

Visibility and Real Estate Values. A Room with View is a Room with Value?

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Abstract

The aim of this paper is to assign real estate values and especially apartment values with positive impacts associated with their view. This kind of impacts, although well described in the literature, are most of the times given in a qualitative approach. This is because of the inability of creating a mathematical model for quality of view for all the geographic space. What is the value of looking to Eifel tower in Paris and what is the value of looking to lake Como in Italy? The area of interest in this paper is the town of Thessaloniki in northern Greece. The choice of Thessaloniki is due to the theatrical scape of the town around the seaside and Thermaikos gulf. The paper also tries to cover the literature review on this subject taking in all the papers that have been published on this subject. This new approach comes from the science of Geographical Information Systems and the detailed building-building approach comes thanks to the ability of the new technologies in measuring the land using new aerial methods.

Keywords: Valuation, GIS, View, Greece, Residential Properties.

Introduction

There is a big number of researches and papers on investigating the relation between visibility and residential properties. In the most papers, the use of hedonic models and GIS has come to be the most classical methodology of solving this problem. Although a thorough examination of the relation between view and real estate values is well covered, and most of the times today's scientific literature gives accurate numbers of percentages –mainly positive- about the influence of the view to the values, the mechanism and the algorithms of measuring the view are not always well described. View is a qualitative phenomenon and economic theories usually agree that we can measure the view as a “desirable item” by measuring the amount an individual is willing to pay for it (Turner, Pearce, & Bateman, 1993); (Lake, Lovett, Bateman, & Langford, 1998). In this work, a detailed approach of measuring the view of an apartment describing all the new tools GIS has given today is well described.

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Literature Review

One of the most common methodologies to investigate the interaction of residential values and visibility is to measure the distance from the apartment to an amenity as a variable in the statistical model (Milon, Gressel, & Muleky, 1984; Kolhase, 1991; Mendelsohn, Hellerstein, Huguenin, Unsworth, & Brazee, 1992; Nelson, Genereux, & Genereux, 1992; Thayer, Albers, & Rasmatian, 1992; Kiel, 1995; Lansford & Jones, 1995; Paterson & Boyle, 2002). Hedonic models and Willingness to Pay models try to evaluate the effect of visibility on individuals' utility or, in other words, individuals' pleasure and enjoyment (Turner, Pearce, & Batement, 1993). Studies on the effect of view and visibility are being conducted from the early 1970s. The majority of the studies clearly documents the positive impact of view and visibility on real estate values (Darling, 1973; Plattner & Campbell, 1978; Gillard, 1981; Rodriguez & Sirmans, 1994). There are cases, though, that a no significant impact was stated mainly due to external issues, such as contamination, fear of flood or fire, overall high-quality view and visibility etc. (Davies, 1974; Brown & Pollakowski, 1977). Even from back in 1968, Yord measured the difference in actual sale values between properties with unhindered visibility (ocean frontage properties) and properties without view to the ocean. These differences ranged between 15 to 30%, a percentage highly significant (Yorshis, 1968). In Australia, McLeod produced results in the impact of river visibility on property values in Perth through dummy variables in a hedonic model, indicating a positive impact (McLeod, 1984).

View and visibility affect not only actual sale values but tax assessment values as well. Seiler, Bond and Seiler (2001) studied the impact of visibility to Lake Erie on property tax assessment values between 1999-2001 and clearly found that visibility was the next most significant factor after structural and internal property characteristics (Seiler, Bond, & Seiler, 2001).

However, it is important to study not simply the view, but, also, the type and quality of view and visibility. Two very interesting studies on the matter are those of Benson et al in 1998 and Bournassa et al. in 2003. Benson et al. (1998) divided visibilities in four categories (full, superior partial, good partial, poor partial) for the ocean, in two categories (view from lakefront property, view from non-lakefront property) for lake and in two categories (view to the mountain, no view to the mountain) for mountains. The study was conducted for Bellingham in Washington and documented different impacts for each category with the categories with the best view being more influential. On the other hand, Bourassa et al. (2004) studied visibility (type, scope) in combination with other factors (distance to the sea, neighbourhood quality) and found that all aesthetic externalities including visibility and view have a significant impact on property values (Benson, Hansen, Schwartz, & Smersh, 1998; Bourassa, Hoesli, & Sun, 2004). GIS has provided a new and efficient way to calculate factors and variables related to the view, such as distance to an amenity, view to an amenity, unhindered view etc., from the 90s. GIS allows the determination of what can be seen (view), of how far can a human eye see without any obstacles from a property (visibility) and of more complicated visual issues (Fisher, 1996). Geoghegan, Waiger and Bockstael (1997), as well as Powe, Garrot, Brunsdon and Willis (1997) both combined hedonic modelling with GIS for the calculation of the effect of different environmental amenities to property values (Geoghegan, Wainger, & Bockstael, 1997; Powe, Garrot, Brunsdon, & Willis, 1997). Impact results range from low to high. A study for San Diego indicated that properties with good visibility or view increase their value at a small extent compared to their mean sale value (Do & Sirmans, 1994), whereas property values in Fairfax of Virginia recorded an increase of 8% (Rodriguez & Sirmans, 1994). It is quite interesting that visibility to an amenity (park, ocean, lake, etc.) is preferred and valued from residents despite any problems that they might appear to have (crime issues, flood risks etc.) (Brown & Pollakowski, 1977; Goodwin, 1977).

