# Variance and Dispersed Expectations in Landscape Evaluation Criteria

Chunqing Liu and Jon Bryan Burley

***Abstract*—** Planners and designers are interested in understand respondents' perceptions concerning the environment. In our study, we examined the criteria respondents indicated to assess landscape. We were interested in comprehending the simplicity/diversity of these responses. In our study we discovered that just a small sample of 71 respondents generated 65 criteria divided into 31 dimensions to evaluate environments. In other words, we found the criteria to evaluate environments to be complex and not uniform. These dimensions explained 80% of the variance in the respondents. We do not suggest that this list is definitive nor precisely represent the larger population. Rather, we suggest that such inconsistency means that agreement amongst respondents concerning how the landscape should be evaluated is dispersed. For planners and designers, this means that achieving agreement across numerous clients, stakeholders, and users requires successful implementation over an extensive programmatic list of expectations. In addition, we had the same respondent group intuitively assess two images of landscapes and then we calculated the variance inherent in the group towards the two images. We also had them employ a landscape visual quality index. We found the variance of the intuitive assessment between the two images to be quite similar around 8.7 to 8.9 for respondents, on a 40 point scale from minus 20 to plus 20. When applying the index the variance was around 4.4, on the same scale of minus 20 to plus 20. Thus, the index reduced the variance in the group. In past studies we found the index to be a good predictor of landscape preference; however, the index contained a different set of criteria than expressed by the respondent group in the first study, resulting in a devaluation of one image by about 5 points and an increase in the value of another image by 12 points. While the index has been a valuable predictor in measuring visual quality, it is clear that it is only a partial explanation in landscape assessment.

***Keywords*—** Criteria analysis, principal component analysis, landscape assessment, environmental psychology, landscape architecture, environmental design, people and environment, social science.

## I. Introduction

UNDERSTANDING the composition of the environment and the perception of the environment are topics of great interest to academics, governmental practitioners, planners, designers, and with citizens [1, 2, 3, and 4]. For example, Chinese traditional gardens are famous for their perfected layout, the placement of natural vegetation, and imaginative compositions [5]. In addition, Western landscapes are celebrated for their metaphors and clever designs [6, 7, 8. 9]. Comprehending the values associated with these varied environments can be a complex social science task.

Considering this complexity of landscape content and composition, we were interested in studying the range of values and the diversity of respondents' beliefs to assess landscape. In a rather lengthy equation, Burley *et al.* has been able to demonstrate that, collectively, the values of European and North American respondents can explain almost 80% of the variance [10]. In contrast Loures has been able to demonstrate that the values of respondents concerning post-industrial environments are quite diverse [11]. To gain insight into this topic, we engaged in a study of a small population of students at Michigan State University to determine how uniform or diverse were their perception about landscape and the criteria they use to assess landscape.

The reason for exploring this range in values is based upon understanding expectations concerning the built and managed environment across individuals and cultures. There is a wide range of opinions concerning who should have input into a design and how many criteria should be considered. For example, Frank Lloyd Wright (1867-1959) an American architect could consider a wide range of criteria (ecological, economic, cultural, functional, social, and aesthetic) for interiors and exteriors, but considered his input in the execution of a design the most essential [12, 13, 14]. In contrast, Lawrence Halprin (1916-2009) was a gifted landscape architect who could also consider a wide range of criteria, but emphasized the inclusion of many viewpoints and stakeholders in developing a design [15, 16, 17]. He could readily resolve conflicts and developed solutions that accommodated seemingly opposing perspectives about the environment. At times, design teams may limit input and stakeholder considerations for the sake of creating a pressing project quickly; while others carefully gain input and assess options thoughtfully before proceeding upon a planning and design project in the built environment [18].

## II. Methodology

For the past 25 years, Dr. Burley, FASLA at various North American institutions has asked auditoriums filled with students to identify the criteria they use in evaluating landscapes (Figure 1). First he asks them to list the criteria they use to evaluate landscapes. This year, we took the results

Manuscript received January 2014

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from the student responses (n=71) for statistical analysis. The students are comprised of majors from across the university ranging from computer science to finance and from biology to interior design.


Figure 1. Dr. Burley lecturing in class concerning "What is good landscaping/environment?" (Copyright © 2014 Chunqing Liu all rights reserved, used by permission).

We took these written answers and coded them into 65 categories. The responses were standardized to a mean of zero and a variance of one. The standardized scores were then subjected to principal component analysis, similar to the procedures described by Burley *et al*. [19]. The goal of the analysis is to determine if the 65 categories can be simplified into a few broad categories (eigenvalues greater than 1.0) or if there are many latent dimensions, meaning that the criteria defies reduction. If the data can be simplified, it would mean that the respondents have some unified general principles concerning the evaluation of the environment. If the list is extensive (somewhere over 10 or 12 dimensions), then one might conclude that there is no universal set of principles imbedded in the responses.

