The perceptual value of individual trees as cityscape elements – a case study in Albertfalva, Budapest

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Abstract:

Trees are both popular and underappreciated elements of the urban landscape. They are often in the focus of conservation efforts and movements against overdevelopment. On the other hand, they are often overlooked elements of the urban landscape, frequently seen as a nuisance or source of conflicts. Historically, urban trees were considered rare and therefore special elements of the urban landscape, but with the mass plantation of trees and tree lines in urban areas in recent decades, the connection of people to individual trees has diminished.

In our research, we studied the role of individual trees in the urban image using a perception-based method. 73 volunteers were asked to visit a study area in Albertfalva, Budapest and choose the trees that they consider the most significant from an urban image standpoint. Afterwards, we analysed the results and mapped the individual trees that received the most votes in order to examine the characteristics that made them especially popular. Using multi-factor statistical analysis methods, we also studied whether the professional background of volunteers had a strong impact on their preferences in trees. The results show that certain trees are clearly objectively more important elements of the cityscape than others. Our analysis also confirms that their location and urban context are the stronger factors in their popularity than their taxon-based dendrological value. Furthermore, our results suggest that perception-based methods can be used for the selection of individual trees of special importance in a community- and participation-based way.

Introduction

Trees in urban areas are becoming an increasingly important topic of discussion. However, research on urban trees is mostly focused on the environmental benefits and other regulation ecosystem services. However, trees are also major components of the urban image and streetscape, and they have significant cultural ecosystem services as well. While in historic times, trees in urban centres were scarce – especially in public areas –, centuries of changes, the accumulation of trees from different eras, and especially the mass plantation waves of recent decades, have increased the number of urban trees to the point where it can be hard to distinguish between individual trees. On the other hand, some trees can gain individual importance through their history or cultural importance. From the point of view of urban image protection, the differentiation between trees is extremely important in order to assign maintenance priorities. However, selecting the individual trees that have the most significant impact on the surrounding urban landscape can be difficult using established tree evaluation methods.

In this paper, we present a case study in Albertfalva, Budapest, Hungary, which was designed to study the perception of trees as streetscape elements. The study area is a residential neighbourhood located in the Southwestern part of the Hungarian capital that has seen several distinct waves of tree plantation in the past century, and which therefore has a diverse vegetation that includes trees of various ages, taxa and condition. Using a perception-based method, volunteers identified the trees that they considered to be important elements of the urban image. The most important goals of our research is to identify the characteristics of individual trees that enhance their significance in the urban image, as well as determining whether the urban image-based value of trees can be considered a community judgment, or it is heavily influenced by professional background. In the end, our research aims to provide data that can be used in the creation of a method for evaluating the significance of individual trees in the urban image.

Background and Literature Review

Numerous tree evaluation methods have been published worldwide, and these have been extensively tested, studied and compared to each other (Watson 2002, Szaller 2013, Ponce-Donoso et al 2017). The existing methods take location and visual appeal into consideration in varying ways and to different extent. Certain methods (Flook 1996, AEPJP 2007, Randrup 2005) specifically take the visual aesthetics and cultural importance of individual trees into consideration, others calculate the value of trees using general zoning or urban planning categories (Szaller 2013, Radó 1999, Ferraris 1984, Fabbri 1989). Some methods (Helliwell 2008, CTLA 2000, Moore-Arthur 1992) include the location and spatial importance of trees as evaluation factors as well. However, the main goal of all widely used methods is to assign a specific – often monetary – value to individual trees. This makes them laborious and difficult to use to choose the most valuable trees of a larger or heavily vegetated area. Also, most methods use either a taxon-specific dendrological value or the nursery price of a young specimen of the same species, effectively tying the value of an individual tree to its taxon.

