Visual Perception of Agricultural Cultivated Landscapes: Key Components as Predictors for Landscape Preferences

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Published online: 25 Sep 2012.

To cite this article: Orly Rechtman (2013) Visual Perception of Agricultural Cultivated Landscapes: Key Components as Predictors for Landscape Preferences, Landscape Research, 38:3, 273-294, DOI: 10.1080/01426397.2012.672639

To link to this article: http://dx.doi.org/10.1080/01426397.2012.672639

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Visual Perception of Agricultural Cultivated Landscapes: Key Components as Predictors for Landscape Preferences

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ABSTRACT This study focuses on the visual perception of agricultural cultivated landscapes by examining the role of five specific landscape components as predictors of visual preferences: field size, lot shape, land texture, crop texture and built elements. The Lower Galilee in northern Israel was chosen as the study area. The landscape was viewed by 90 participants using a photographic representation. Overall, the preference ratings indicated a relatively positive judgment of the agricultural cultivated landscapes. More specifically, the findings suggest that visual preferences regarding agricultural cultivated landscapes may be explained to a large extent by land textures, crop textures and lot shapes that are associated with complexity and fertility. Despite these findings, the intensification of agriculture over the last decades in many agricultural areas is still characterised by the removal of boundaries and the reduction of crop types. Increasing knowledge related to the visual perception of these landscapes may encourage the managers of agricultural areas to begin taking into account several crucial factors that influence the aesthetic quality of cultivated lands.

KEY WORDS: agricultural cultivated landscape, visual perception, visual preferences, landscape components

1. Introduction

1.1. Overview

1.1.1. Agricultural landscapes in transition. Over recent decades, agricultural landscapes in Europe and in Israel have undergone significant changes (Meeus, 1993; Moriera et al., 2001; Usher, 1999). These modifications are an expression of both the crisis that has befallen the agricultural arena and the effects of modernisation over the last 50 years (Meeus, 1993, 1995). The main causes of this crisis are the demand for increased agricultural production and specialisation, alongside technological developments. Together, these two factors have caused surplus production, a decrease in trade conditions, and an increase in competition. These conditions have led to a drop in profits and damage to the environment by
agriculture which has in turn further deteriorated production conditions (Hunziker, 1995; Hunziker & Kienast, 1999).

As a result, there has been a significant reduction in the scope of agricultural production, a transition to increased specialisation, an intensification of processing methods and an increased conversion of agricultural lands for real estate development or other alternative incomes. These trends have left their mark on the visual character of agricultural landscapes in several ways: 1) a growing urban sprawl, extending into agricultural fields adjacent to metropolitan areas; 2) abandoned fields are gradually being covered by young forests or shrubs; 3) an infiltration of built elements into cultivated land; 4) changes in crop types and the unification of small heterogeneous plots into larger monoculture plots; 5) increased use of covered crops (Dramstad et al., 2001; Hunziker & Kienast, 1999; Meeus 1993, 1995; Wascher, 2000).

Agricultural lands are lands designated for food production. However, in addition to this productive aspect, they also have the potential to create a wide variety of landscapes that represent the interface between the natural conditions and the aesthetic, ideological and cultural values of a particular community (Arriaza et al., 2004; Bunce, 2001; Claval, 2005; Dramstad et al., 2001; Krause, 2001; Meeus, 1995).

Much effort has been invested during the last few decades in the development of knowledge, policies and programs for managing agricultural landscapes throughout the world (Countryside Agency, 2001; Countryside Commission for England, 1988, 1991, 1994; European Centre for Nature Conservation, 2000; European Commission, 1998; Green et al., 2005; Ministry of Agriculture, 2000). Decisions regarding the conservation value of agricultural landscapes are based on a myriad of ecological, economic, aesthetical, social and cultural considerations.

1.1.2. Visual perception of agricultural landscapes. Landscape perception is the result of the interaction between an individual and the landscape (Zube et al., 1982). Since the early 1970s, many studies have been conducted relating to landscape perception. Lothian (1999) has summarised much of the work that has been accumulated in the field, relating to both objective and subjective paradigms. This study focuses on two different paradigms through which people perceive visual landscapes and which have been suggested in the literature: 1) the viewer’s responses to the landscape are based on experiencing the totality of the landscape (Appleton, 1975, 1994; Higuchi, 1983; Jakle, 1987; Lewis & Philip, 1996); 2) the viewer’s response is derived from the ability to discern specific physical components of the landscape (Bishop & Hulse, 1994; Brabyn, 1996; Ervin, 2001; Hough, 1990; Muir, 1999; Prost & Buhyoff, 1980).