For each dimension, an eigenvector is associated with the eigenvalue. The eigenvector indicates the relative strength of each variable with the dimension. The minimum value for each coefficient of the vector is -1.0 and the maximum is 1.0. Coefficients of less than -0.4 or greater than 0.4 are considered significant [19]. These significant coefficients often define the dimension, providing they are significant in one and only one dimension [19]. If there are no significant variables in a dimension, coefficients closer to 0.0 can be examined. Based upon which variables are associated with each latent dimension, the dimensions are labeled/named/identified. Burley *et al*. provides greater detail for this methodology [19]. Employing coefficients less than -0.4 and greater than 0.4 is a standard methodology approach; however, weaker coefficients from -0.2 to -0.4 and from 0.2 to 0.4 can also be examined, especially if the stronger coefficients are lacking in many of the dimensions. Analysis where there are numerous dimensions (10 to 12 or more), may not have very many strong coefficients [19]. The lack of strong coefficients lends to the problem of labeling and identifying the character/name of a dimension [19].

We also asked the respondents to rate two images (Figure 2 and Figure 3). Figure 2 is an image of a well-known theme park in the United States that is admired by many Americans and global citizens. Figure 3 is an image of a primarily unknown place containing a bird (black-capped chickadee, *Poecile atricapillus* Linnaeus, 1766) resting on a snag (a dead tree trunk). There is a building in the background and mulch on the ground-plain. These images often invoke opposing initial impressions by the respondents with the theme park being more favorably scored by the respondents. We asked the respondent to rate the image from plus 20 to minus 20. A score of plus 20 would be the best and most beautiful landscape they ever expect to experience. A score of minus 20 would be the ugliest and worst landscape they would ever expect to experience. Then the respondents would discuss the reasons for their scores. Next, the respondents would be presented an environmental evaluation index based upon the work of Smyser, Table 1 [20]. This index rates environments from scores of plus 20 to minus 20. The index has been employed as a predictor of environmental quality, explaining up to 30 percent of the variance in North American and European respondents [4]. We examined the variance in these scores and how the scores changed from the intuitive evaluation by the respondents and the application of the index.

Much of this evaluation effort was then employed as a framework to study other cultures and environments of landscapes from around the world, including: China, Japan, Turkey, Egypt, Greece, Italy, France, Spain, Portugal, the United Kingdom and the United States of America. In addition, students examined their hometown and favorite places in North America. Examples of this effort are illustrated in the discussion of this article.

Figure 2. An image of Disney World (Copyright © 1975 John Royce all rights reserved, used by permission).

Figure 3. An image of a landscape containing wildlife (Copyright © 1980 Jon Bryan Burley all rights reserved, used by permission).

Table 1. Environmental Quality Index

| Variable | Score |
|---|---|
| A. Purifies Air | +1 0 -1 |
| B. Purifies Water | +1 0 -1 |
| C. Builds Soil Resources | +1 0 -1 |
| D. Promotes Human Cultural Diversity | +1 0 -1 |
| E. Preserves Natural Resources | +1 0 -1 |
| F. Limits Use of Fossil Fuels | +1 0 -1 |
| G. Minimizes Radioactive Contamination | +1 0 -1 |
| H. Promotes Biological Diversity | +1 0 -1 |
| I. Provides Food | +1 0 -1 |
| J. Ameliorates Wind | +1 0 -1 |
| K. Prevents Soil Erosion | +1 0 -1 |
| L. Provides Shade | +1 0 -1 |
| M. Presents Pleasant Smells | +1 0 -1 |
| N. Presents Pleasant Sounds | +1 0 -1 |
| O. Does Not Contribute to Global Warming | +1 0 -1 |
| P. Contributes to the World Economy | +1 0 -1 |
| Q. Accommodates Recycling | +1 0 -1 |
| R. Accommodates Multiple Use | +1 0 -1 |
| S. Accommodates Low Maintenance | +1 0 -1 |
| T. Visually Pleasing | +1 0 -1 |
| Total Score _____ | |

The Smyser Index was initially developed to facilitate homeowners to consider environmental criteria [20]. Smyser appeared concerned that homeowners would only consider primarily aesthetic criteria in the development of home landscapes and wanted to expand the range of issues that a homeowner would use in the evaluation of a design

## III. Results

In our study, we discovered 31 dimensions with eigenvalues greater than 1.0 (Table 2). These eignevalues represent the significant dimensions. The remaining 44 insignificant eigenvalues are not considered for further analysis.

