ECOTERRA
Journal of Environmental Research and Protection

GIS assessment of visual quality along the major thoroughfares of Pécs

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Abstract. Good panorama has a positive psychological influence. Numerous methods have been elaborated for aesthetic quality assessment. We apply a GIS method for the assessment of the visual quality of an area of mixed land cover of Pécs (Hungary). Our goal is the establishment of the value for part of a residential area in a diverse environment, based on the visibility of the area from characteristic points. In addition, statistical approaches were also applied for the relationship between elevation above sea level and the visual quality of the landscape. For the purposes of the study the best lookout points were designated along these roads. The localities are arranged on W to E and N to S cross-sections of the town.
Key Words: GIS, aesthetic quality assessment, settlement, Pécs.

Introduction and objectives. Most authors of environmental assessment studies try to avoid employing subjective factors which are difficult to quantify. Such a factor is, for instance, the aesthetic or visual value of the landscape, the view from a single point, which has only indirect, but undoubtedly significant impact on the life of society (Lóczy 2002).

Good view or wide panorama has a positive psychological influence. The large size of the terrain visible from one point, however, does not automatically mean high visual quality of the area visible. If this area is filled with industrial plants or presents a lunar landscape in immediate need of land reclamation, no positive associations can be detected.

In the recent decades numerous methods have been elaborated for aesthetic quality assessment, involving, for example, the quantitative analyses of photographs, sociological questionnaire surveys, screening from ecological aspect (Mezősi 1991). A tool of great help in research is rapidly developing Geographical Information Systems (GIS), also applied for the study and modelling of a range of other environmental problems, which have emerged in the environs of the town Pécs (Berki & Csapó 2006; Bugya & Kovács 2008; Czigány et al 2008; Fábián et al 2005; Geresdi & Lovász 2000; Gyenizse et al 2007; Kovács et al 2007; Lóczy 2002, 2006; Nagyváradi 2000, 2001; Pirisi & Trócsányi 2006; Pirkhoffer 2005; Pirkhoffer et al 2008; Ronczyk & Trócsányi 2006; Ronczyk & Wilhelm 2006).

In the present paper we also apply a GIS method for the assessment of the visual quality of an area of mixed land cover. Our goal is not merely the assessment of the elements of the natural and anthropogenic environment, but the establishment of the value for part of a residential area in a diverse environment, based on the visibility of the area from characteristic points. We have performed the investigation from the lookout points on the major roads most often used by locals and visitors in order to determine the value of such points and the E to W and S to N cross-sections composed of the points. In addition, statistical approaches were also applied for the relationship between elevation above sea level and the visual quality of the landscape.

The study area covers the town of Pécs, Southwest-Hungary, and its immediate environs, which is highly variable physical environment. The largest town of Southern

Transdanubia occupies the southern dissected slopes of the Mecsek Mountains of E-W strike and to the south the waterlogged bottom of the Pécs Basin (Figure 1). The modes of housing development are variable in the town and the environs present a variety of land cover types.