This paper addresses the visual aspect of the agricultural landscape and based on the second paradigm, focusing on the role of particular landscape components as predictors of visual preferences.

Although there are a number of studies on the visual perception of agricultural landscapes (Arriaza et al., 2004; Brush et al., 2000; Dramstad et al., 2001; Franco et al., 2003; Gomez-Limon & de Lucio, 1999; Nijnik & Mater, 2008; Sevenant & Antrop, 2009), relatively little empirical research has been conducted on preferences regarding agricultural landscapes as compared to the broad knowledge gathered on
the visual perception of natural settings and open landscapes (Bell, 2003; Hellerstein et al., 2002; Ryan, 2002).

Agricultural areas significantly contribute to the visual quality of open landscapes. Research findings show that viewers express a high value towards landscapes that contain an agricultural factor. This finding is further supported by the presence of elements that create complexity, enable legibility and indicate fertility in the landscape (Anon, 2000; Dramstad et al., 2001; Misgav & Amir, 2001; Rechtman, 2006; Scott, 2002).

Boyd and Gardiner (2005), Palang et al. (2005) and Stobbelaar et al. (2004) called attention to a new visual concept: the cyclical changes of the agricultural landscape. According to these studies, changes in the agricultural landscape are perceived to be a meaningful and integral part of a landscape’s particular identity only when the change is cyclical.

1.1.3. The agricultural landscape of Israel. The agricultural areas of Israel are an integral part of the open landscapes in the country. The total agricultural area covers about 600 000 hectares, of which 420 000 hectares are cultivated fields (Etinger, 2006). In addition to the worldwide changes described above (see section 1.1.1), three other factors have occurred in Israel: 1) social and ideological changes have lowered the value of agriculture as a means of implementing national goals such as providing a source of income for new immigrants and developing new settlement areas (Egoz, 1996; Rechtman, 2006); 2) the water crisis, which has increased since the beginning of the 1990s, has significantly decreased the irrigated areas (Kelly, 1997); 3) an accelerated population growth has resulted in an increased interest in using agricultural land reserves for development (Hun & Sagy, 2006).

Very few previous studies have investigated the visual perception of agricultural landscapes in Israel (Bro-Zaks, 2001; Fleishman & Feitelson, 2007; Fleishman et al., 2008; Stern & Rabinovitch, 2006). These few studies examined public attitudes towards the rural landscapes of certain areas with particular agricultural land use. None of these studies aimed to understand the wider context of factors affecting the development of the agricultural landscape and the factors underlying viewers’ visual preferences. In addition, these studies did not involve questioning the community of experts in Israel, some of whom are involved in the management and planning of these open landscapes.

1.2. Research Objectives

The visual perception of agricultural landscapes raises a variety of questions that are beginning to interest researchers, decision-makers, managers and planners of agricultural areas.

The present study focuses on the visual perception of cultivated lands in Israel, which constitute a dominant feature of the agricultural landscape. Agricultural environments inevitably undergo rapid transformations. Although there is a wide consensus that these transformations greatly affect the characteristics of the agricultural landscape, reduce its variety and eventually its visual qualities, there is very little knowledge on the way the cultivated component of the agricultural landscape is perceived. Sevenant and Antrop (2009) emphasise the need to
distinguish between different viewers and landscape types when exploring the visual perception of landscapes, rather than rely on generalisations or on the consensus. Studies that do address this issue mostly focus on public attitudes and preferences regarding rural landscapes; very few studies have involved experts’ knowledge.

In view of this argument, the present study set three main goals:

1. To identify the key components that determine the visual preferences of experts regarding agricultural cultivated landscapes in Israel.
2. To ascertain the relative importance of these components and their visual characteristics.
3. To determine the relationships between the key components and visual preferences.

2. Methodology

A five-step research process was designed for this study (Figure 1): 1) classifying the study area into visual units using a geographic information system (GIS); 2) reviewing the literature to identify the key visual components of cultivated landscapes as mentioned in previous studies; 3) defining the visual components of the cultivated lands in the study area from the observer’s point of view. A final list of components was then composed based on both the literature review and the observations in the field; 4) creating a sample of representative agricultural landscapes of the study area; 5) assessing the perceived beauty of the sampled views by a group of 90 experts. The relationship between the various landscape

![Figure 1. Research process.](image-url)
components and the visual preferences were then statistically analysed to determine the relative importance of each of the components to the visual preferences.

