Evaluating Landscape Character through Parametrical Indicators: A Case Study of the Campus-Community Edge

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Abstract

What gives an outdoor public space character? There is a broad range of literature on perceptions and usage of public spaces. Yet the majority of this literature focuses on the internal structure of physical components needed to create landscape and urban character, the space as it is socially constructed, or the combination of both of these approaches. A landscape assessment framework created by Ode, Tveit and Fry (2008) describes that many of the assessment characteristics commonly applied on a large scale in the science of landscape ecology can be useful in the evaluation of outdoor spaces at the site level as well. The framework is based on well-established theories in landscape preference and environmental psychology, yet is employed through entirely quantitative means by introducing parametrical indicators such as Simpson's diversity index, heterogeneity, edge density, aggregation index, shape index, and autocorrelation indices.

The purpose of this study is to apply the Ode et al. framework within the context of public space at a university campus edge, where the campus meets the municipal downtown. The study encompasses the evaluation of the combined entirety of the site as well as the framework's usefulness in investigating the character of the landscape. This exploratory research aims to provide a foundation for analytic site assessment using modern landscape metric software. Results might inform a more critical way to identify desirable landscape character within a site, either prior to construction or as it occurs in the realm of existing public space.

Introduction

What makes an outdoor space desirable and attractive to current and potential users? Cultural preference theories argue that the desirability of a place is culturally dependent. Yet, evolutionary theories might determine that there are universal character indicators that cross cultural boundaries, originating with the primordial needs of human survival. In order to make appropriate design and planning decisions in the creation of place, an understanding of both of these theoretically based approaches might be helpful. This article addresses the desirable landscape character of place by combining parametrical indicators and orthophoto observation techniques. The method is evaluated through an exploratory study in the college town of Clemson, South Carolina at the edge where the Clemson University campus meets the downtown area. The goal is to investigate the Ode et al. framework for the identification and quantification of landscape character. By understanding the time-tested qualities that people find attractive in an outdoor space, designers and planners might use empirical evidence to aid in the decision-making process related to the built environment.

Methods and Data Collection

Ode et al. (2008) provide an extensive overview of landscape aesthetic theory as a basis for visual indicators of character in the outdoor environment. The framework that Ode et al. present is based upon Swanwick's 2002 Landscape Character Assessment, but focuses specifically on visual character within the landscape (Ode et al., 2008, p. 89). Indicators of theory-based landscape aesthetic character relevant to this study, as well as their respective theoretical basis are displayed in *Figure 1*. Within the framework are a series of recommended data sources, including landscape photos, orthophotos, land cover data, and field observations. In addition, a number of measures are indicated for each concept. However, Ode et al. identify that not all concepts and data sources are appropriate or feasible for every study; therefore, they provide a series of filters to best determine the suitability of the indicators within the context of a specific study (p. 108). Filters begin with the relevance of the theoretical base for each concept, leading to whether the concept is transferable, quantifiable, mappable, available, and, finally, whether the concept is relevant to the proposed study. This exploration will specifically focus on the concept of *complexity* in the landscape.

Concept	Definition	Theory	References
Complexity	The diversity and richness of landscape elements and features and the interspersion of patterns in the landscape	Biophelia	Kellert & Wilson (1993)
Coherence	the unity of a scene, the degree of repeating patterns of color and texture as well as a correspondence between land use and natural conditions	Information Processing Theory	Kaplan & Kaplan (1982, 1989)
Disturbance	the lack of contextual fit and coherence in a landscape	Biophelia	Kellert & Wilson (1993)
Stewardship	the sense of order and care present in the landscape reflecting active and careful management	Aesthetic of care	Nassauer (1995)
Imageability	the ability of a landscape to create a strong visual image in the observer and thereby making it distinguishable and memorable	Spirit of place/genius loci/vividness	Lynch (1960); Litton (1972); Bell (1999)
		Topophilia	Tuan (1974)
Visual scale	landscape rooms/perceptual units in relation to their size, shape and diversity, and the degree of openness in the landscape	Prospect-refuge theory	Appleton (1975)
Historicity	the degree of historical continuity and richness present in the landscape	Topophilia	Tuan (1974)
		Landscape heritage/ historic landscapes	Lowenthal (1978, 1985); Fairclough et al. (1999)

Figure 1- Concepts Describing Landscape Character- Relationships to Theories of Landscape Preference and Experience (Ode et al., 2008, p. 92)

The landscape character assessment indices in this framework are theoretically based on human preference, and therefore provide a level of guidance as to how well humans would perceive any given landscape. Swanwick (2002) describes that prior to performing observation, an overarching desk analysis should occur. For this study, the researcher gathered information on municipal zoning, Architectural Review Board zones, AutoCAD base plans, GIS data, campus master plans, and other documents on the area where the campus meets the municipal downtown. These data sources displayed a variety of conditions at the campus-community edge, providing background information and a basis for observations to occur. The site of interest for this study, shown in *figure 2*, is where Old Greenville Highway meets College Avenue in Clemson, South Carolina. The intersection of these roads serves as the primary go-between where pedestrians cross from campus to downtown and vice versa. The image shows two Clemson University icons, Tillman Hall and Bowman Field, as well as the entrance to historic downtown Clemson.