Apart from the view to amenities, topography can affect values too. Whereas land measurement and topography issues would need field research, GIS simply provides all the tools for the derivation of the necessary information. For example, a ground with slope may affect value as it may provide view and visibility to a river or a sea to more than the riverfront or seafront properties. Lake et al. conducted continuous studies on the influence of topography and visibility on real estate values. It is significant to mention that those studies did not include structural characteristics of each property and so provided more clear results on the effects of topography, visibility and amenities (Lake, Lovett, Bateman, & Langford, 1998; Lake, Lovett, Bateman, & Day, 2000a; Lake, Lovett, Bateman, & Day, 2000b).

Study area, aim of the paper and geo data

The seaside city of Thessaloniki is the second largest city in population in Greece (Fig. 1 and 2). The paper works on a part of the city (Fig. 2), which was previously a district of the municipality of Thessaloniki. The aim is to export visibility rates (percentages) to the sea of penthouses (Fig. 2 and 3) utilizing geo information tools. The sea surface, within which the percentage of visibility from the penthouses of the study area will be determined, is up to 3,500m far from the waterfront (Fig. 2). The aim of the paper is the introduction of the above information in property values assessments.



Figure 1. The map of Greece with the location of Thessaloniki.

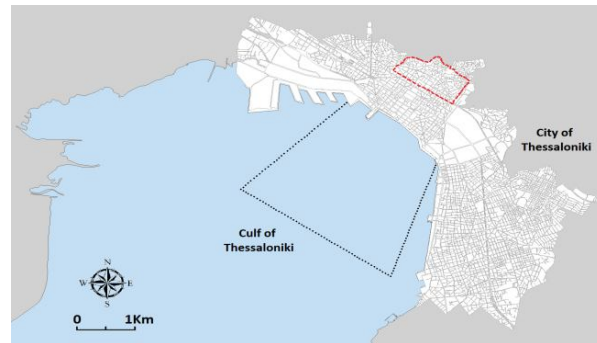


Figure 2. The urban area of Thessaloniki, the study area of penthouse visibility (red dashed line), and the part of the sea (mask, black dotted line) on the surface of which the percentage of visibility of the penthouse is calculated.



Figure 3. A picture of a part of the study area from the sea (in yellow color at right).

The study area consists of 3967 buildings, the terrain is smooth and varies from 20 to 135m. It is located in the northern part of the historic city center and the shortest distance from the seafront is about 950m (Fig. 2). The south-western part of the study area (Fig. 4) is covered with apartment buildings, while the north-eastern part is built with smaller houses, especially detached houses (tile roofed). The part of the sea that penthouses are expected to "see" is shown in Figure 2. This way buildings oriented from 290° to 320° will be identified and maintained (the angles are measured clockwise from North, fig. 2).

Figure 4. The study area (yellow dotted line). Background of an orthostaeelte image of Ikonos-2 in 2006 (RGB) of spatial resolution of 1m.



In this paper the Digital Surface Model (DSM, image img) of the National Cadastre of Greece was used (LiDAR product, absolute altitudes) for the study area, which has $0.8 \times 0.8\text{m}$ grid size and elevation accuracy of 0.1m (Fig. 5), as well as the floor plans of buildings (polygons shapefile), product of another research paper which were generated from the processing of stereo satellite images (Kaimaris & Patias, 2016).

