LANDSCAPE VISUAL QUALITY ASSESSMENT IN WASHTENAW COUNTY, MI

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Visual Quality

How do we make decision of which landscape is beautiful, which is not?

How do we quantify this?

Visual Quality

- What is landscape visual quality?
- In this paper, we define it as analysis of human landscape preferences as viewed from fixed points at ground level (Wu et al., 2006).

Applications of Landscape Visual Quality

- Gaining a better understanding of landscape
- Assisting with landscape planning and location analysis
- Providing objective scenic beauty assessment.

Neutral Space vs. Perception Space

- Landscape components can be more easily measured as they are physical properties;
- The human aspect is more complicated. Because humans consider the landscape not as a neutral space (Boira, 1992), but as a part of their own perception space.
- In order to decrease this objectivity, in this study, visual quality are mainly analyzed from the ecological aspect.

Washtenaw County

- Founded: 1822
- Population: 344,791
- County seat: Ann Arbor

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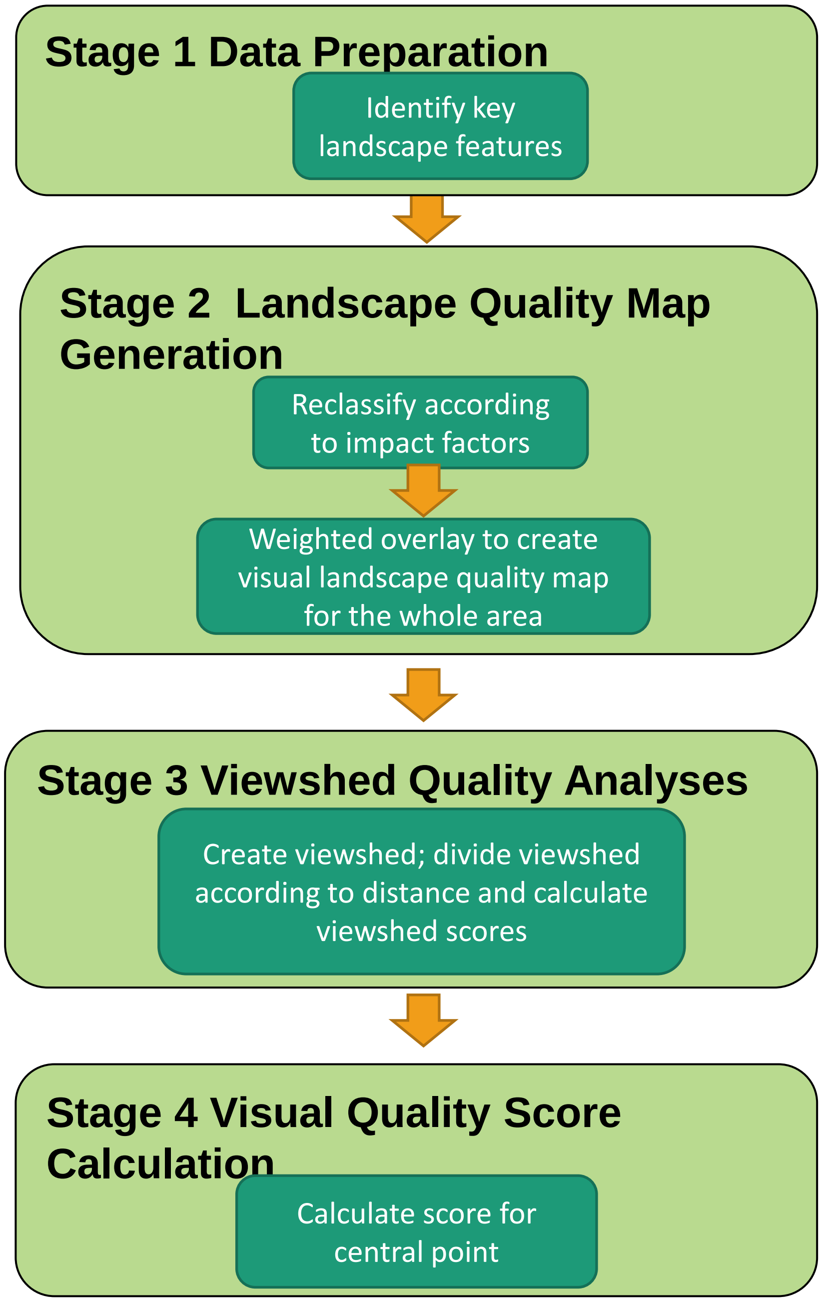
Background and Related Work

- Steinitz (1990), Bishop and Hulse (1994), they mapped visual quality based on key features within viewsheds, and used regression analysis to identify key variables of landscape public preference;
- Wu et al. (2006) addressed this problem by developing formula to generate LVQ for selected viewpoints, then using spatial interpolation to map LVQ across the study area;
- Manyoky et al., 2014,using game engine to create GIS-based virtual 3D landscape model
- LÛpez et al., 2014, using fuzzy logic and GIS method

Method


Stage 1 Data Preparation
Identify key landscape features
Stage 2 Landscape Quality Map Generation
Reclassify according to impact factors
Weighted overlay to create visual landscape quality map for the whole area
Stage 3 Viewshed Quality Analyses
Create viewshed; divide viewshed according to distance and calculate viewshed scores
Stage 4 Visual Quality Score Calculation
Calculate score for central point

Reclassify Layers Based on Area

Park

The larger the park area, the more positive impacts it will have on visual quality. We did reclassification based on area to park layer, forest layer and water layer.