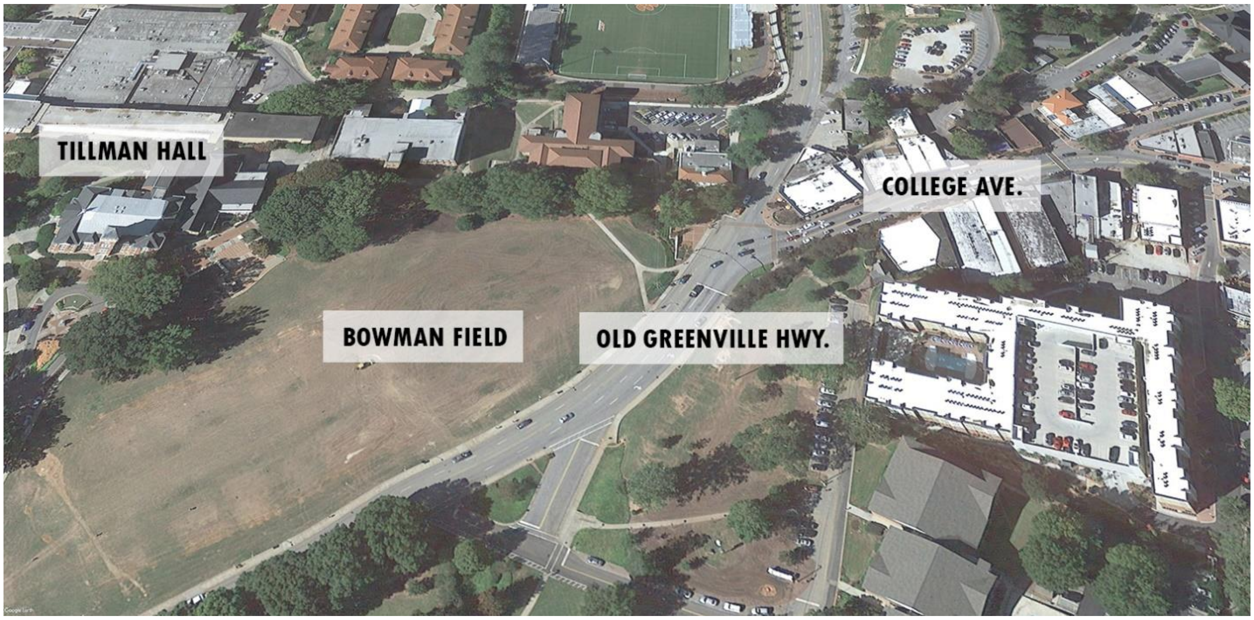

Figure 2- The campus-community edge site of interest

Prior to testing the Ode et al. framework method for site complexity, there was a need to determine appropriate observation boundaries for where the campus-community edge, specifically where the university campus meets the municipal downtown area, begin and end. The Clemson municipal zoning map (2011) shows that zones CP-1 Neighborhood Business, RLC Residential and Limited Commercial, C General Commercial, RM-3 Multi-Household Residential, and OC Office Commercial all immediately neighbor the campus near the downtown area (*see figure 3)*. While the extents of these high to medium density zoning areas combined with the property line between the city and university provide a starting point for observation boundaries, this study is concerned with the perceived campus-downtown edge rather than demarcated limitations.