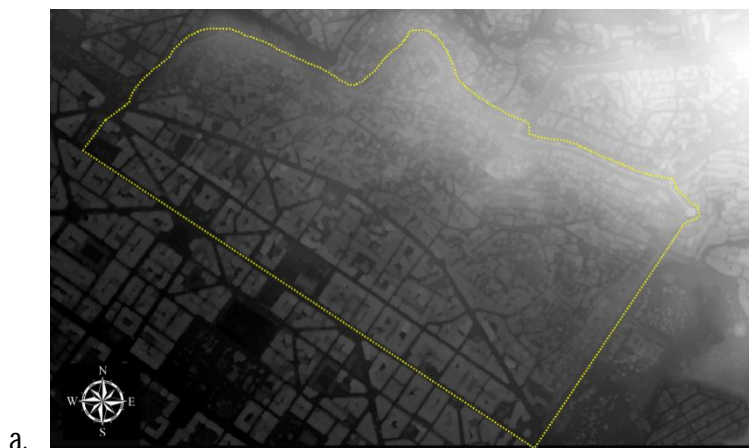




Figure 5. a. The Digital Surface Model (DSM) in the study area (study area boundary with dotted yellow line). Small altitudes with dark tone of grey, high altitudes with open grey tone. b. Buildings (green) in the study area (3967 buildings).

Methodology

DSM

The Digital Surface Model (Fig. 5) is a 3D geospatial product which is used in a wide range of applications including, terrain visualization, telecommunication, navigation, disaster management, planning of civil engineering, etc. (Liu, 2011). For its creation, apart from classical calculation processes with topographic measurements (total stations and / or GPS), methods based on Photogrammetry and Remote Sensing are being used. By using stereoscopic aerial photographs and a sufficient number of ground control points (known 3D coordinates) the surface model can be calculated with high elevation accuracy (up to several centimeters, depending on the altitude, the type of the digital camera, the overlap rate of aerial photographs and the number of images). The same can be achieved, but less accurately, through the utilization of stereoscopic satellite images, like panchromatic and multispectral satellite imagery with elevation accuracy up to about 1,5m (Kaimaris & Patias, 2016) or images of interferometric synthetic aperture radar-IFSAR with elevation accuracy up to about 0,5m (Wei & Coyne, 2008). Besides those methodologies, the use of LiDAR or airborne laser scanning (ALS) allows for the calculation of the third dimension, the altitude, with very high accuracy up to about 0.1m (Hodgson & Bresnahan, 2004).

Digital processing of the geodata

The maximum height of each building was originally estimated (H_{max} , fig. 6). Specifically, the DSM raster file was converted to a vector file (shape file, in Erdas Imagine 2015[®]), and through the intersection of the polygon (shape file) of each building with the vector file of the DSM inside the used GIS software (the below procedures refer to the same software) the highest altitude was selected and maintained. To calculate the height of each building base (H_{min} , fig. 6) a 5m zone at each polygon building was created. After the intersection of the zone area with the DSM vector file the lowest elevation of each building was selected and maintained. Then the center-points of the buildings' polygons were created (as the visibility GIS tool only accepts points as input). The identification and maintenance of the buildings oriented from 290° to 320° followed. The buildings (and thus their center-points) that did not abide to the orientation limits, as well as buildings that host public services were excluded from the study. Specifically, from 3967 buildings in the study area 2463 buildings were finally studied.

It is known that the exit of each building is located on the terrace, which usually hosts the lift mechanism (Fig. 6). In several cases buildings roofs cover the above construction. In both cases (with or without a roof) these structures have a typical height of about 2.7m, while the top floor (like the other floors) each reaches a height of about 3.5m (total of $2.7 + 3.5 = 6.2\text{m}$ approx.). Therefore, to determine the viewing point from the penthouse of a man of a height of about 1.7m, the height of the building must be reduced by 4.5m ($6.2 - 1.7 = 4.5\text{m}$). The same applies, approximately, in the case of detached houses (one-storey, two-storey, etc., with a roof, as it is found in the study area). Thus, from the difference in the height of the building ($H_{\text{max}} - H_{\text{min}}$, Figure 6) 4.5m were removed to determine the altitude of the viewing point.