2.1. Classifying the Study Area into Visual Units

The study was conducted in the eastern Lower Galilee, located in northern Israel (Figure 2). The area is bound in the west by the central Lower Galilee (500–600 meters above sea level) and in the east by the Sea of Galilee (213 meters below sea level). The region is characterised by a mountainous section in the west and plains in the east, while the northern region is characterised by a structure of ridges and valleys which run in a general northeast–southwest direction. This region has a rich variety of landforms, altitudes, slope positions, soil types, vegetation formations and land uses. The open areas of the region are equally divided into agricultural lands and a mixture of forested lands and Maqui, creating agricultural landscapes with a rich visual diversity. The agricultural areas are mainly used for field crops and olive orchards, most of which are in the valleys or on the lower parts of the hillsides. The eastern plains are characterised by extensive wheat fields and orchards.

Figure 2. General location of the study area.
The study area was divided into visual units based on Sheppard’s method (Tetlow & Sheppard, 1979). According to this method, the boundaries of the visual units were derived from a specific observation point. Figure 3 demonstrates the visual unit concept. This method was chosen in order to understand the perceived landscape and identify its visual components based on the observer’s point of view, rather than using a mapped analysis, which is based on an aerial ‘bird’s eye’ view.

Sheppard’s method was applied to the GIS (geographic information system) using a watershed analysis. This application efficiently produced the distribution of the area into its visual basins depending on the ability to define the suitable watershed size (Figure 4). Using this method, the study area was divided into fifteen visual units (Figure 5).

2.2. Defining Visual Components and Sampling the Landscape

This present research is based on the landscape components paradigm (see the second paradigm in section 1.1.2). This approach provides a conceptual framework for investigating the relationships between the physical components of the cultivated landscape and the way they are visually perceived.

Figure 1 demonstrates the process of identifying the cultivated landscape components, defining the visual landscape types of the study area and creating a representative sample of cultivated scenes from the observer’s perspective. A literature review was conducted to identify the visual components that have already been identified in previous studies.

The visual components of the study area were identified by a process combining the GIS procedure with field observations (described below). The cultivated lands of the study area were mapped. A process was developed in the GIS to define the best viewing positions according to the following criteria: 1) the chosen points must obtain the best viewing conditions regarding relief considerations (obstacles stemming from land uses identified in the field such as agricultural structures and vegetation); 2) all viewpoints must be taken from the foreground zone distance

![Figure 3. The visual unit.](#)
**Figure 4.** Watershed analysis of the study area.

**Figure 5.** Classification of the study area into visual units.
(400–800 m) to enable discerning landscape components and their visual characteristics (Litton, 1968, 1972; USDA, 1974, 1995); 3) the viewpoint locations must take into account the average human height, binocular field vision (1240) and the limitations resulting from the observer’s static position; 4) the number of viewpoints must be determined according to the ability to observe the entire cultivated area according to these criteria. Observing the entire area is important in order to obtain a reliable sample of photographs that represent the visual variety of the study area.

A complete explanation of the GIS procedure is beyond the scope of this paper; the viewpoint locating procedure will be only briefly described, in order to explain the sampling process and results.

Based on the criteria delineated above, the number of points needed in order to observe the entire cultivated area is derived from the relation between the observation angle ($\beta$), the width of the cultivated field ($s$) and the distance ($d$), according to the following calculation:

$$\tan\left(\frac{\beta}{2}\right) = \frac{s}{2d}$$

$$d = \frac{s}{2 \tan\left(\frac{\beta}{2}\right)}$$

The final location was the result of the above calculation and visibility considerations, as conducted by the GIS application of view shade analysis. A total of 116 viewpoints were defined, covering almost the entire cultivated lands of the study area (Figure 6). Respectively, 116 observations and photographs were taken of the study area.

Figure 6. The viewpoints.
The key components and visual characteristics of the cultivated landscape in the study area were identified by matching the results from the field observations and viewing the photographs on the computer. Five visual components were defined: field size, lot shape, land texture, crop texture and built elements (Table 1).