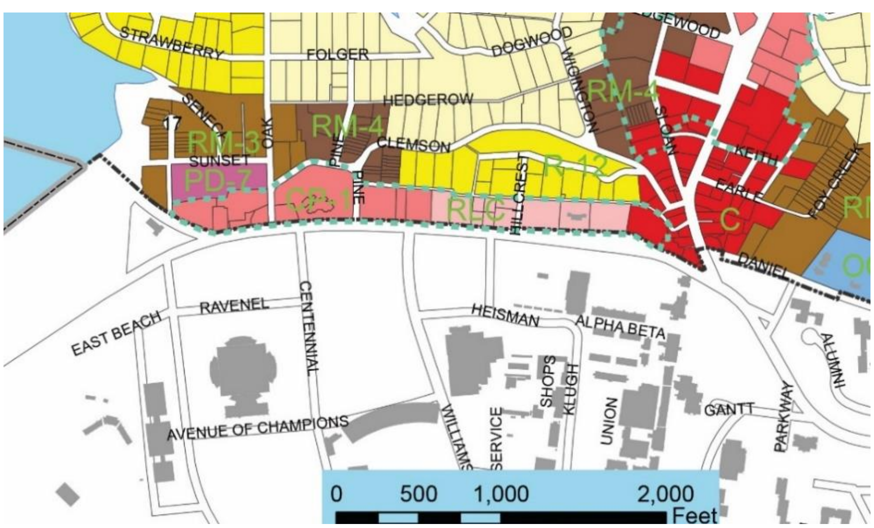

Figure 3- City of Clemson zoning map enlargement, 2011

For clarification the researcher informally surveyed five members of the Clemson University academic community asking the question of where they perceive that the Clemson downtown begins and ends along the university edge. Each of these individuals identified the extents of the Esso Club (*observation point 7, figure 4*) to Bowman field (*observation point 1, figure*

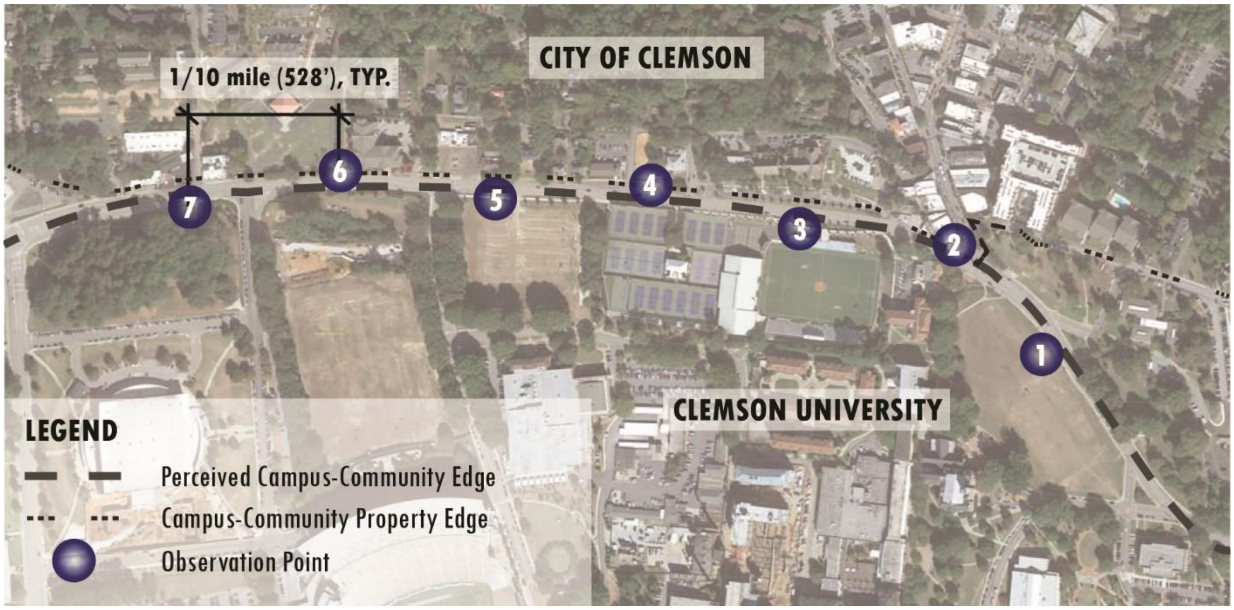

Figure 4- Observation Points for Site Extent Determination and Campus-Community Edge

4). Additionally, several of these individuals identified Old Greenville Highway as the boundary that the edge is based upon despite the fact that this road does not follow the property line in all areas (see *figure 4*). In order to perform observation in a systemic manner from case to case, observation points were identified every 1/10 mile, or 528 feet. This number is based on several considerations, including the researcher's judgement of depth perception during an initial site visit, its semblance to block sizes in the case studies identified which range from 400 to 850 feet, and the distance's divisibility into the Imperial system predominantly used in the United States. As shown in *figure 4*, based on this measurement procedure a full observation study of the City of Clemson and Clemson University would include seven observation points. However, for this exploratory study the researcher limited field and orthophoto observations to points one and two.

