categorize as *proximity*, *similarity*, or *proximity/similarity*. While this study focused on *vegetation* and *man-made elements* as variables of landscape structure, future research should have more defined landscape structure criteria. An example would be measuring the preference related to the proximity of live oak trees within a scene. This would allow different types of landscape scenes to be measured to determine if the Gestalt concept is broad enough to be a conceptual base.

Additionally, more research is necessary to determine if continuation, common fate (synchrony), parallelism, symmetry, common region, and connectedness are reliable preference indicators. *Proximity* and *similarity* are just two of several Gestalt principles that might affect visual preference. Other grouping principle may be even better indicators of user preference.

Finally, more scholarship must be applied to the relationships of Gestalt theory of visual perception to general landscape theory. Limiting Gestalt theory to a few grouping rules is insufficient. Thinking of the Gestalt concept it terms of few rules undermines the purpose of the original Gestaltist. Understanding how Gestalt psychology can affect landscape architecture with its creative, holistic philosophy is an advantageous topic for future research.

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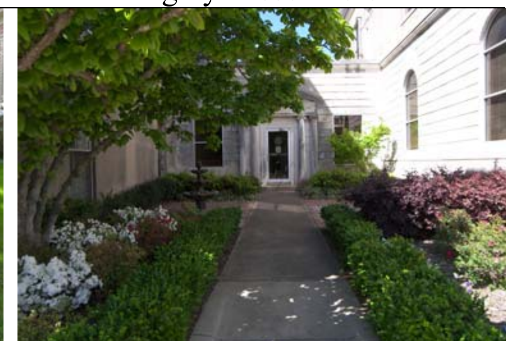
APPENDIX A

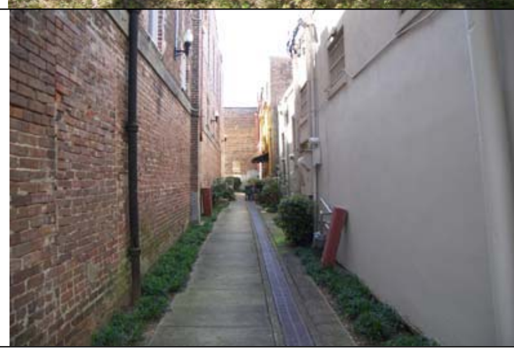
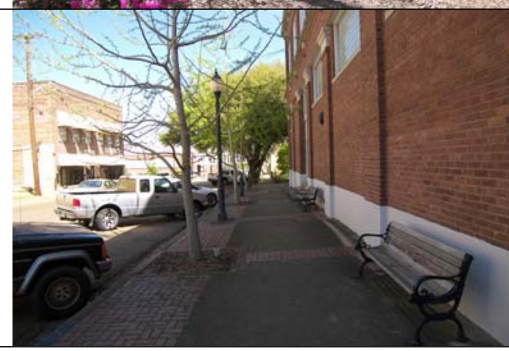
IMAGES MEASURING PROXIMITY, SIMILARITY AND SIMILARITY/PROXIMITY IN THE WEB-BASED VISUAL PREFERENCE SURVEY

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 1,2,3			
Man-made Structure From L to R: Image no. 4,5,6			

F O R E G R O U N D   P R O X I M I T Y

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 7,8,9			
Man-made structure From L to R: Image no. 10, 11, 12			

BACKGROUND PROXIMITY

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 13, 14, 15			
Man-made structure From L to R: Image no. 16, 17, 18			

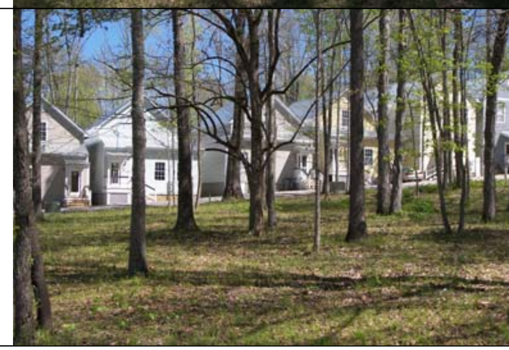
FOREGROUND SIMILARITY

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 19, 20, 21			
Man-made structure From L to R: Image no. 22, 23, 24			

BACKGROUND SIMILARITY

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 25, 26, 27			
Man-made Structure From L to R: Image no. 28, 29, 30			

FOREGROUND SIMILARITY/PROXIMITY

	Not Discernable	Discernable	Highly Discernable
Vegetation From L to R: Image no. 31, 32, 33			
Man-made structure From L to R: Image no. 34, 35, 36			

BACKGROUND SIMILARITY/PROXIMITY

L E G E N D

	Foreground Proximity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*P111*	*P112*	*P113*
Man-Made Structure	*P211*	*P212*	*P213*

	Background Proximity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*P121*	*P122*	*P123*
Man-Made Structure	*P221*	*P222*	*P223*

	Foreground Similarity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*S111*	*S112*	*S113*
Man-Made Structure	*S211*	*S212*	*S213*

	Background Similarity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*S121*	*S121*	*S123*
Man-Made Structure	*S221*	*S222*	*S223*

	Foreground Similarity/Proximity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*SP111*	*SP112*	*SP113*
Man-Made Structure	*SP211*	*SP212*	*SP213*

	Background Similarity/Proximity		
	Not Discernable	Discernable	Highly Discernable
Vegetation	*SP121*	*SP122*	*SP123*
Man-Made Structure	*SP221*	*SP222*	*SP223*

APPENDIX B

EMAIL INVITATION AND QUESTIONPRO™

PREFERENCE SURVEY

Subject: Landscape preference survey-LA graduate research

Dear Participant,

Complete the short survey below to be eligible to win a $100.00 American Express gift card.

http://landscapepreferencesurvey.questionpro.com

This survey tests your preference towards different types of landscapes. It is important for us to understand what characteristics of a landscape scene affect your preference. To complete the survey simply rank each landscape photograph from 1 (LOW) to 5 (HIGH). The information you provide will be used as primary data in a landscape architecture graduate thesis.