Many of the dimensions did not have coefficients with a strong association. Dimensions 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 14, 16, 17, 19, 20, 21, 24, 26, 27, 28 and 31 contained coefficients with either significant or weak variable associations that provided clues to their naming/identification (Table 3). Table 4 presents the names/labels given to the 31 dimensions.

The first dimension produced the largest natural grouping of associated criteria, containing four primary variables: resourceful, colourful, water features, and sunlight. We discovered the second dimension contained fertile soil, agricultural landscapes, and high technology as primary eigenvector coefficients. The third, fourth, and fifth dimension each contained attractive, natural and flat grounds as a primary variables separately.

Naturalness as a criteria had strong association with dimension four. The sixth dimension included a feeling of safety, approved by majority, and economical as primary variables. Comfortable, diversity and a spaciousness criteria were the primary variables strongly associated with dimension seven, eight, and nine.

The tenth dimension included species-richness, and to create an experience for users as primary variables. The eleventh dimension contained uniqueness as a primary variable. The fourteenth dimension comprised of pre-designed or in a planned manner as the primary variable and the sixteenth dimension was composed of an intended balance between nature and humans as a primary variable. The seventeenth dimension contained creativity, native species, and memorable characteristics as primary variables. The nineteenth and twentieth dimension contained landscapes that were extraordinary and height as a primary variables. The twenty-first dimension contained symmetry, preservation, and awareness of climate as primary variables. The twenty-fourth, twenty-sixth, twenty-seventh and twenty-eighth dimension comprised of hygiene, practical, informality of design, and limit use of energy primary as variables. They all have a strong association except dimension twenty-four. The thirtieth dimension was composed of a successful landscape and durability as primary variables. What deserves special mention is the two criteria also have a very strong association with the thirtieth dimension (eigenvector coefficients reach the value of 0.707).

Six criteria were considered strongly or certainly associated cross-dimension criteria connecting one dimension to another dimension. The fresh air criteria spanned the thirteenth and twenty-fifth dimensions. The twenty-eighth dimension has four associated criteria, but three criteria were also cross-dimension categories associated with other dimensions.

Suitable for living also appeared on the fifteenth. Water and sun were also associated with the twenty-fourth dimension, complexity was strongly associated with the twenty-ninth dimension. Dimension twenty-eight had the limited use of energy as a primary criteria variable. In addition, building foundation planting as a criteria was a cross-dimension category spanning dimensions twenty-one and thirty. Convenience was a strong criteria category which spanned the twenty-second and twenty-sixth dimensions. Further, there were six notable weak associations bridging various dimensions. Harmony with surroundings illustrated weak connections between dimensions twelve and eighteen.

Table 2**.** Eigenvalue results

| Dimension | Eigenvalue |
|---|---|
| 1 | 2.97902046 |
| 2 | 2.81197249 |
| 3 | 2.64586746 |
| 4 | 2.38063483 |
| 5 | 2.26218541 |
| 6 | 2.21772272 |
| 7 | 2.11363970 |
| 8 | 2.04441465 |
| 9 | 1.99280818 |
| 10 | 1.95699498 |
| 11 | 1.86096415 |
| 12 | 1.81797185 |
| 13 | 1.75612259 |
| 14 | 1.69588998 |
| 15 | 1.62212023 |
| 16 | 1.49696395 |
| 17 | 1.48985441 |
| 18 | 1.47259587 |
| 19 | 1.43157155 |
| 20 | 1.37519410 |
| 21 | 1.33924259 |
| 22 | 1.28546838 |
| 23 | 1.23879854 |
| 24 | 1.21134657 |
| 25 | 1.18821756 |
| 26 | 1.08052562 |
| 27 | 1.07432664 |
| 28 | 1.06045449 |
| 29 | 1.04187059 |
| 30 | 1.02026980 |
| 31 | 1.01250000 |

Seventeen criteria contained no strong association with any dimension and appeared to be independent of the thirty-one significant dimensions. There were criteria such as *beautiful, organized, conceptual, functional, sustainable, movement,* and *cultural,* criteria appeared to be somewhat independent of the thirty-one dimensions. These variables were not weakly associated with any dimension and have values as eigenvector coefficients less than 0.200 or greater than -0.200.