While archival data and informal interviews helped identify where the campus-downtown edge begins and ends, it did not address how far the edge is offset outward from this delineation. This offset becomes critical to orthophoto measurements. While humans with 20/20 vision can view objects clearly at twenty feet away, humans can also perceive objects and spaces several miles into the horizon except when visual barriers exist. Therefore, observations of the campus-downtown edge began at pre-identified points along the perceived border between town and gown on Old Greenville Highway, and extend to the point of visual blockage. See panoramic views in *figures 5 & 6* for full extent of observations for the exploratory study.

Figure 5- Observation Point 1. Panoramic images display extents of observation at this point.

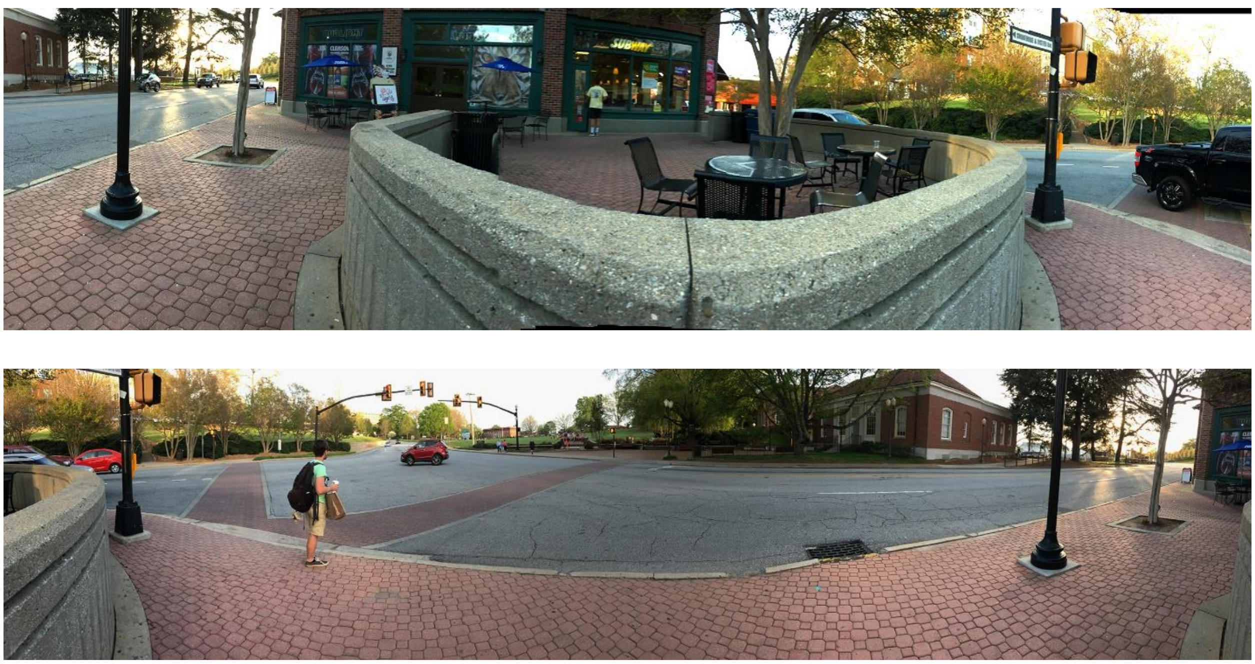

Figure 6- Observation Point 2. Panoramic images display extents of observation at this point. (See figure 4 for location)

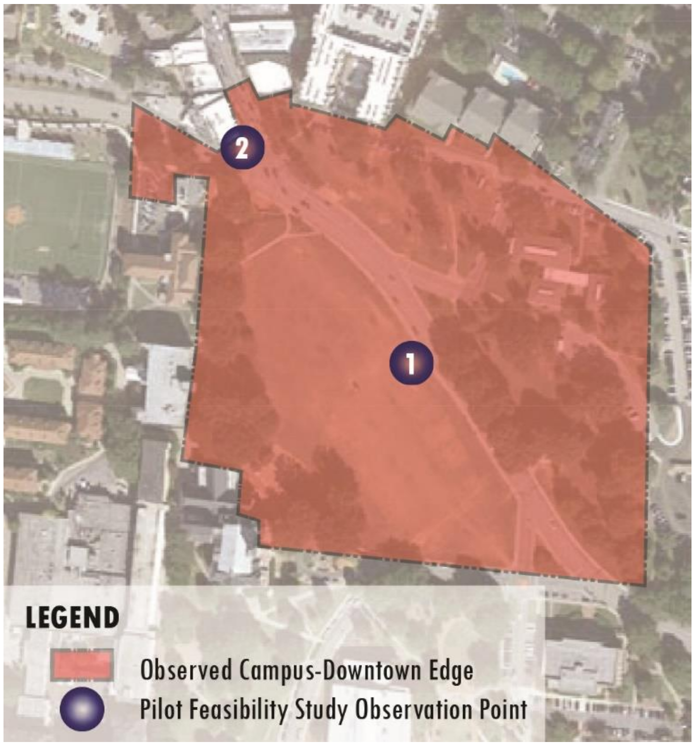

Figure 7- Observation points at the perceived campus-downtown edge

Figure 8- Extents for observed campus-downtown edge at Observation Points 1 & 2.