The sampled landscapes were chosen by a process of elimination based on visibility and accessibility criteria. According to the visibility criterion, the viewpoint must enable the participant to view the field’s entire cultivated landscape, without any visual obstacles or lighting effects. According to the accessibility criterion, the cultivated land must be accessible to the public, meaning it should be easily visible from roads, settlements or recreational areas and sites. Applying these criteria, the 116 viewpoints were reduced to 46. These viewpoints provided the best impressions of the cultivated landscapes in the study area.

The landscape types of the 46 photographs were determined based on the list of the visual key components (Table 1). Seven agricultural cultivated landscape types were identified in the study area. A total of 14 photographs, two for each landscape type, were chosen to represent its visual diversity (Figures 7–9).

2.3. The Procedure

2.3.1. The subjects. Ninety subjects participated in the study: 67% were landscape professionals from various disciplines and 33% were landscape architecture students in an advanced stage of their studies at the Technion-Israel Institute of Technology (Table 2). The students were considered to be part of the expert group, albeit at the lowest level of qualification and experience. Sevanant & Antrop (2009) conducted an in situ questionnaire in different rural landscape types using undergraduate geography students. Tveit (2006) used students as a representative group of future landscape professionals.

Landscape perception depends on both the properties of a given landscape and the profile of the viewer (Zube et al., 1982). Many studies show significant differences between the visual preferences of landscapes as viewed by experts as compared to the

Table 1. Key visual components of agricultural cultivated landscapes

<table>
<thead>
<tr>
<th>Visual components</th>
<th>Visual characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field size</td>
<td>Different sizes of cultivated fields: from very small to very large</td>
</tr>
<tr>
<td>Lot shape</td>
<td>Two visual types of lot shape: regular and irregular</td>
</tr>
<tr>
<td>Land texture</td>
<td>Four different visual types according to the pattern of division into lots: undivided fields, fine texture created by the division of the land into small lots, coarse texture created by the division of the land into large lots and a combination between both textures in a single field</td>
</tr>
<tr>
<td>Crop texture</td>
<td>Four different visual types were formed due to the variety of crop species: bare fields, fine texture created by the presence of field crops, coarse texture created by the presence of orchards and a combination of both textures in a single field</td>
</tr>
<tr>
<td>Built elements</td>
<td>The spatial pattern created by the agricultural built elements (such as greenhouses) within the cultivated area: gathered or dispersed</td>
</tr>
</tbody>
</table>
general public (Brush et al., 2000; Buhyoff & Wellman, 1978; Herzog et al., 2000; Kaplan & Kaplan, 1989).

Zube et al. (1974) found that professionals from related fields such as architecture, landscape architecture and planning are likely to be a homogeneous group in their landscape preferences. Brown and Daniel (1987), Buhyoff et al. (1982) and Shuttleworth (1980) support this claim but still demonstrate minor differences between these groups regarding their visual preferences. However, other studies have demonstrated significant differences between experts and the public regarding their aesthetic perception of human-influenced landscapes in general, particularly when involving built components (Calavita & Daves, 1994; Ryan, 2006; Stamps & Nasar, 1997). Scott (2002) indicates another significant difference between experts and the public, regarding the perception process: while the public tends to perceive the totality of the landscape, experts also base their judgment on their ability to discern landscape parts, components and features. Therefore, as this research aimed to explore the correlation between landscape components and visual perception, relying on experts was the most suitable choice to address the objectives of this study. Furthermore, experts are deeply involved in decision-making that greatly influences the future of the landscape. In Israel, the visual perception of experts has not yet been studied. By doing so, these findings may then be taken into account when making decisions regarding cultivated lands in Israel. Focusing this research on professionals in the field may help bring this issue into their managerial awareness, while gathering preliminary knowledge regarding their visual perception.

2.3.2. Photograph questionnaire. In this study, the landscape was viewed by the participants using photographic representations. Photographs of the cultivated landscapes of the study area were taken by digital camera from an observer’s static
viewpoint in the summer between June and September, at noon (11:00–14:00), when there were optimal atmospheric conditions (clear blue skies). In order to neutralise the effect of irrelevant details, the photographs were cropped in a way that created an equal horizon for all of the landscapes.

An important assumption underlying the use of photographic representation is that human judgment based on photographs provides a valid substitute to the actual settings they represent (Daniel & Boster, 1976; Hull & Stewart, 1992; Schroeder, 1988; Shuttleworth, 1980; Stewart et al., 1984; Zube et al., 1974). Daniel and Meitner (2001) broadly discussed the issue of validity regarding photographic representation and concluded that this method is valid mainly under conditions of passive environmental experiences such as sightseeing, which is precisely the method used in this research.