Reclassify Layers According to Rank

Road

The higher the road class, the more negative impacts it has on visual quality. We did reclassification based on rank to road layer.

Reclassify Layers According to Area

Industrial area

Inverse

The larger the industrial area is, the more negative impacts it has on visual quality. Therefore during reclassification, we use inverse value. We did inverse reclassification to industrial layer.

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Weighted overlay

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Forest: 25%

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Park: 25%

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Water: 30%

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Industry: 15%

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Road: 5%

Create Visual quality map

Washtenaw County Landscape Quality Map

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Viewshed

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Overlay Viewshed and Distance Layer

Viewshed

Human can typically see buildings from 8km away. Therefore we use 8km (approximately 24,000 feet) as the largest distance when analyzing. We then divided the viewshed into three rings according to distance.

Viewshed
within 24,000 ft

Viewshed
within
16,000 ft

Viewshed
within
8000 ft

Zonal Statistics

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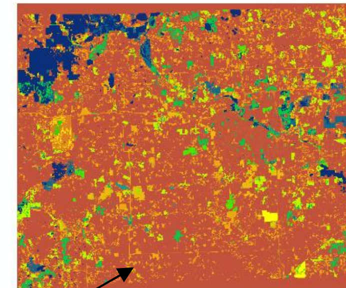

Calculate Zonal Statistics for Each Ring

Use zonal statistics to calculate sum value within each ring to get visual quality value of each ring.