Figure 7 displays the extents of exploratory study observation limited to observation points one and two. First, quantifiable theoretically based landscape assessment indices were measured through orthophotos and the use of AutoCAD, Rhinoceros, and Grasshopper programs. High-resolution imagery exported from Google Earth Pro served as the basis for orthophoto assessment. Google Earth Pro was chosen over other sources such as Geographic Information System (GIS) software based on the quality imagery produced, and the ease of moving through historic aerial imagery at a consistent scale so that the site could be appropriately documented in AutoCAD (see f*igure 8*).

Method Assessment and Discussion

Figure 9 displays the various parametrical indices used to evaluate the complexity of the site. Complexity was chosen for this exploration because of its identification as a "key concept of visual quality" (for example, Kaplan & Kaplan, 1989; Litton, 1972; as cited in M. Tveit, Ode, A. & Fry, G., 2007). Complexity has also been identified as important indicator of landscape preference (Stamps, 2004). Indicators include richness, diversity, edge density, aggregation, and regularity of forms.

Findings for the concept of complexity (see *figure 9*) display a fair level of site diversity (.77 out of 1). Aggregation of lawn (.89 out of 1) is high when compared to other site elements such as small trees (.24 out of 1). This factor ties into the site's imageability and visual scale and can be perceived as an indicator of positive landscape character. The regularity of assessed forms were comparable, suggesting that shapes such as mulch beds, lawn, and hardscape materials are somewhat natural in appearance. The combination of a diversity of landscape elements with regularity implies that the site has desirable landscape complexity. However, indices such as edge density and richness are comparable in nature and necessitate the need for other measured sites in order to determine significance.

Parametrical Indices for the Concept of Site Complexity

Measurement	Formula	Calculation	Result	Notes
Richness	Number of landscape elements per area	$\frac{\text{total landscape elements}}{\text{total area}}$	1.97	Richness measures the number of landscape elements per area. It's the indicator of whether the site has a variety of different landscape components compared to its size.
Diversity	Simpson's Diversity Index	$SIDI = 1 - \sum_{i=1}^{m} P_i^2$	0.77	Scale of 0 - 1, 1 means all patches are different landscape elements with same size. 0 means only one patch existed in the site
Edge Density	Spatial organization of landscape attributes for edge density	$ED = \frac{\sum_{k=1}^{m} e_{ik}}{A}(10,000)$	4034 feet/acre	The edge density calculates the total length of edge in landscapes per area. A higher edge density indicates more interaction boundaries between different patches. It also presents more natural and curvy forms.
Aggregation	Aggregation Index	$AI = \left[\frac{g_{ii}}{\max \rightarrow g_{ii}}\right](100)$	Small Trees: 0.24 Lawn: 0.89	Aggregation index is a measurement of the resiliency of one landscape element. 1 is the maximum number. 1 indicates the landscape element is the very aggregated and intact with little disturbance, while 0 indicates the landscape is very scattered and fragmented.
Regularity of Forms	Shape Index	$LSI = \frac{.25\ E^*}{\sqrt{A}}$	Shape of Specialty Hardscape Materials: 1.68 Shape of Mulch Areas: 1.67	The shape index provides a quantifiable indication of the regularity of forms of one landscape element. If a patch presents geometric shapes such as a rectangle, triangle, or circle, it will have a lower shape index. A shape more natural in appearance presents a higher shape index.

Landscape elements included in the study as different components (basis for measurement): asphalt+ large tree; asphalt; brick paver; brick paver + large tree; concrete; concrete + large tree; dirt unmaintained; soil unmaintained + large tree; lawn + large tree; lawn; lawn + small tree; monument; mulch + large tree; mulch; shrub; shrub + large tree; shrub + brick; small tree; small tree + large tree

Figure 9- Site Complexity at the Campus-Community Edge

The use of parametrical indices to explore desirable landscape character can be supplemented by qualitative methods such as field observation, interview and survey to increase the validity of the findings. Nevertheless, the use of orthophotos and quantitative measurements provides a foundation to begin to understand the visual appeal of the character of an existing or proposed site layout or design.

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