2.3.3. Questionnaire design. Before beginning the actual study, a pilot test was conducted with five participants to test the length of the questionnaire, its complexity, the quality of the data obtained and the clarity of the language and the photographs.

The questionnaire was comprised of three tasks. First, the subjects were required to rank their visual preferences regarding the 14 sampled photographs of the cultivated landscapes of the study area using a five-point Likert scale where (1) indicates the lowest visual preference and (5) labels the highest preference. The second task was designed to ascertain the contribution of the key components to the visual quality of each sampled cultivated landscape. Subjects were asked to determine the contribution of each key component to the visual quality of the agricultural cultivated landscape, by marking their choice on a five-point scale. The third and final task required ranking the contribution of each visual characteristic to the visual quality of the agricultural cultivated landscape, again using a five-point scale.

The questionnaire was based on a photographic presentation under laboratory conditions. Each photograph was viewed for 10 seconds. Presenting the photographs for a fixed amount of time is necessary for studies held in an enclosed space, and essential in order to record the first impression of the viewed landscape (Aoki, 1991). Statistic analyses were conducted in order to study the relationship between landscape components and the visual preferences of the cultivated landscapes.

3. Results

3.1. Visual Preferences

Table 3 reports the mean scores of the subjects’ visual preferences regarding the sampled agricultural landscapes (Figures 7–9). A qualitative analysis of these findings suggests four general conclusions: 1) overall, the preference ratings indicated a relatively positive judgment of the agricultural cultivated landscapes. The subjects ranked 12 out of the 14 landscapes between high and very high on the preference scale; 2) the lowest preference rates were attributed to flat fields characterised by undivided lands of extensive wheat fields that created the most homogeneous and bare cultivated landscape type (Figure 7:7a, mean 2.66; Figure 7:7b, mean 2.91). The landscape type that was similar to the wheat fields in terms of its visual homogeneity,
but differed due to the presence of green agricultural crops, was rated a bit higher (Figure 8:8a, mean 3.24). Other flat, undivided wheat fields that included some special elements like rows of trees and bales of hay, were rated higher than the homogenous green fields (Figure 8:8f, mean 3.64; Figure 8:8h, mean 3.81); 3) for the remaining photographs, the preference results show that in general, landscapes that

<table>
<thead>
<tr>
<th>Fig. no.</th>
<th>Photograph no.</th>
<th>Preference mean</th>
<th>Preference level</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>7a</td>
<td>2.66</td>
<td>Medium</td>
<td>0.95</td>
</tr>
<tr>
<td>7</td>
<td>7b</td>
<td>2.91</td>
<td></td>
<td>0.77</td>
</tr>
<tr>
<td>8</td>
<td>8a</td>
<td>3.24</td>
<td>High</td>
<td>0.82</td>
</tr>
<tr>
<td>8</td>
<td>8b</td>
<td>3.41</td>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td>8</td>
<td>8c</td>
<td>3.42</td>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td>8</td>
<td>8d</td>
<td>3.46</td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>8</td>
<td>8e</td>
<td>3.48</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>8</td>
<td>8f</td>
<td>3.64(^1)</td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>8</td>
<td>8g</td>
<td>3.62</td>
<td></td>
<td>0.84</td>
</tr>
<tr>
<td>8</td>
<td>8h</td>
<td>3.81(^2)</td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>8</td>
<td>8i</td>
<td>3.90</td>
<td></td>
<td>0.84</td>
</tr>
<tr>
<td>9</td>
<td>9a</td>
<td>4.11(^3)</td>
<td>Very high</td>
<td>0.82</td>
</tr>
<tr>
<td>9</td>
<td>9b</td>
<td>4.19</td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>9</td>
<td>9c</td>
<td>4.43(^4)</td>
<td></td>
<td>0.70</td>
</tr>
</tbody>
</table>

Scale: 1–5; 1 = very low visual preference, 5 = very high visual preference

Note: Four of the landscape types included special elements as detailed below: \(^1\)A row of eucalyptus trees on the horizon. \(^2\)Bales of hay. \(^3\)Agricultural buildings. \(^4\)Unique topographic features.