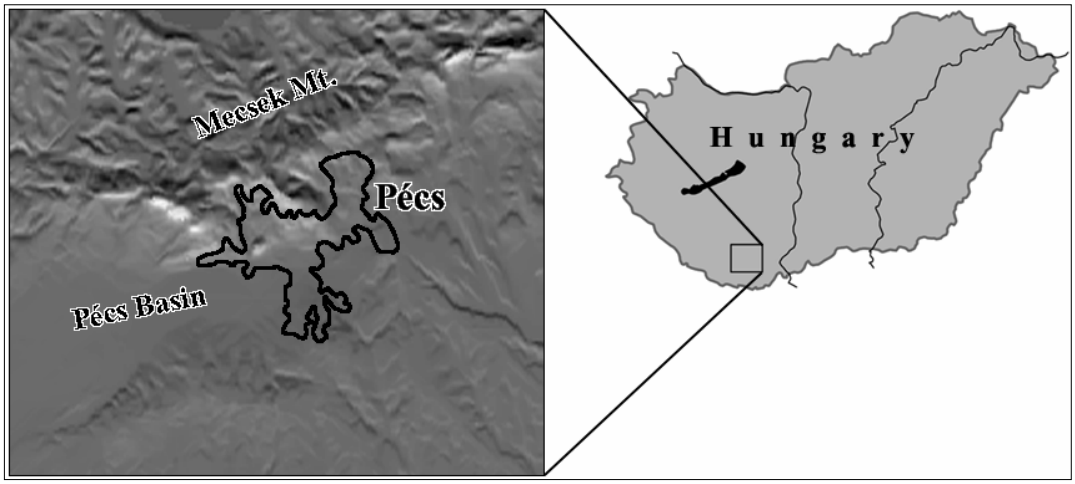

Figure 1. Topography of Pécs and its environs.

Developing the scoring system. How can we quantify such an apparently unidentifiable property as the aesthetic value of an area? In fact, this property does not belong to the landscape, but is related to the perception of the observer and necessarily contains many subjective elements. Therefore, the only way to set up a more or less objective scoring system is to summarize the opinions of a large number of people. To this end, we have taken a number of slides on the built-up areas of various types in Pécs, including parks and the cultivated lands of the outskirts. A series of altogether 31 slides was prepared, including recently built, high-rise, prefabricated blocks of flats; previously built, brick blocks of flats; the now popular housing parks and terraces; old middle-class residences in the centre; forests; meadows and arable land (Figure 2). In 2006 the slide show was presented to 58 first-year students of the University of Pécs and asked them to rate the view on a scale of five grades.

After evaluating the questionnaires of visual quality assessment, we obtained information on the total scores of ('votes' for) the individual visual types in the categories of 1, 2, 3, 4 and 5. Using the MS Excel program, we multiplied the scores with the categories. The outcome scores could theoretically range from 178 to 870, but proved to be too high for a GIS interpretation. Therefore, we calculated the ratio of the scores in comparison to the minimum value (178) and established weights from 1,0 to 5,0 on this basis (Table 1).

Table 1

Weighted visual quality score of the residential areas of different type and outskirts areas based on the applied survey

Visible area	*Weight*
Recently built, prefabriated block of flats	1.7
Older, brick block of flats	2.6
Housing parks and terraces	3.1
Historical town centre, middle-class residences	2.4
Residential area in poor conditions, in need of rehabilitation	1.7
Industrial plants, shopping centres	1.6
Densely built-up family home area	2.9
Summer houses zone	3.8
Broader road, railway line	1.7
Arable, meadow, grassland close to housing estate	3.9
Forest	3.9

The thus weighted residential and environmental types were mapped, first by analogue, then by digital methods. For the delineation of areas personal experience, field survey and the aerial photograph atlas of Pécs (Székely 2001) were of great help. The resulting map of types of land use and built-up areas are shown in Figure 3.

The various classes were delineated digitally to be interpreted in a GIS program. Following raster conversion, the types of residential areas, previously only ordered by numbers, were reclassified according to the weighted scores. This way a base layer was achieved which was already suitable for determining the visual quality value.

Figure 2. Areas in Pécs variously built up and with different land use types.
A selection of the slides used for the aesthetic assessment of the environment.