Table 3. Eigenvector coefficients for the first three principal components. *Bold* coefficients indicate potential naming criteria.

| Criteria | Prin1 | Prin2 | Prin3 |
|---|---|---|---|
| C01= pre-designed or planned | 0.032 | -0.028 | -0.004 |
| C02= attractive | 0.228 | 0.087 | **0.333** |
| C03= beautiful | -0.097 | -0.239 | -0.205 |
| C04 = organized | -0.026 | -0.117 | -0.019 |
| C05= balance between nature and humans | 0.183 | 0.022 | 0.171 |
| C06= harmonious with surrounding | -0.007 | 0.044 | 0.078 |
| C07= spacious | -0.041 | 0.078 | 0.117 |
| C08= species-rich | -0.180 | 0.097 | 0.209 |
| C09= similar shapes | 0.042 | 0.089 | 0.063 |
| C10= resourceful | **0.311** | 0.296 | 0.023 |
| C11= symmetry | 0.033 | 0.035 | 0.037 |
| C12= conceptual | 0.093 | 0.004 | 0.158 |
| C13=preservation | 0.052 | -0.052 | 0.066 |
| C14=creativity | -0.022 | -0.066 | 0.025 |
| C15=functional | 0.008 | -0.148 | -0.240 |
| C16=create experience for users | 0.033 | -0.075 | -0.011 |
| C17=successful | -0.009 | -0.075 | -0.095 |
| C18=convenient | 0.052 | -0.016 | 0.061 |
| C19=sustainable | -0.069 | -0.097 | -0.078 |
| C20=unique | -0.029 | -0.104 | -0.068 |
| C21=native species | -0.020 | -0.078 | -0.063 |
| C22=awareness of climate | -0.003 | -0.034 | -0.004 |
| C23=matching species with the site | 0.012 | -0.022 | 0.017 |
| C24=simplicity | -0.027 | -0.067 | 0.000 |
| C25=foundation | 0.088 | 0.070 | -0.001 |
| C26=movement | 0.003 | -0.028 | -0.003 |
| C27=water and sun | -0.043 | 0.015 | -0.008 |
| C28=green plants | -0.228 | 0.215 | 0.052 |
| C29=informality of design | -0.037 | 0.012 | 0.047 |
| C30=durable | -0.009 | -0.075 | -0.095 |
| C31=meet human needs | -0.029 | -0.052 | -0.017 |
| C32=benefit for wildlife | -0.226 | 0.067 | 0.109 |
| C33=utilizing the space properly | -0.066 | -0.009 | 0.050 |
| C34=purpose-designed | 0.212 | 0.036 | 0.236 |
| C35=enriched environment | 0.169 | 0.263 | -0.219 |
| C36=cater clients | 0.054 | 0.045 | -0.142 |
| C37=suitable for live | -0.019 | -0.062 | -0.045 |
| C38=natural | 0.204 | -0.111 | 0.118 |
| C39=comfortable | 0.053 | -0.066 | 0.031 |
| C40=no business purposes | 0.059 | -0.060 | 0.033 |
| C41=practical | 0.010 | -0.055 | -0.012 |
| C42=limit use of energy | -0.028 | 0.021 | -0.080 |
| C43=cultural | 0.272 | 0.092 | 0.245 |
| C44=colorful | **-0.328** | 0.160 | 0.034 |
| C45=fertile soil | 0.024 | **0.312** | -0.275 |
| C46=trimmed trees | -0.099 | 0.117 | -0.121 |
| C47=flat grounds | -0.073 | 0.140 | -0.181 |
| C48=good weather | -0.019 | 0.126 | -0.166 |
| C49=safe | 0.072 | -0.073 | 0.063 |
| C50=approved by majority | 0.031 | -0.074 | -0.004 |

Table 3. Continued.

| Criteria | Prin1 | Prin2 | Prin3 |
|---|---|---|---|
| C51=economical | 0.026 | -0.120 | -0.054 |
| C52=memorable | 0.092 | -0.017 | 0.132 |
| C53=complex | -0.068 | -0.014 | -0.032 |
| C54=diversity | -0.129 | -0.005 | -0.032 |
| C55=contrast | -0.102 | 0.017 | -0.015 |
| C56=water features | **-0.313** | 0.212 | 0.245 |
| C57=hygiene | -0.084 | 0.086 | 0.130 |
| C58=healthy | 0.030 | -0.151 | -0.075 |
| C59=height | -0.047 | 0.053 | 0.045 |
| C60=agricultural landscape | 0.131 | **0.308** | -0.184 |
| C61=high technology | 0.180 | **0.343** | -0.225 |
| C62=flesh air | 0.004 | 0.129 | -0.064 |
| C63=extraordinary | 0.046 | -0.049 | 0.017 |
| C64=sun light | **-0.305** | 0.184 | 0.207 |
| C65=ecology | 0.064 | -0.137 | -0.016 |

Table 4. Dimension labeling/naming: shadow coefficients indicate criteria with a strong association for a particular principal component (dimension); bold coefficients indicate criteria with a moderate association for a particular principal component (dimension); italic coefficients indicate criteria with a weak association for a particular principal component (dimension); underlined coefficients indicate multiple association.