Figure 7. Agricultural cultivated landscape types—medium level of preference.
Figure 8. Agricultural cultivated landscape types—high level of preference.
were characterised by the division of the land into lots and that had a diversity of agricultural vegetation were clearly the most preferred cultivated landscape types (Figures 8:8i, 9:9a–9c, mean 3.90–4.43). Regarding agricultural vegetation, it was found that the olive orchards, were ranked a high (4) preference level, but not the highest (5). It was found that in most cases, built components may negatively affect the visual preferences of cultivated landscapes. Two photographs showed the same field with and without built elements. Figure 9:9a, which includes three agricultural buildings grouped together at the right side of the photograph, was ranked lower (mean 4.11) than Figure 9:9b, which does not have these buildings (mean 4.19), although it still received a very high preference score.

3.2. The Key Components

Subjects were also asked to rate the contribution of each key component and its visual characteristics to the visual quality of the agricultural cultivated landscape.

Figure 9. Agricultural cultivated landscape types—very high level of preference.
Generally, the subjects rated land texture (mean 4.53) that reflects the division of the land into lots, and crop texture (mean 4.01) that expresses the presence and variety of agricultural vegetation, to be the most important contributors to the visual quality of the agricultural cultivated landscape. The contribution of the remaining components was perceived to be of only secondary importance (Table 4). A possible explanation for this finding may be that the subjects perceived the components associated with complexity and fertility as the most important factors positively affecting the visual quality of the agricultural landscape.

For landscapes that were not divided into lots, the presence of built elements within the cultivated area and bare fields were perceived to be the lowest contributors to the visual quality of the cultivated landscapes (means of 2.99, 2.82, 2.79, respectively). On the other hand, a diverse landscape created by the mixture of field crops and orchards, land divided into lots with a regular shape and fine land texture where the fields are divided into small lots, were perceived to have the most positive effect on the visual quality of the agricultural landscape (means of 4.12, 3.99, 3.92, respectively). Furthermore, the subjects clearly preferred built elements to be in close proximity to each other rather than dispersed. They also preferred the presence of vegetation rather than bare fields, and preferred land that was divided into lots (Table 5).

### 3.3. The Relationships between Landscape Components and Visual Preferences

Statistical analyses were conducted to determine the effect of each of the key components on the visual preferences of the agricultural cultivated landscapes (Tables 6 and 7). Table 6 shows a significant positive correlation between the key components and the visual preferences regarding the cultivated landscapes ($R = 0.440$, $p = 0.000$).

Table 7 shows significant strong positive relationships between the visual components of land texture ($R = 0.872$, $p = 0.002$), crop texture ($R = 0.862$, $p = 0.003$) and lot shape ($R = 0.852$, $p = 0.004$) with the visual preferences of the subjects. The relationship between field size, which may be associated with the relative presence of cultivated fields in the open landscape, and the subjects’ visual preferences was found to be insignificant ($p = 0.442$). A similar result was found for built elements ($p = 0.523$).

### Table 4. The contribution of key components to the visual preferences regarding the agricultural cultivated landscapes

<table>
<thead>
<tr>
<th>Visual components</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land texture</td>
<td>4.53</td>
<td>1.626</td>
</tr>
<tr>
<td>Crop texture</td>
<td>4.01</td>
<td>1.587</td>
</tr>
<tr>
<td>Lot shape</td>
<td>3.01</td>
<td>1.559</td>
</tr>
<tr>
<td>Field size</td>
<td>2.73</td>
<td>1.582</td>
</tr>
<tr>
<td>Built elements</td>
<td>2.62</td>
<td>1.469</td>
</tr>
</tbody>
</table>

Scale: 1–5; 1 = very low contribution, 5 = very high contribution.
Table 5. The contribution of visual characteristics to the visual preferences regarding agricultural cultivated landscapes