Viewshed Analyses General Process

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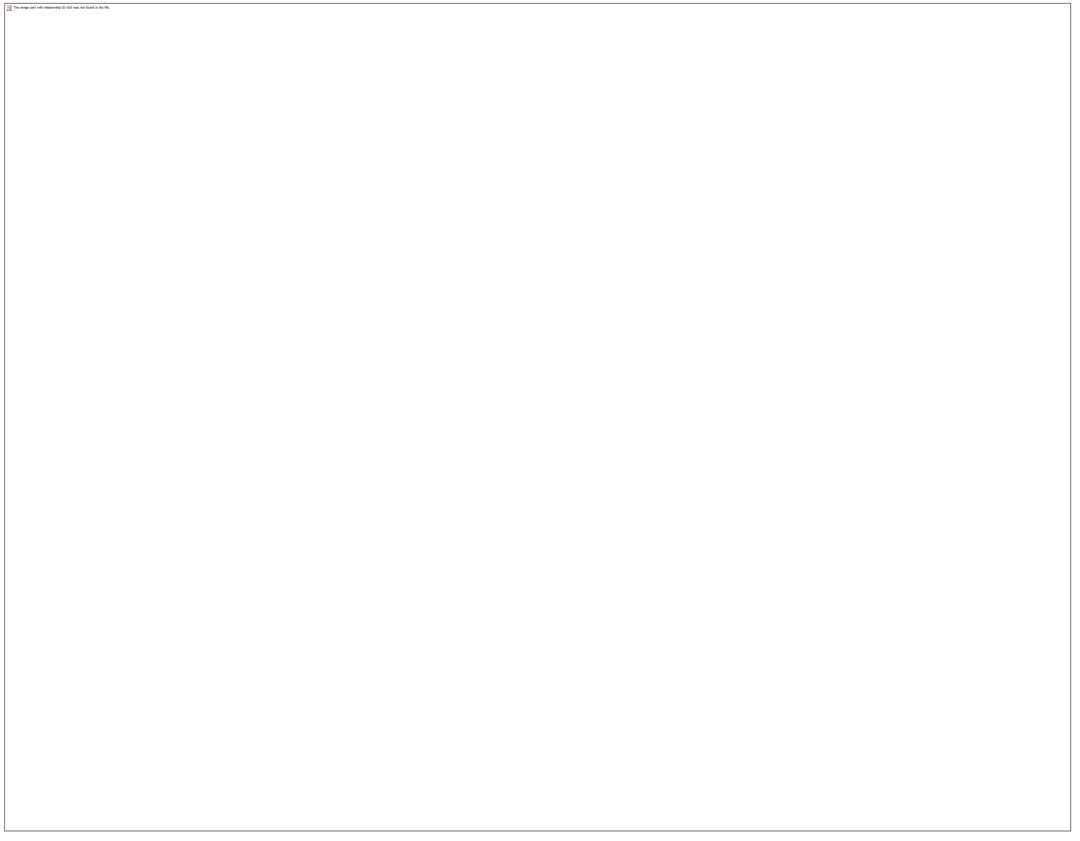
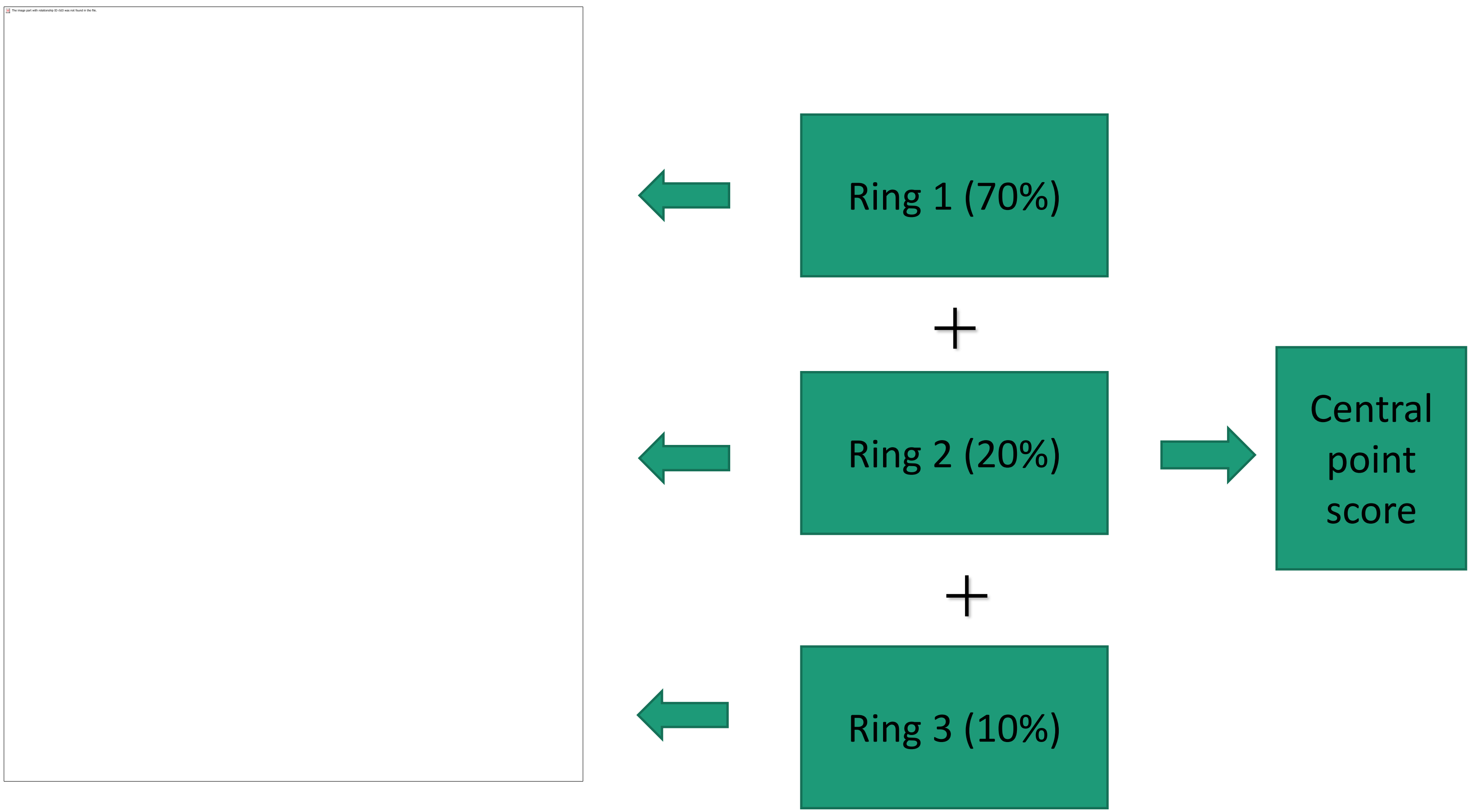
Calculate Visual Quality Score for Each Point

- A closer object has more impact than a distant one and should be weighted accordingly.
- The geometry of vision suggests that as distance d increases, size diminishes as $1/d^2$.



- However, perception studies suggest that the true rate of decline of influence is considerably slower.
- We use 1/d to determine the weight of each ring. (Wu et al, 2006)

Calculate Visual Quality Score for Each Point



Result Evaluation

Evaluate assessment result with Google maps and photos

Central point score: 211.58

Result Evaluation

- Point score: 211.58

Score: 254.19

Central point score: 230.78

Future Study

- A. 50 Landscape photos will be taken. These picture are of similar quality to exclude unrelated factors. Each of the photo will include the key landscape features in different ratio.
- B. In each survey, the photos will be shown to the participants. Participants will then be asked to rank the landscape preference of each pictures from least to most preferred (scaled 1 to 5) based on their intuition. Participants will include people from different culture, race, country and age group.

Discussion

- It should also be noted that one drawback of this study is that it only calculates scores for certain points.
- Researchers used spatial interpolation to solve this problem.
- However, interpolation might lead to inaccuracy because viewsheds of different points vary significantly in undulate terrain. This is a problem worth of further research.

References

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- Shang, H., I.D. Bishop. Visual thresholds for detection, recognition and visual impact on landscape settings. J Environ Psychol, 20 (2000), pp. 125–140
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