Prin1 **Resourceful**; **colourful**; **water features**; **sun light**
Prin2 **fertile soil**; **agricultural landscape**; **high technology**
Prin3 **attractive**
Prin4 **natural**
Prin5 **flat grounds**
Prin6 **safe**; **approved by majority**; **economical**
Prin7 **comfortable**
Prin8 **diversity**
Prin9 **spacious**; **Similar shapes**
Prin10 **species-rich; create experience for users**
Prin11 **unique**
Prin12 *harmonious with surrounding; species-rich; Similar shapes; Symmetry; Awareness of climate; Simplicity*
Prin13 flesh air
Prin14 **Pre-designed or planned**
Prin15 suitable for live
Prin16 **balance between nature and human**
Prin17 **Creativity**; **native species**; **memorability**
Prin18 *harmonious with surrounding; create experience for users; enriched environment; cater clients; healthy; flesh air; ecology*
Prin19 **extraordinary**
Prin20 **height**
Prin21 **Symmetry**; **Preservation**; **Awareness of climate**; foundation
Prin22 convenient
Prin23 complex

Table 4 continued. Dimension labeling/naming: shadow coefficients indicate criteria with a strong association for a particular principal component (dimension); bold coefficients indicate criteria with a moderate association for a particular principal component (dimension); italic coefficients indicate criteria with a weak association for a particular principal component (dimension); underlined coefficients indicate multiple association.

Prin24 water and sun; **hygiene**
Prin25 flesh air
Prin26 convenient; **practical**
Prin27 **informality of design**
Prin28 water and sun; suitable for living; **limit use of energy**; complex
Prin29 complex
Prin30 foundation
Prin31 **successful**; **durable**

Overall, the first thirty-one dimensions explained 80.0% of the dataset's variance, leaving 20.0% as unassigned in 44 insignificant dimensions.

The average intuitive score by the respondents for Figure 2 was a score of 5.67. In contrast, the average intuitive score by the respondents for Figure 3 was a score of -5.86. In other words, the respondents overall preferred Figure 2. The variation for Figure 2 was 8.96 and for Figure 3 the variation was 8.87. When the environmental index from Table 1 was employed, Figure 2 scored 0.77 with a variance of 4.27 and Figure 3 scored 6.84 with a variance of 4.44.

## IV. Discussion

First, we do not claim that any of the dimensions are definitive. Rather the 31 dimensions illustrate the complexity of the respondents' criteria. The extended nature of the dimensions coincide with the concept that "beauty is in the eye of the beholder," an idiom presented in print by Margaret Wolfe Hungerford (Hamilton) in her 1878 book *Molly Bawn* [21]. Upon first glance, these complex results seem to contradict the equations of Burley because his team is able to quite firmly predict the preferences of respondents [1, 2, 4, and 10]. However, upon further reflection the equations by Burley and his team are themselves quite complex, including many variables and accounting for a wide variation in values. The dimensions in Table 3 are fairly consistent with many of the variables in the equations by Burley's team such as color and water in dimension 1, species rich in dimension 10, and fresh air in dimension 25. Although some of the variables in Table 3 such as high technology in dimension 2, safety (dimension 6), hygiene (dimension 24) and durable (dimension 31) are relatively new variables that could be examined in future variable construction experiments and analysis.

The PCA results reinforce the concept that various criteria are independent and orthogonal to other variables (not being redundant). This was also true in Burley's studies where the extensive list of variables in the equations were not inter-

correlated and each variable added value to the equations [4, 22, 23].

It has been interesting to note that the criteria from the Smyser Index has been an important predictor of respondent preferences concerning environmental quality, because the application of the index by the respondent group does have a fair amount of variance (around plus and minus 4.3). We expected the variance of such an important predictor to have a variance of around 1.0. We believe this means that the construction of a more reliable and less fluctuating index may be possible, thereby reducing the variance of a new index when applied by the respondents.

In addition, we were surprised that even though the index was a strong predictor in some environmental quality equations, the index did not necessarily reflect the values of respondents, as the index produced scores that were different from the intuitive scores by the respondents. As Smyser suspected, the index reflected contrary values that amateur designers might be employing when assessing the landscape. Yet the index is predicting something that correlates with respondent preferences. Mazure and Burley reported that the evaluation of the environment by respondents is a mixture of traditional aesthetic variables studied in the 1970s to 1990s with other types of values such as economical and ecological criteria [24]. Researchers are discovering that the evaluation of the environment by respondents is a combination of aesthetic values with other criteria such as ecological, cultural, social, functional, and economic values. Single-minded planning and design criteria may not reflect the values of respondents. Such a multi-criteria assessment is consistent with the research reported in this study.

The Smyser Index is also employed in the classroom to study environments. The index is applied in an environmental history course at Michigan State University (MSU) taught through an integrated social science curriculum. In other words, the course takes a social science perspective (sociology, anthropology, political science, psychology, history, and economics—all in the college of social science at MSU) to examine planning and design. During the course, students are required to prepare three assignments during the semester that apply the index to various landscape settings.