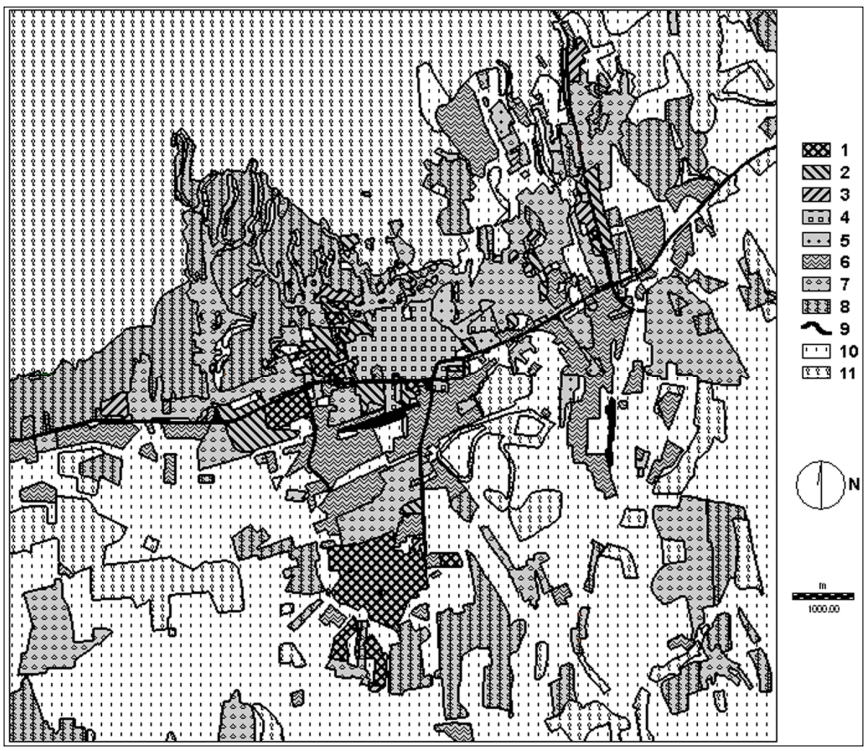

Figure 3. Built-up areas of different types in Pécs and the neighbouring areas (1 = recently built, prefabriated block of flats; 2 = older, lower, brick block of flats; 3 = housing parks and terraces; 4 = historical town centre, middle-class residences; 5 = residential area in poor conditions, in need of rehabilitation; 6 = industrial plants, area transformed by industrial activities, shopping centres; 7 = densely built-up family home area; 8 = sparsely built-up summer houses zone; 9 = broader road, railway line; 10 = arable, meadow, grassland close to housing estate; 11 = forest).

Aesthetic quality assessment using GIS. The selection of suitable lookout points were also important in the investigation. First of all places were chosen for this purpose which are often used as lookout points by the inhabitants of Pécs and the visitors who arrive to the town. These were two major thoroughfares intersecting at right angles. The value of visual quality was calculated for localities where the roads are broader, major intersections, squares or lookout facilities allow to get a view in all directions.

The road with the heaviest traffic in the region, the number 6 national main road, connecting Pécs to Budapest and on towards the W to Croatia, Slovenia etc., crosses the town from E to W. Perpendicular to it, number 58 main road arrives to the town from the south, also receiving traffic from road no 57, coming from the southeast. Although there are no major roads right in the centre or in the northern part, the most often visited sights, the television tower on Misina Hill (535 m) and other lookout points are found there. They are linked by a steep winding road running uphill.

For the purposes of the study the best lookout points were designated along these roads. The localities are arranged on W to E and N to S cross-sections of the town (Figure 4).

For the assessment of visual landscape quality IDRISI GIS was applied, the VIEWSHED module of shich calculates the area visible from the designated lookout point and represents it on a separate layer. Naturally, this requires the Digital Elevation Model of the area, which is produced by the vectorization of contour lines of the topographical map, rasterized and areally interpolated. The IDRISI VIEWSHED module identified visible areas for each lookout point (within the study area) and attached the value 1 to it, while the areas outside the visible area were marked by 0. This partial result layer was used as a mask in the EXTRACT module, and the number of picture elements with the individual weights was generated. Finally, from the cumulative scores the visual quality values of the areas visible from the lookout points were achieved.