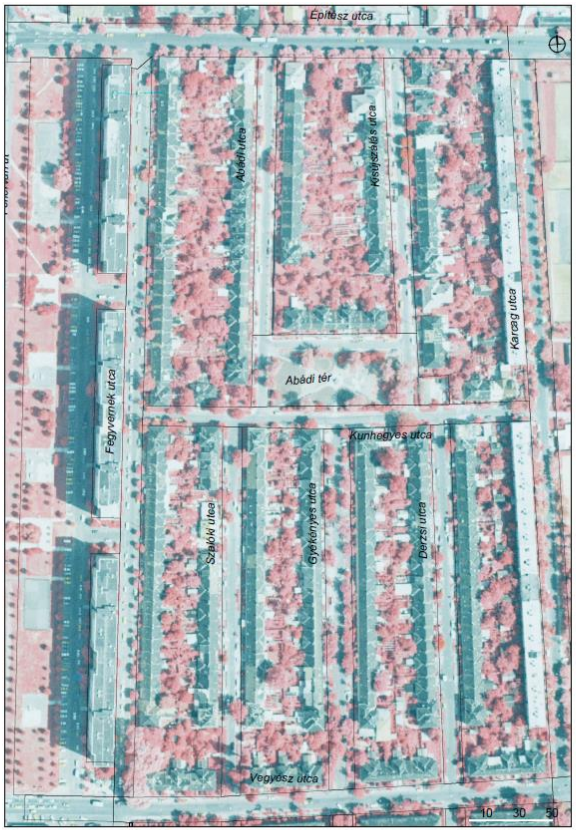
In recent years, Hungary introduced Urban Image Handbooks and local Decrees for the Protection of Urban Image into the urban planning toolkit of Hungarian municipalities. These new tools aimed towards the protection and management of the urban image can be applied to protect urban green elements as well, and several municipalities have already included trees in their list of object protected for their urban image value. However, in order to utilize these tools in an optimal way from the standpoint of urban trees, the creation of a method for selecting the most important individual trees is necessary. For this, we must understand the characteristics and factors that make certain trees stand out in an urban setting.

For our research, we have used a participation-based, perceptual approach. While there have been several studies on public opinion and perception of trees (Gestenberg-Hoffmann 2016, Garcia-Ventura et al. 2020) and green areas (Polat-Akay 2015), these generally use photographs. While the use of images makes research easy to conduct, pictures cannot completely show the surroundings, and therefore the urban context, of individual trees. In order to study the full visual impact of individual trees on the surrounding cityscape, we decided to conduct our survey in the field.

Our chosen study area is located in Albertfalva, in the 11th district of Budapest, Hungary. The architecture of the study area has two markedly different parts: the Eastern part was constructed as a neighbourhood for the workers of the National Social Security Institute, consisting of terraced houses and 2-storey apartment buildings, built between 1929 and 1931. The 10-storey prefabricated housing estate located on the Western side of the study area was built in the 1970s. Since the construction of the first buildings in the study area, urban trees appeared in several distinct waves. According to aerial photographs taken in 1944 (Figure 1), the first tree lines were placed at approximately the same time as buildings – by 1944, some tree lines had already started losing their uniformity. After World War 2, several tree lines were replanted, and street trees were added to streets that previously were lacking trees. By the early 1970s (Figure 2), practically all streets are more or less uniformly lined with trees. However, by this time, the oldest tree lines are already missing some individuals. After the construction of the prefabricated housing estate, the newly created park and green area next to it is also planted in a rather uniform way, using mostly linden trees (*Tilia* spp.).

Figure 1. The study area on an aerial photograph (1944) Source:URL1

Figure 2. The study area on an aerial photograph (1972) Source: fentrol.hu photo numbers 1972_0026_4867, 1972_0026_4868, 1972_0026_4926



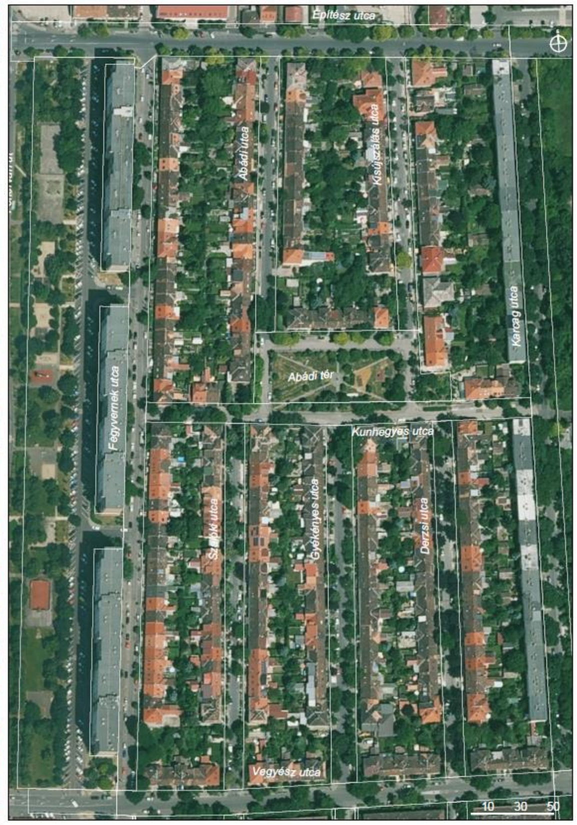


Figure 3. The study area on an aerial photograph (1992) Source: fentrol.hu, photo number 1992_0034_9530