The survey should take no longer than 10 minutes to complete.
You may end participation at any time without penalty, but by completing the survey in its entirety you will be eligible to win a $100 American Express gift card.

We appreciate your willingness to participate and value your feedback.
If you have any questions or concerns about the survey, please contact Mark R. Levy at mrl48@msstate.edu.

Hello:

You are invited to participate in a survey about which landscapes your prefer. This survey is being conducted by a graduate student in the department of landscape architecture at Mississippi State University. The purpose of this research is to measure your predilection toward landscape scenes. The survey measures your preference towards 36 landscape scenes based on a 1-5 ranking. It will take approximately 10 minutes to complete the questionnaire.

Your participation in this study is completely voluntary. Your refusal to participate will involve no penalty or loss. There are no foreseeable risks associated with this survey, however, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for us to learn your opinions.

Your survey responses will be strictly confidential. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact Mark R. Levy by email at the email address specified below.

Thank you very much for your time and support. Please start with the survey now by clicking on the **Continue** button below.

For additional information regarding your rights as a research subject, please contact the MSU Regulatory Compliance Office at (662)325-5220 or email IRB@research.msstate.edu
To contact research advisor email rfb7@msstate.edu.

What is your gender?
- Male
- Female

What is your age?
-- Select --

What is your race?

-- Select --

What is your country of origin?
-- Select --

What is the highest level of education you have achieved?
-- Select --

Are you currently working in or toward a planning, design, or management profession?
- Yes
- No

What is your yearly income?
-- Select --

What is the population of the city/town you currently reside in?
-- Select --

Instructions: Indicate how much you like the landscape scenes. Your degree of liking is personal and based solely on the landscape scene, NOT on the photograph quality. Higher preferences receive higher ranking.

Consider each scene to be independent. Please, do not compare scenes.

There are NO right or wrong answers.

Please indicate your preference for the scene

1 (Low)	2	3 (Neutral)	4	5 (High)

Please indicate your preference for the scene

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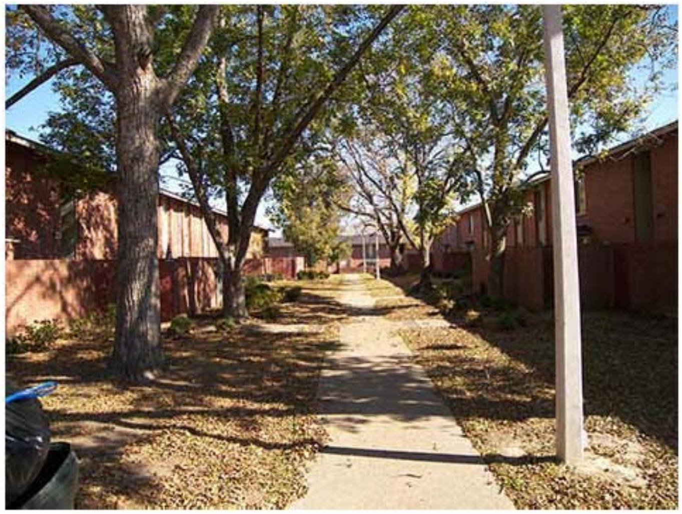

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Please contact mrl48@msstate.edu if you have any questions regarding this survey.

APPENDIX C

INSTITUTIONAL REVIEW BOARD

APPROVAL LETTER

Mississippi State
UNIVERSITY
Office of Regulatory Compliance
Post Office Box 6223
Mississippi State, MS 39762

Compliance Division
Administrative Offices
Animal Care and Use (IACUC)
Human Research Protection
Program (IRB)
1207 Hwy 182 West
Starkville, MS 39759
(662) 325-3496 - fax

Safety Division
Biosafety (IBC)
Radiation Safety
Hazardous Waste
Chemical & Lab Safety
70 Morgan Avenue
Mississippi State, MS 39762
(662) 325-8776 - fax

http://www.orc.msstate.edu
compliance@research.msstate.edu
(662) 325-3294

April 20, 2009

Mark Levy
P.O. Box 1600
Mississippi State, MS 39762

RE: IRB Study #09-107: Landscape Preference Survey

Dear Mr. Levy:

The above referenced project was reviewed and approved via administrative review on 4/20/2009 in accordance with 45 CFR 46.101(b)(2). Continuing review is not necessary for this project. However, any modification to the project must be reviewed and approved by the IRB prior to implementation. Any failure to adhere to the approved protocol could result in suspension or termination of your project. The IRB reserves the right, at anytime during the project period, to observe you and the additional researchers on this project.

Please note that the MSU IRB is in the process of seeking accreditation for our human subjects protection program. As a result of these efforts, you will likely notice many changes in the IRB's policies and procedures in the coming months. These changes will be posted online at http://www.orc.msstate.edu/human/aahrpp.php. The first of these changes is the implementation of an approval stamp for consent forms. The approval stamp will assist in ensuring the IRB approved version of the consent form is used in the actual conduct of research.

Please refer to your IRB number (#09-107) when contacting our office regarding this application.

Thank you for your cooperation and good luck to you in conducting this research project. If you have questions or concerns, please contact me at cwilliams@research.msstate.edu or call 662-325-5220.

Sincerely,

Christine Will

Christine Williams
IRB Compliance Administrator

cc: Robert (Bob) Brzuszek