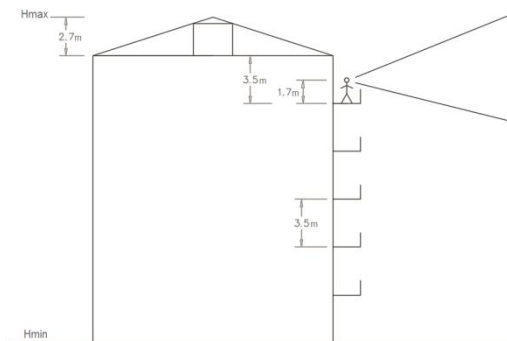
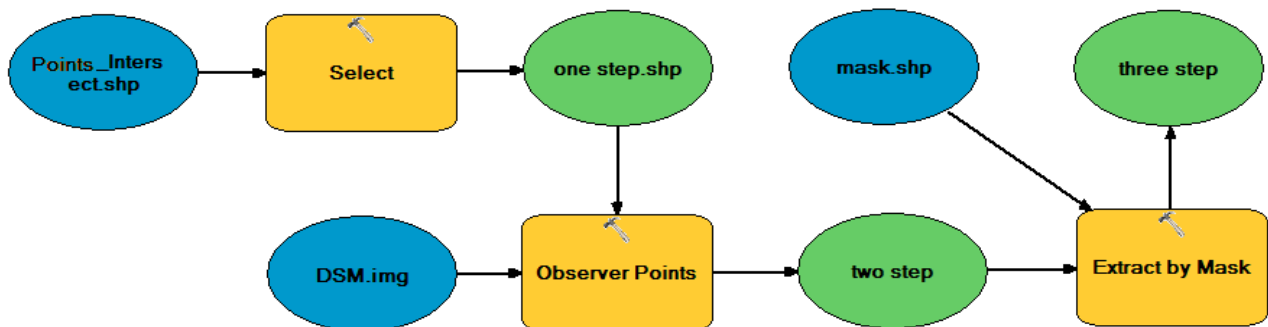


Figure 6. Building section and the position of the penthouse. Typical floor height 3.5m, 1.7m average human height, and 2.7m height of the exit on the terrace or roof height.

The use of the visibility tool (Observer Points) in GIS followed in the study. However, the tool can only simultaneously use (in each operation process) up to 15 center-points. That is the reason for which a model was created (Fig. 7) which allows, firstly, the manual selection of 15 center-points (by typing the value range) from the attribute table of the buildings (Select tool, fig. 7), secondly, the introduction of the mask (shapefile) of the sea area (Fig. 2) on the surface of which the percentage of visibility is investigated, and, thirdly, the insertion of the DSM of the study area in img image type. Upon activation of the model the visibility of the penthouses of the 15 selected buildings is the result of each operation process (three step, Fig. 7). The result is basically the number of pixel of the DSM image (img format, fig. 7) within the mask of the sea area (mask.shp, fig. 7) that a person of medium height of 1.7m can see from the penthouse. By connecting all visibility files (per 15 center-points), the attribute table of buildings is updated with the visibility of 2.463 buildings in the study area.

Figure 7. Model for the calculation of the visibility per 15 center-points.



Visibility visualization

The processing of the visibility of the study area buildings resulted in the creation of Figures 8 and 9. In Figure 10 examples of different visibility percentages for selected buildings are presented.

Figure 8. Visibility percentages from the penthouses of the study area buildings.

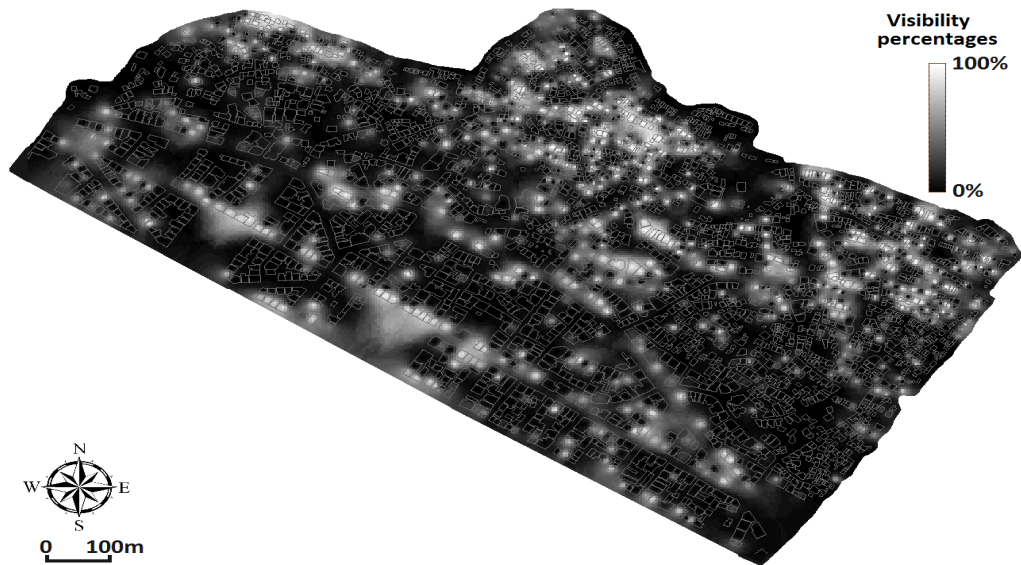


Figure 9. Visibility percentages from the penthouses of the study area buildings.