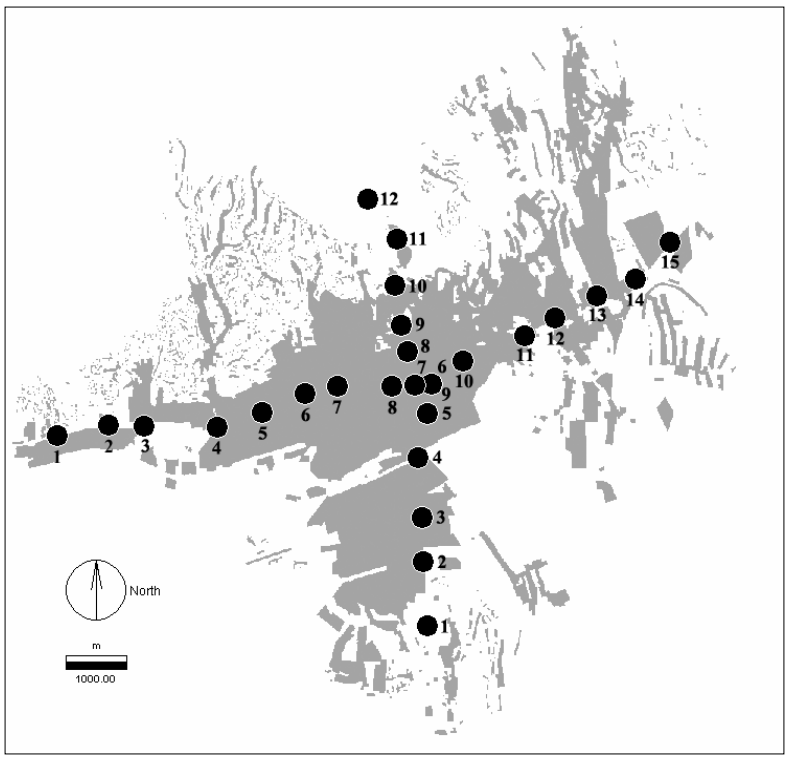

Figure 4. Location of lookout points (in background: built-up areas of Pécs).

Results. In the logic of geography, the higher a lookout point rises above its environs, the larger is the area visible from that point and also the visual quality value too. Is this rule valid for the study area?

At first, the lookout points along the S to N cross-section were evaluated (Figure 5). Descending into the Pécs Basin, the elevation above sea level of the points is decreasing (to 122 m) and then markedly rises as we approach the car-park on Tubes Hill (at 527 m). Even at a first glance, it is clear that the visual quality excellently follows elevation, drops and rises again. The correlation calculated between both data series results a value of 0.865, a close positive correlation. In this case, our assumption has been affirmed.

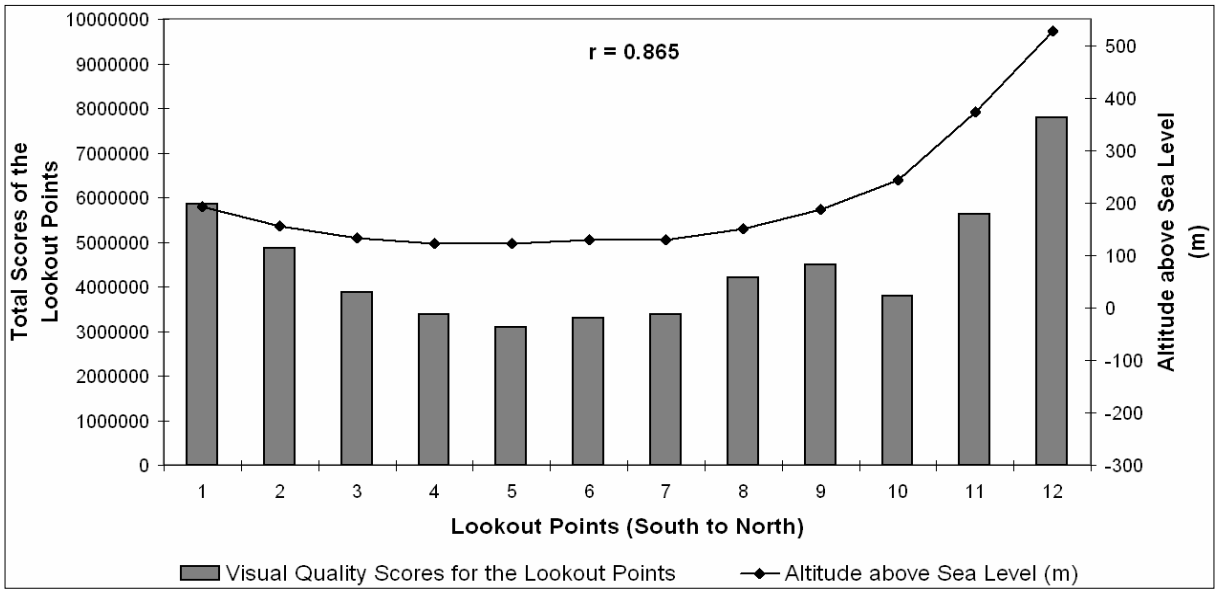

Figure 5. The elevations above sea level and visual quality scores of the lookout points along the S to N cross-section.