<table>
<thead>
<tr>
<th>Visual components</th>
<th>Visual characteristics</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land texture</td>
<td>Undivided</td>
<td>2.99</td>
<td>1.17</td>
</tr>
<tr>
<td></td>
<td>Fine texture (small lots)</td>
<td>3.92</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>Coarse texture (large lots)</td>
<td>3.40</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>Combined textures</td>
<td>3.63</td>
<td>0.90</td>
</tr>
<tr>
<td>Crop texture</td>
<td>Bare</td>
<td>2.79</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>Fine texture (field crops)</td>
<td>3.47</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Coarse texture (orchards)</td>
<td>3.79</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Combined textures</td>
<td>4.12</td>
<td>0.93</td>
</tr>
<tr>
<td>Lot shape</td>
<td>Regular</td>
<td>3.99</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Irregular</td>
<td>3.44</td>
<td>1.02</td>
</tr>
<tr>
<td>Field size</td>
<td>Small cultivated area</td>
<td>3.18</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Medium cultivated area</td>
<td>3.53</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Large cultivated area</td>
<td>3.86</td>
<td>1.16</td>
</tr>
<tr>
<td>Built elements</td>
<td>Gathered</td>
<td>3.58</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>Dispersed</td>
<td>2.82</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Scale: 1–5; 1 = very low contribution, 5 = very high contribution.

Table 6. Relationships between landscape components and visual preferences

<table>
<thead>
<tr>
<th>$R$</th>
<th>$R^2$</th>
<th>$t$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.440</td>
<td>0.193</td>
<td>12.272</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Predictor: all of the visual components.
Dependent variable: all of the preferences.
Correlation is significant at the level of 0.01.

Table 7. Relationships between landscape components and visual preferences—by each key component

<table>
<thead>
<tr>
<th>Visual components</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$t$</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land texture</td>
<td>0.872</td>
<td>0.761</td>
<td>4.716</td>
<td>0.002</td>
</tr>
<tr>
<td>Crop texture</td>
<td>0.862</td>
<td>0.744</td>
<td>4.505</td>
<td>0.003</td>
</tr>
<tr>
<td>Lot shape</td>
<td>0.852</td>
<td>0.727</td>
<td>4.314</td>
<td>0.004</td>
</tr>
<tr>
<td>Field size</td>
<td>0.294</td>
<td>0.087</td>
<td>0.814</td>
<td>0.442</td>
</tr>
<tr>
<td>Built elements</td>
<td>0.246</td>
<td>0.061</td>
<td>0.672</td>
<td>0.523</td>
</tr>
</tbody>
</table>

Predictors: mean visual component.
Dependent variables: preference mean.
Correlation is significant at the $p < 0.05$ level.

It may be reasonable to assume that built elements such as greenhouses and other agricultural structures negatively affect the visual quality of the agricultural landscape. Unlike other agricultural areas in Israel, where covered crops are becoming more widespread, dramatically changing the visual character of the
landscape, the study area was characterised by only a limited and sporadic presence of built elements within the cultivated lands. The increased presence of covered crops in the agricultural areas of Israel and its impact on the visual perception of the landscape has not yet been addressed.

The statistical analysis also revealed that land texture \( R^2 = 0.761 \), crop texture \( R^2 = 0.744 \) and lot shape \( R^2 = 0.727 \) account for more than 70% of the variance (Table 7). In other words, visual preferences regarding agricultural cultivated landscapes may be explained to a large extent by three key components used in this research.

4. Discussion and Conclusions

The results of this study contribute to the general theoretical discourse on the visual perception of agricultural cultivated landscapes. More specifically, it presents findings on the relationships between various visual components of cultivated landscapes and the aesthetic preferences of experts in the field. These findings may provide some preliminary insights relevant to the management of agricultural landscapes in Israel, where there are very little data regarding visual perception.

The research examined the impact of five key components on the visual character of agricultural cultivated landscapes: land texture, crop texture, lot shape, field size and built elements. The findings suggest that land texture, lot shape and crop texture may be considered to be the most significant factors influencing the perceived visual preferences of the agricultural cultivated landscapes. Land texture, lot shape and crop texture are all physical components that enrich the complexity of the cultivated landscape.

The visual preference results clearly indicated that divided fields were unequivocally preferred over undivided ones. The study area included lots with regular and irregular shapes. Together, these lots create different patterns of land division that enrich the agriculture landscape of the area. Although both regular and irregular lot shapes increase the visual complexity of the agricultural landscape, the participants preferred the division into regular lots as compared to the agricultural scenes dominated by the irregular-shaped pattern.

A possible explanation for this preference may be found in the sense of order and organisation that the regular-shaped pattern creates within the open areas. This sense may be associated with legibility and an increased ability to understand the landscape. Legibility plays an important role in the visual preference of landscapes, for it allows the viewer to interpret the basic spatial structure, providing the observer with a feeling of orientation, control and security (Herzog & Leverich, 2003; Kaplan & Kaplan, 1989). This research suggests that the spatial structure of fields may significantly affect the visual perception of the agricultural landscape. However, very little has been written on the effect of different division patterns on landscape legibility or viewers’ visual preferences regarding this factor (Dramstad et al., 2001; Misgav & Amir, 2001; Scott, 1999, 2002).