Figure 4. The study area on an aerial photograph (2019) Purchased from fentrol.hu

In following decades, tree lines became less and less uniform. New trees were barely planted between the 1970s and the regime change in 1989. (Figure 3.) In the 1990s and in the 21st century, trees have started appearing individually – usually planted by residents to replace trees that had died out. This practice has not only significantly increased the total number of trees in the study area, but also made woody vegetation much more diverse than ever before (Figure 4.). The several, overlapping historical layers of urban tree plantations make the study area rather complex from an urban image standpoint. The age and condition of older individuals, combined with the challenges of modern urban tree management, make it especially important to select those specimens that have the most significant impact on the cityscape, before it becomes too late to preserve and protect them.

Method and Data

A total of 73 volunteers were asked to visit the study area. After they walked through and observed all streets within the area, they were asked to identify and photograph up to 10 individual trees that they considered to be the most impactful from a streetscape or cityscape viewpoint. All volunteers were given a map showing the boundaries of the study area, a spreadsheet for documenting the chosen trees and providing data regarding their personal characteristics (age, place of residence, gender and professional background), as well as a short letter with the instructions of the research. Volunteers were asked to choose individual trees should (instead of tree lines or tree groups, but their individual components could be chosen), to only consider trees that are visible from areas open to the public, and to disregard trees that are noticeable due to their poor condition or seasonal attraction (like flowers) as much as possible. Fieldwork was conducted between May 10 and June 27, 2021. The timeframe was chosen to minimize the impact of seasonal ornamental value. By this time, spring-blooming trees (ornamental cherries, crab-apples, etc.) had already finished flowering. Also, by early May and in June, all trees are already in full foliage, while the effects of the seasonal Summer drought (drying and discoloration of leaves) is not yet significant enough to change visual preferences.

During the fieldwork period, all trees standing on public property were also surveyed and evaluated using the most commonly used Hungarian tree assessment method, known as MFE-method (Szaller 2013). In the week following the conclusion of volunteer fieldwork, all trees located on private property that received any votes were also evaluated. During this period, we identified all trees taxonomically, measured their size (trunk diameter) and calculated their estimated age using the online application of the Hungarian Association of Arboriculturalists (Magyar Faápolók Egyesülete, URL2). The dendrological value of each tree species, which is a factor in the commonly used MFE evaluation method, was also determined (Szaller 2013).

38 volunteers had a professional background that involved trees, while 35 people had no expertise in the field. Participants submitted a total of 669 eligible votes for trees within the study area, spread across 192 different individual trees. 79 trees were chosen once, wile 42 received two votes – these choices can mostly be attributed to personal taste and preferences. On the other hand, 27 trees were chosen by seven or more volunteers (10% or more). In our research, we studied the most commonly chosen trees in order to determine the properties that make them stand out from their surroundings.

Additionally, we analysed data collected from participants and in the field as well. Using data analysis methods, we studied whether the professional background of volunteers had a significant influence on their choice. We also analysed if the dendrological value of trees had an impact on their importance in the streetscape. In order to reveal possible differences or similarities in data structure, PCoA (Principal Coordinates Analysis) ordinations were performed on the collected data on the properties of participants (professional background) and trees (dendrological value). In the analysis binary (presence-absence) data were used. For data processing, the Euclidean distance resemblance matrix was used. For computation we used the SYN-TAX 2000 program package (Podani 2001).

Results

Figure 5 shows the location of the trees chosen by at least 10% of participants. 13 out of the 27 specimens are located at a place of importance from a spatial standpoint: they are either standing on street corners or are situated in a way that makes them visible from relatively far away (elevated position, standing on the edge of a wide, open area).

Figure 5. Location and taxon of the 27 individual trees chosen by more than 10% of participants.

Other properties shared by a large number of often selected trees include being the tallest visible elements in the surrounding streetscape (aside from 10-storey housing blocks that are large enough to function as background rather than visually competing objects); having a marked visual contrast with neighbouring plants, either in colour or shape; and having a unique or bizarre appearance that differs significantly from the expected, generic tree-shape – such features include contorted branches, heavily tilted trunks and even visible scars. Table 1. shows the occurrence of the four mentioned properties for the 27 trees selected by most participants.