For example, in the first assignment, during the spring of 2011, students had the opportunity to apply the index (Table 5) to a Chinese environment, the Humble Administrator's Garden (Figure 4) in Suzhou, Jiangsu, P. R. of China. In addition the student had to develop five additional criteria based upon readings and lecture that the Chinese might consider. The student who responded in Table 5, added: does the environment build stronger relationship in families?; does the environment teach you something?; does the environment speak to you?; do you feel enlightened after witnessing it?; does the image have good feng shui? Compared with the list in Table 4 and the Smyser Index, one can observe that the student is growing in perception about environmental values and criteria. This does not mean that the student has to agree with any set of values, but rather the student is developing a larger set of potential values and understanding.

Figure 4. An image of the Humble Administrator' Garden applied in exercise 1, spring 2011 (Copyright © 2007 Jon Bryan Burley all rights reserved, used by permission).

Table 5. Example of a student response to Figure 4.

| Variable | Score |
|---|---|
| A. Purifies Air | +1 |
| B. Purifies Water | 0 |
| C. Builds Soil Resources | +1 |
| D. Promotes Human Cultural Diversity | +1 |
| E. Preserves Natural Resources | +1 |
| F. Limits Use of Fossil Fuels | 0 |
| G. Minimizes Radioactive Contamination | 0 |
| H. Promotes Biological Diversity | +1 |
| I. Provides Food | +1 |
| J. Ameliorates Wind | 0 |
| K. Prevents Soil Erosion | 0 |
| L. Provides Shade | +1 |
| M. Presents Pleasant Smells | +1 |
| N. Presents Pleasant Sounds | +1 |
| O. Does Not Contribute to Global Warming | 0 |
| P. Contributes to the World Economy | +1 |
| Q. Accommodates Recycling | 0 |
| R. Accommodates Multiple Use | +1 |
| S. Accommodates Low Maintenance | 0 |
| T. Visually Pleasing | +1 |
| Total Score | 12 |

In the second assignment, students explore expanding the list based upon values from Japan, France, England, and Italy and compare the values. The students begin by listing any 20 criteria that were/are observed in lectures or readings about Italian Japanese, French, and English environments. For example, Table 6 lists the results of a typical student's response. There is necessarily no incorrect answer, but rather the assignment offers the opportunity for the student to explore, reflect, and consider environments in an international setting. The response may not be brilliant, as the students are composed across the many majors at Michigan State University and it may be the first time they have ever thought about these specific criteria. At the same time, it is reassuring that students across many majors have to ability to thoughtfully develop their criteria.

Table 6. An example of a student's response and attempt to list 20 criteria concerning planning and design from Italian, Japanese, French, and English environments.

| |
|---|
| 1. Does the landscape use simple geometric features? (Italian) |
| 2. Does the design include enclosed spaces? (Italian) |
| 3. Is the city enclosed by a circular or polygonal wall? (Italian) |
| 4. Can proportions derived from the Golden Mean be seen? (Italian) |
| 5. Do design elements implement Bi-lateral symmetry? (Italian) |
| 6. Are evergreens used to keep the garden green all year? (Italian) |
| 7. Does the design tell a strong story? (Italian) |
| 8. Does the landscape include set stones? (Japanese) |
| 9. Are buildings in an asymmetrical layout? (Japanese) |
| 10. Does the design use waterfalls to symbolize permanent impermanence? (Japanese) |
| 11. Does the architecture implement indoor-outdoor transparency? (Japanese) |
| 12. Does the design implement Allees? (French) |
| 13. Does the design implement a Rond-Point? (French) |
| 14. Does the design include a Tapis Verte? (French) |
| 15. Does the landscape make use of a Parterre? (French) |
| 16. Does the landscape treat plants as architectural features (topiary)? (French) |
| 17. Does the landscape include a Landscape Folly in the distance? (English) |
| 18. Is the landscape blend designed with nature, creating naturalistic forms? (English) |
| 19. Does the landscape use natural form, eliminating geometric semblance? (English) |
| 20. Does the landscape include a large natural shaped water feature? (English) |

The students then apply the Smyser Index to an image of Villa Lante, a well-known garden in Italy and also the list they developed such as the one in Table 6. The student who developed the list in Table 6, gave Villa Lante as score of 8 with the Smyser Index and a score of -2 with the list from Table 6. Then the student had to comment about the two different rating systems. The student stated,

"These two rating systems differ in many ways because of the criteria I chose for my index. For my index I used specific design elements of a cultures design as the criteria. An example would be, does the design implement Allee's? A path which is cut through woods but also a classic element of French landscape design. By choosing criteria such as this it reduced the amount of subjectivity when rating an image. It also reduces an image's ability to get a "good" score because very few landscapes would implement so many design elements across multiple cultures in a single space.