Our experience, however, was different for the lookout points along main road number 6 (Figure 6). The points here lie at similar elevation on the floor of the basin – with the exception of those on the eastern basin margin. The height difference between these points does not exceed 60 m, while it is about 400 m for the other series of points. In the case of points in the west, visual quality values are adjusted to elevation, but in the east remarkable deviations are observed. The overall correlation of elevation and visual quality is only 0.528, i.e. a minimum reverse relationship was found between the two variables. Here our expectations are not fulfilled. The reason for this is the following: although in the east the extension of areas visible from the individual points grows with elevation, the major industrial areas in this part reduce visual quality.

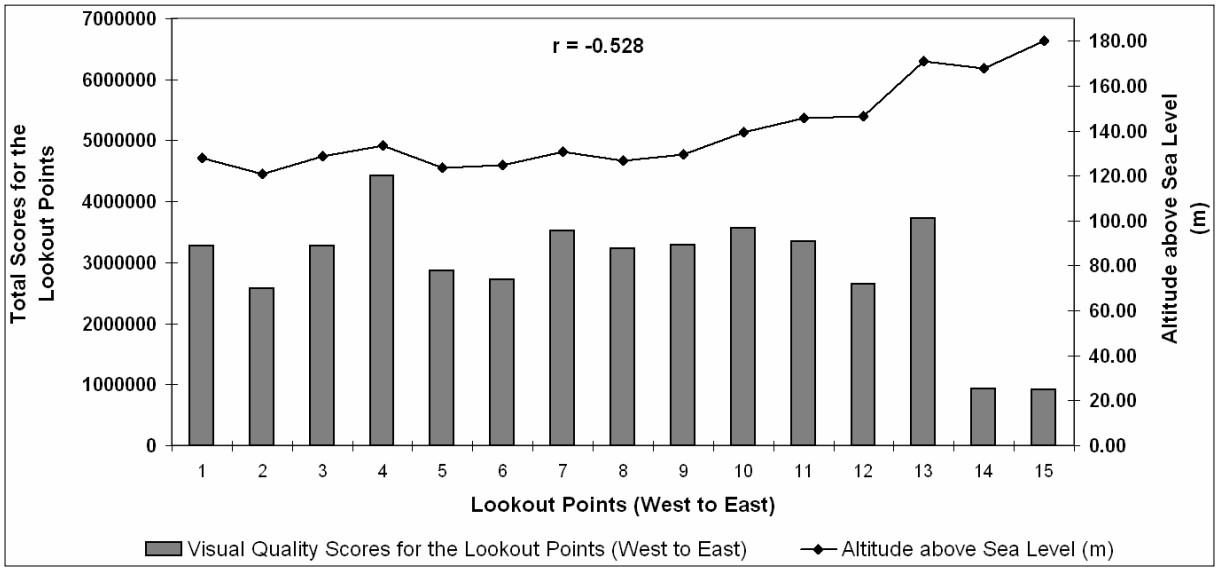

Figure 6. Elevations above sea level and visual quality of the lookout points along the W to E cross-section.

Conclusion. In summary, we can claim that the relationship between elevation and visual quality is unambiguous in the case of great height differences, but if relief is moderate, i.e. the visible areas of the same size, land use becomes the decisive factor in visual quality.

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How to cite this article:
Gyenizse P., Elekes T., Bognar Z., Németh S., 2013 GIS assessment of visual quality along the major thoroughfares of Pécs. Ecoterra 34:13-19.