The distance from which the photographs were taken in this research enabled the subjects to recognise the presence of crops and discern their texture, but not the specific crop species. The subjects could differentiate between field crops and orchards by their typical fine or coarse textures respectively. In general, the presence
of vegetation in the agricultural landscape had a positive impact on visual preferences. The subjects preferred orchards over crops and the mixture of both types over a homogeneous texture. Many studies have emphasised the role of vegetation as one of the most important visual components in open landscapes (Bourassa, 1991; Lewis & Philip, 1996; Purcell & Lamb, 1998; Smardon, 1988). Some preference studies have examined vegetation types, plant height, field size and texture as indicators of landscape visual quality (Haider & Hunt 2002; Hull & Buhyoff, 1986; Purcell & Lamb, 1998; Ulrich, 1986). This research concludes that the presence of agricultural crops enhances the aesthetic quality of the landscape, and becomes even more profound when there is a mixture of crops, creating diversity within the cultivated landscape. However, only a limited number of studies have focused on the influence of different agricultural crops as possible factors determining the visual perception of agricultural cultivated landscapes (Dramstad et al., 2001).

Many studies show a significant positive correlation between landscape complexity and diversity with visual preference (Franco et al., 2003; Kaplan & Kaplan, 1989; Palmer, 2004; Purcell et al., 2001; Zube et al., 1975, 1989). Tveit et al. (2006) broadly discussed the issue of landscape complexity and considered it to be one of nine key concepts that greatly affect the visual character of the landscape.

Complexity in the agricultural landscape is created by spatial division patterns, the variety of agricultural crops and the presence of special elements such as boundaries, trees, etc. Cultivated lands contain different patterns of land divisions. These components are believed to enrich the diversity of the cultivated landscape and to be an important factor in the perceived visual character of agricultural areas (Dramstad et al., 2001; Gulinck & Wagendrop, 2002). Gulinck and Wagendrop (2002) found boundaries to be one of the most significant visual characteristics that affects the complexity and regional identity of agricultural landscapes.

Despite these findings, the intensification of agriculture over the last decades in many agricultural areas in Western Europe is still characterised by the removal of landscape elements such as field boundaries and the reduction of crop types (Meeus, 1993; Vos & Meekes, 1999). Such trends have changed the traditional structure of agricultural areas and have reduced the complexity and visual diversity of the landscape, while also causing a loss of regional identity. These changes have also occurred in the study area used in this research.

The agricultural landscapes in Europe and in Israel have been undergoing major transformations due to changes in agricultural practices. Another phenomenon that reflects the changes in the agricultural practices in Israel is the widespread use of covered crops which entails building temporary structures in the agricultural landscape (Bro-Zaks, 2001). The impact of this phenomenon on the visual quality of the agricultural landscape has not yet received adequate attention, especially when considering its significant extent. Moore-Colyer (1999) and Scott (1999, 2002) related to this issue in the rural landscape and concluded that modern building styles that clash with traditional architecture are perceived negatively.

Increasing knowledge relating to these issues may encourage the managers of agricultural landscapes to begin taking into account several crucial factors that influence the aesthetic quality of these cultivated agricultural lands. In Israel, the management of agricultural land is driven mostly by productive and economic considerations (Bro-Zaks, 2001; Kaplan et al., 2001; Rechtman, 2006). Economic
forces, along with the rapid development of new technologies, will continue to cause major changes in the agricultural landscapes in Israel. Therefore, it is crucial to evaluate the effect of these changes on the visual characteristics of the agricultural landscapes and their scenic quality.

It is important to integrate the issue of visual perception into the management of the agricultural landscapes. This research focuses on the importance of the fields’ division pattern—greatly determined by lot size and shape, as well as by crop textures—on the perceived visual quality of the agricultural landscape. The challenge for rural managers and planners is to develop tools and plans that enable agriculture to remain profitable, while adapting mechanisms that maintain a high aesthetic visual quality of the agricultural cultivated landscapes.

Acknowledgements

The author of this study would like to express gratitude to the Jewish National Fund (JNF) for its support of this research.

References