With Carol Smyser's criteria this does not happen. Smyser chose to include some very general criteria. Examples from Smyser index are, does the landscape purify water, provide food or present pleasant sights and sounds. This allows the judge to stress a greater amount of subjectivity in their decision. However, it also does a much better job at fairly rating different landscapes because the criteria is not so specific to a single culture's ideas of design elements."

The student's response was a typical average response. At this stage in their education, it is difficult for some students to have a lengthy and thoughtful discourse on the subject.

In 2011, the students are then asked to select a Dutch, German, Polish or Russian environment, and to evaluate the environment with the Smyser Index and describe any French, Italian, or English influences in the environment. The same student who developed the list in Table 6 chose a Dutch garden from a country estate "Den Hemelschen Berg" designed in 1872 to 1876 by Henri Copijn (1842-1923). The student stated:

"Yes, the garden design looks to be most influenced by English Landscapes. It also has a few features which could be considered French design as well.

The site looks to be greatly influenced by Capability Brown with its reduced design and naturalistic features. It also has similar features to English landscapes with its natural and picturesque views. It has a large grassy field with trees placed through but turn into a woody area at the end of the space creating a very pleasant view.

It also strays away from solid geometry in with its winding paths which is an element seen in many English and Japanese landscapes. These paths also have elements of French design as well, they tend to meet at nodes and radiate outward from them.

The image also includes a natural pond but not at the same size as those of English landscapes.

However, Dutch gardens are also very famous for their formal designs as well which are entirely different from the one naturalistic one I chose. A classic "Dutch Garden" means a particular type of rectangular garden space which is often within hedges or walls even if it is part of a larger garden or park land, a design element very similar to Italian garden design. They are also laid out in a highly cultivated, geometrical and often symmetrical manner which further represents Italian design. A unique element

in these gardens are the flower beds which often contain brightly colored flowers edged with a box or low-rising, clipped shrub. A good example of this type of "Dutch Garden" is found adjacent to Kensington Palace in England."

In the response, the student was able to also understand how the Dutch design criteria may have influenced the notable English. The student demonstrates an ability to examine, compare, reflect, and make assertions about what is occurring in the environment.

For the third assignment, students had the opportunity to examine a local environment that they preferred and one that they did not prefer. In this example, a student from Ohio who took the class in the spring of 2011 is presented. The environment that the student preferred was a stream near Toledo, Ohio in Wildwood Nature Park. The image features a stream and a snow covered landscape. Table 7 presents the student's score.

Table 7. Student response to a park in Toledo, Ohio.

| Variable | Score |
|---|---|
| A. Purifies Air | +1 |
| B. Purifies Water | 0 |
| C. Builds Soil Resources | 0 |
| D. Promotes Human Cultural Diversity | 0 |
| E. Preserves Natural Resources | +1 |
| F. Limits Use of Fossil Fuels | +1 |
| G. Minimizes Radioactive Contamination | 0 |
| H. Promotes Biological Diversity | +1 |
| I. Provides Food | +1 |
| J. Ameliorates Wind | +1 |
| K. Prevents Soil Erosion | -1 |
| L. Provides Shade | +1 |
| M. Presents Pleasant Smells | +1 |
| N. Presents Pleasant Sounds | +1 |
| O. Does Not Contribute to Global Warming | +1 |
| P. Contributes to the World Economy | 0 |
| Q. Accommodates Recycling | 0 |
| R. Accommodates Multiple Use | -1 |
| S. Accommodates Low Maintenance | +1 |
| T. Visually Pleasing | +1 |
| Total Score | 10 |

The student chose a playground as an example they did not personally like and employed the Smyser Index (Table 8). The playground had recreation equipment to facilitate children's play.

Table 8. Student response to a playground.

| Variable | Score |
|---|---|
| A. Purifies Air | 0 |
| B. Purifies Water | -1 |
| C. Builds Soil Resources | 0 |
| D. Promotes Human Cultural Diversity | +1 |
| E. Preserves Natural Resources | 0 |
| F. Limits Use of Fossil Fuels | -1 |
| G. Minimizes Radioactive Contamination | 0 |
| H. Promotes Biological Diversity | +1 |
| I. Provides Food | +1 |
| J. Ameliorates Wind | -1 |
| K. Prevents Soil Erosion | 0 |
| L. Provides Shade | +1 |
| M. Presents Pleasant Smells | 0 |
| N. Presents Pleasant Sounds | 0 |
| O. Does Not Contribute to Global Warming | +1 |
| P. Contributes to the World Economy | 0 |
| Q. Accommodates Recycling | -1 |
| R. Accommodates Multiple Use | +1 |
| S. Accommodates Low Maintenance | 0 |
| T. Visually Pleasing | +1 |
| Total Score | 2 |