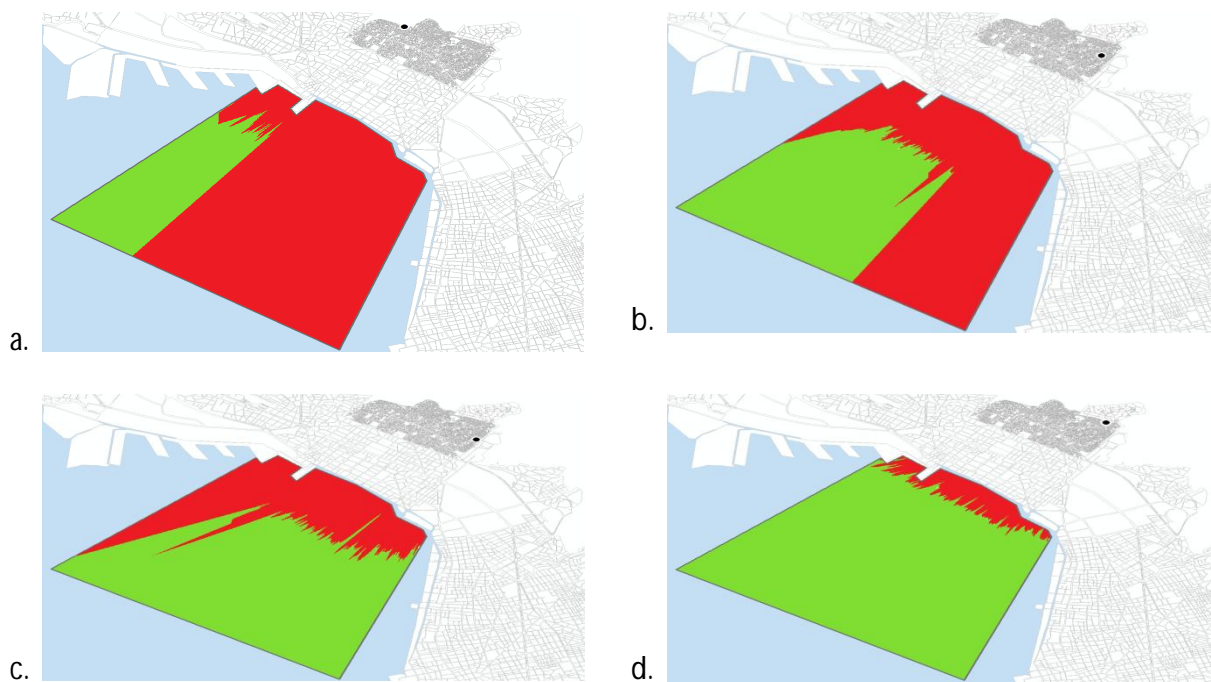


Figure 10. The percentage of visibility from the penthouse of random buildings, with percentages of: a. 25%, b. 50%, c. 75%, and d. 100%. Green area seen from the penthouse of the building (black circle point). With red the part of the sea that is not observed.

Conclusion

The determination of property values is a complex issue with subjective and objective factors influencing each case. After certain common characteristics (safe neighborhood, earthquake defenses etc.), the sense of openness from a property constitute a significant factor of value. The view or the visibility of a property affect its value up to an extent that depends on the percentage of openness. A property with partial view is valued less than a common property with unhindered view. This paper investigated the impact of different percentages of visibility to the sea on property values. Through the use of GIS, the derivation of view percentages was possible. It is important to mention that unlike other studies, GIS was used only for the calculation of the percentages and not for other factors (distance to the sea etc.). This was deliberately conducted so that the abilities and opportunities provided by GIS were highlighted. As far as values are concerned, the fact that no structural or neighborhood characteristics were used lead to more clear results as there were no problems of correlation or peer exclusion between factors affecting values. Future work of this paper is to establish a hedonic model to describe the relation of view and apartment values to an environment like today's economic crisis of Greece.

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