Table 1. Properties of trees with the most impact on the local urban image

Nr.	Taxon	Votes received	Tallest visual element in street	Location / Place of importance	Contrast	Unique or bizarre appearance
62	Acer platanoides 'Crimson King'	18		yes	color	
91	Morus alba	13	yes			yes
115	Morus alba	13		yes		
120	Acer platanoides	33	yes			
171	Tilia tomentosa	7		yes		
177	Prunus cerasifera f. atropurpurea	7				
185	Tilia tomentosa	14	yes		color	
225	Koelreuteria paniculata	9	yes		shape	
253	Acer campestre	8		yes		
254	Juglans regia	11	yes			
273	Acer platanoides 'Globosum'	11			shape	

298	Acer saccharinum	11	yes		color	
326	Ulmus minor	14	yes			yes
357	Salix alba	7			color	yes
395	Acer platanoides 'Crimson King'	7			color	
444	Koelreuteria paniculata	7				yes
468	Fraxinus pennsylvanica	9		yes		yes
487	Celtis occidentalis	8	yes	yes		yes
529	Catalpa bignonioides 'Nana'	13		yes		yes
568	Tilia tomentosa	12		yes		
573	Acer platanoides	8		yes		
639	Fraxinus angustifolia	7		yes		
686	Tilia tomentosa	7	yes	yes		
712	Tilia tomentosa	18		yes		
729	Platanus × hispanica	13		yes		
M1	Abies nordmanniana	8	yes		shape	
M2	Styphnolobium japonicum	11	yes			

Figure 6. shows the results of our analysis on the connection between the professional background and tree choices of participants.

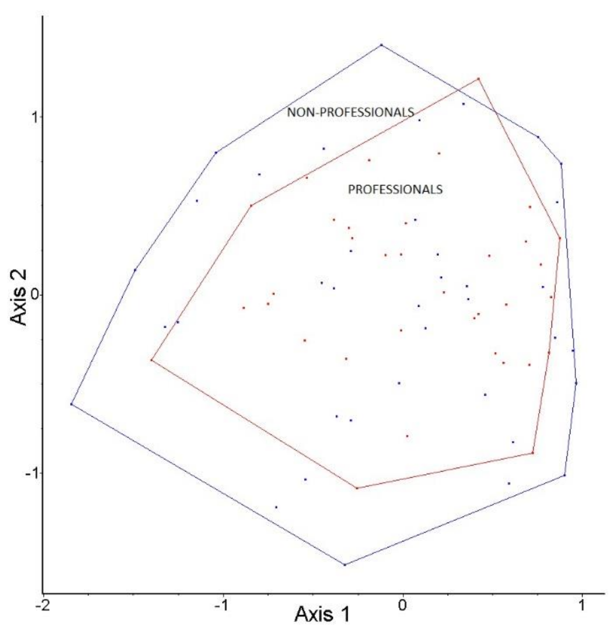


Figure 6. Partition (groups of professionals and non-professionals) superimposed on ordination (PCoA) for the participants as object data. Eigenvalues of the 1st and 2nd axes were 5.7% and 4.5%, respectively.

The partition superimposed on the PCoA ordination does not show any clear differences between the two groups of participants (professionals and non-professionals). It can therefore be stated that expert knowledge has no influence on the selection of individual trees. Figures 7 and 8 show the categorized dendrological values of all documented trees of the study area and the most commonly chosen 27 tree specimens, respectively. While the proportion of trees of average dendrological value is much larger in the overall tree population than among the most commonly selected individuals, the two figures show a generally similar spread in dendrological values.

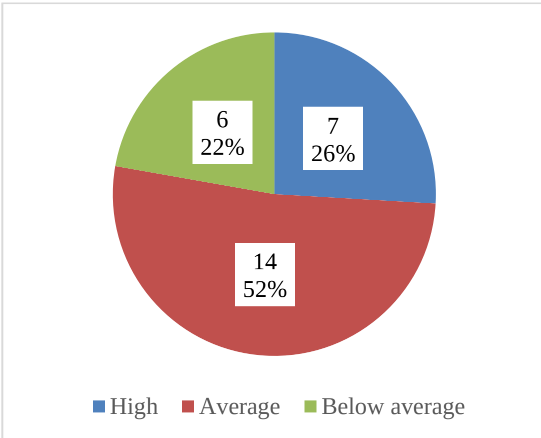


Figure 7. Proportion of dendrological values among all documented trees in the study area