The student expressed self-awareness. When comparing the two environments, the student said,

"The positive image scored a 10 and the negative image only scored a 2. I believe that the major difference in the scores comes from the human interference. Wildwood is a nature preserve park, and with the exception of paths being added to the park, there is very little human interference. White park on the other hand was once a plot of woods. A majority of the woods were cleared out for playground equipment and baseball diamonds. While White Park is more popular and has a greater variety of uses, what was added does not blend into the surrounding natural environment, and in my opinion, lowers its score in many

categories. The overall scores do reflect my opinion of each image, but that may be due to my preexisting bias towards the two parks."

In a final comparison, the student selected a botanical park in Canada (preferred environment—Table 9) and a trash collection area in Cleveland, Ohio (non-preferred environment Table 10).

Table 9. Student response to a botanical garden in Canada.

| Variable | Score |
|---|---|
| A. Purifies Air | +1 |
| B. Purifies Water | 0 |
| C. Builds Soil Resources | 0 |
| D. Promotes Human Cultural Diversity | +1 |
| E. Preserves Natural Resources | 0 |
| F. Limits Use of Fossil Fuels | 0 |
| G. Minimizes Radioactive Contamination | 0 |
| H. Promotes Biological Diversity | +1 |
| I. Provides Food | +1 |
| J. Ameliorates Wind | 0 |
| K. Prevents Soil Erosion | +1 |
| L. Provides Shade | +1 |
| M. Presents Pleasant Smells | +1 |
| N. Presents Pleasant Sounds | +1 |
| O. Does Not Contribute to Global Warming | +1 |
| P. Contributes to the World Economy | 0 |
| Q. Accommodates Recycling | 0 |
| R. Accommodates Multiple Use | +1 |
| S. Accommodates Low Maintenance | -1 |
| T. Visually Pleasing | +1 |
| Total Score | 10 |

When comparing the two environments, the student stated:

"The botanical garden received a 10 and the trash/storage yard received a -12. This is a huge difference in scores and is due to the immense difference in the way humans interacted with the environment. The botanical garden was obviously planned and crafted by humans as was the trash storage yard. The way humans built the botanical garden was by utilizing plants and pieces of nature to build a pleasing and flowing landscape. Even the parts of the botanical garden that aren't plants blend in well with the landscaping around it and are crafted from wood and pieces of stone. Overall, it enhances the natural environment and is obviously well maintained. The storage/trash yard has very nearly no natural elements. It is essentially a concrete island. It provides no aesthetically pleasing elements, and the only bits of plant life shown are weeds that have escaped through cracks in the pavement. Beyond the complete destruction of natural environment involved in the creation of this, it is obviously abandoned and completely unmaintained. The two images are polar opposite examples of humans' interactions with environment. The scores they received are very reflective of this difference and of my opinion of the two images."

Table 10. Student response to a Cleveland, Ohio receiving area.

| Variable | Score |
|---|---|
| A. Purifies Air | -1 |
| B. Purifies Water | -1 |
| C. Builds Soil Resources | -1 |
| D. Promotes Human Cultural Diversity | 0 |
| E. Preserves Natural Resources | -1 |
| F. Limits Use of Fossil Fuels | -1 |
| G. Minimizes Radioactive Contamination | -1 |
| H. Promotes Biological Diversity | -1 |
| I. Provides Food | 0 |
| J. Ameliorates Wind | -1 |
| K. Prevents Soil Erosion | +1 |
| L. Provides Shade | -1 |
| M. Presents Pleasant Smells | -1 |
| N. Presents Pleasant Sounds | -1 |
| O. Does Not Contribute to Global Warming | -1 |
| P. Contributes to the World Economy | 0 |
| Q. Accommodates Recycling | -1 |
| R. Accommodates Multiple Use | 0 |
| S. Accommodates Low Maintenance | +1 |
| T. Visually Pleasing | -1 |
| Total Score | -12 |

These three assignments illustrate how the landscape evaluation criteria is employed in the classroom setting and the types of responses provided by students.

## V. Conclusion

Our study suggests that the respondents indicated that landscape assessment and evaluation is comprised of many variables that are orthogonal and independent. Even in relatively small groups, the expectations associated with planned and designed environments may be highly dispersed and varied. We believe the insights of Lawrence Halprin (mentioned in the introduction of this paper), who considered the various criteria provided by numerous stakeholders when developing a planning and design project is admirable and probably consistent with the findings of this research. We encourage planners and designers to employ methods that seek the declaration of multiple criteria when working on a project. In addition, we have provided examples of how this work is applied in a classroom setting to gain insight into the values associated with people and environments.

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