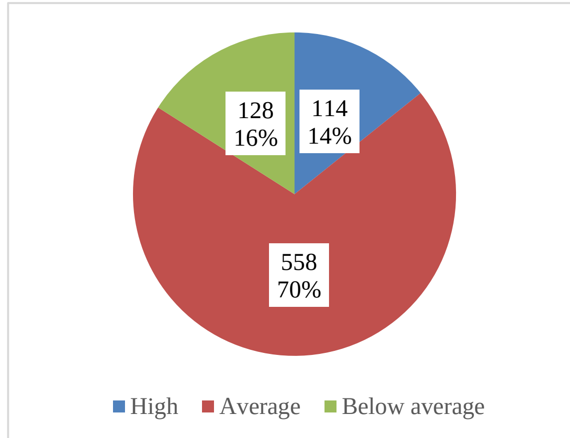


Figure 8. Proportion of dendrological values among the 27 specimens receiving at least 7 votes

Figure 9 shows the results of our multi-factor statistical analysis on trees with different dendrological values.

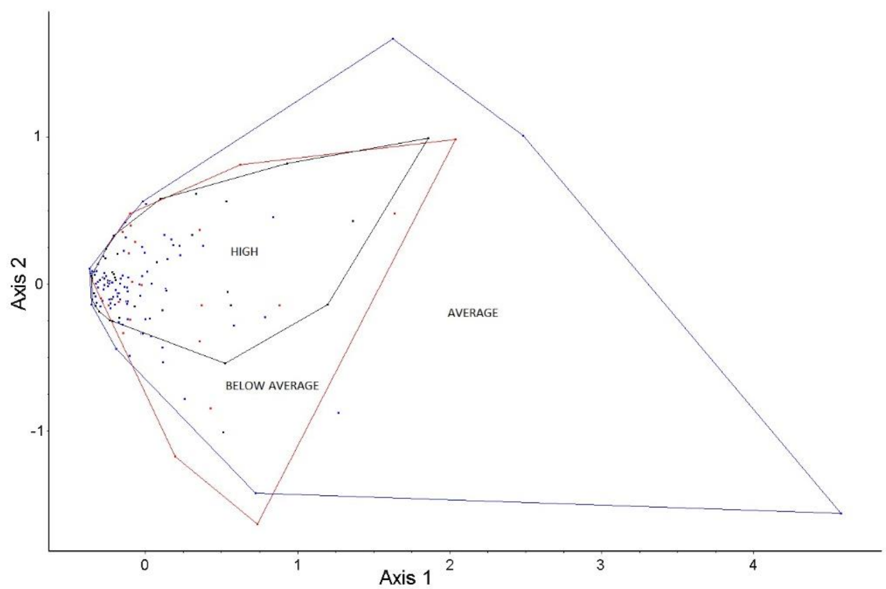


Figure 9: Partition (groups of dendrological values) superimposed on ordination (PCoA) for the tree as objects data. Groups refer to high, average and below average dendrological values, respectively. Eigenvalues of the 1st and 2nd axes were 9.7% and 4.2%, respectively.

Our results – the partition superimposed on the PCoA ordination shows no clear differences between the three groups of dendrological values (high, average and below average) – confirm that the taxon-related dendrological value of individual trees has no impact on the selection. In fact, the trees that received the three largest number of votes are all average in dendrological value.

Discussion and Conclusion

The results of our perception-based field survey show that the professional background of participants have no detectable impact on their choice regarding trees with the highest impact on the surrounding cityscape. This suggests that the importance of individual trees in the urban image can be considered to be a community decision, and therefore can be mapped and documented using community-based methods and can be carried out by non-professional participants.

Additionally, our results show that the taxon – and taxon-based dendrological value – of trees have very limited, if any, impact on their visual importance in the streetscape. We have, however, identified four factors – being located at a place of importance, being taller than any other visual element in its street, having a shape or colour that contrasts with its surroundings and having a bizarre or otherwise unique and unexpected appearance – that are characteristic of specimens selected by many participants. Our findings show that the efficient selection and protection of trees with high visual impact on the streetscape can be based on a new, perception-based participatory evaluation method.

Further studies are necessary to confirm and further pinpoint factors that might increase the importance of certain individual trees in the urban image. However, our study shows that it is possible to select such specimens even in the context of the increasing diversity of city trees, as well as new paradigms and challenges connected to climate change and urbanisation processes. Recognizing individual trees as important elements of the cityscape and understanding their cultural significance could promote sustainability in urban planning as well.

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