Uncovering mono-functional developments in a Seventeenth-century canal-zone block in the Canal District of Amsterdam World Heritage

Jolien Bruin1; Dave van den Berg1; Loes Veldpaus1; Ana Pereira Roders1
1 Eindhoven University of Technology, Department of the Built Environment, Eindhoven, the Netherlands

1. Introduction
This paper presents part of the results of a research focusing on the evolution of functions, determining its impact on the cultural significance of protected urban areas in general, and World Heritage (WH) properties in particular (van den Berg and Bruin, 2013). The research is part of a research program called “Outstanding Universal Value, World Heritage Cities and Sustainability” led by Eindhoven University of Technology (TU/e), the Netherlands, and the UNESCO World Heritage Centre, France. The local authorities in Amsterdam, namely the Central Borough of Amsterdam, the Amsterdam Bureau of Monuments (BMA) and their jointly established Amsterdam World Heritage Bureau (BWE), are the local partners in this research project.

The canal district of Amsterdam, which was inscribed on the WH list in 2010 (UNESCO, 2010), consists in large of four canals: Singel, Herengracht, Keizersgracht and Prinsengracht (Figure 1). The area that is subject to this research is the building block (F20), located within the core-zone of the UNESCO site and surrounded by the main canals Herengracht (north) and Keizersgracht (south), and the radial streets Leidsestraat (east) and Nieuwe Spiegelstraat (west).

In terms of sustainable urban development, it was assumed by the local partners to be more logical to match functions to specific buildings (with compatible typologies), instead of refurbishing buildings independently from the original function in order to adapt them to a random function (de Boer and Knol, 2012). This research aims to assist sustainable urban development by contributing a clear overview of the current functional situation and its development in recent history. It aims to create this overview by unveiling the cur-
rent state of integrity of the functional mix of one of the building blocks of the Amsterdam canal ring area.

1.1. UNESCO and World Heritage Cities
WH Cities, like other cities, need to keep evolving in order to meet the needs of their current and future communities. This evolution often requires urban (re)development. The challenge lies in finding development solutions that comply with the sites community as well as its protection needs. The management of historic urban landscapes, is slowly shifting from an object-based approach to a landscape-based approach [Veldpaus et al, 2013], strengthened by the adoption of the UNESCO Recommendation on the Historic Urban Landscape (HUL) in 2011. The Historic Urban Landscape stretches the definition of cultural heritage to include a wide – nearly unlimited – range of tangible and intangible attributes, without a specific geographic demarcation. The main aim of HUL is to provide guidance for sustainable urban (heritage) management, by means of a comprehensive and integrated approach for the identification, assessment, conservation and management of the significance of urban landscapes within an overall sustainable development framework [Veldpaus and Pereira Roders, 2013].

1.2. World Heritage in the Netherlands and Amsterdam
The Amsterdam canal zone is the latest Dutch heritage property inscribed on the WH list. The property is part of the national conservation area of the inner city of Amsterdam, which is subject to protection by the 1988 Monuments Act [Ministry of Cultural Heritage, 2012]. The management of the property is also embedded into the local planning policies, both spatial and aesthetical, which strive to conserve and protect both international and national significance [City of Amsterdam, 2013, p.XX]. When the canal-zone of Amsterdam was built in the 17th century, a strict set of rules determined what functions could be settled on which canals and building blocks: the Herengracht and the Keizersgracht were the exclusive domain of housing, whereas businesses, as well as houses, were allowed on the Prinsengracht [Abrahamse, 2010, p.58; Hoffschulte, 2011, p.50]. The latest Inner City Trend Report states that the ratio between residents and employees is an “important measure for functional mix” and it is optimistic about the current ratio, respectively 48% residents versus 52% employees [Hoffschulte, 2011, p.51]. The report states that the ideal ratio is 50:50, and thus, that the current situation is, according to their data, healthy in terms of liveliness and functional mix. The ‘mixed use of functions along the canals’ is recognized as culturally significant by national and international communities, when it was defined as one of the attributes of OUV [Kingdom of the Netherlands, 2009, p.71 and p.95; ICOMOS, 2010, p.260]. The Nomination File specifically mentions the potential threat of mono-functional-ity with regard to areas with a high concentration of hotels [Kingdom of the Netherlands, 2009, p.214]. Recent research focusing on the effects of building consolidations in Amsterdam noted that “the functional integrity of the property in general remained stable as a living urban environment with housing and
commercial functions, but in terms of individual buildings there is a reduced occurrence of mixed uses and a trend towards mono-functionality" [Claus and Swart, 2012, p.70]. This concern is shared with the officials at the Central Borough of Amsterdam, though they lack evidence to prove their suspicions [de Boer and Knol, 2012].

2. Methodology

This research has chosen to study the functional mix quantitatively, both in area size and unit size, and by geographical distribution. Six moments in time (1959, 1969, 1979, 1994, 2002 and 2010) were chosen to analyze the evolution of the functional mix so that possible trends in the sample block could be disclosed.

Where the Inner City Trend Report states the ratio of residents to employees as an important measure for functional mix [Hofschulte, 2011, p.51], this research takes the two most frequently occurring functions, namely housing and offices [van den Berg and Bruin, 2013], and looks at the ratio between these two functions on the studied variables.

This research makes use of the hard-copy Building Block Documentation (BBD) as a dataset, available for the entire inner city conservation area of Amsterdam, in which the UNESCO core- and buffer-zones are located. The BBD is comprised of a set of maps which show the function of each building per floor, as well as, the functional connections between floors and buildings thus showing which floors are combined to form functional units, e.g. the actual house or office (Central Borough of Amsterdam, 1959:2010). As such, a unit is referred to as a single house or single office and may stretch out over several floors and/ or buildings. The research by Van den Berg and Bruin (2013) used the same categorization of functions as the BBD, namely: offices, housing, retail, catering/ entertainment industry, atelier/ factory/ workshop, warehouse/ storage, parking/ traffic, education, under construction and vacant. However, it took ‘hotels’ as a separate category, whereas in the BBD it is part of the ‘housing’ category. This is done to test the concerns about the development of hotels.

The information collected from the hard-copy BBD was structured into a database, which served as input for a Geographic Information System (GIS). This process enabled the quick calculation of the number of floors per function and the square meters per function and it was a means to graphically represent the database into maps. It was chosen for allowing the easy comparison between years, buildings, floors and functions. The open source program QGIS was used to create the graphical representations of the data and to calculate the area sizes of the individual plots; the database itself was created in FilemakerPro12. The database and the area sizes from QGIS were later combined in Microsoft Excel to create graphs that show the development of functions since 1959.

This research looked at the functional mix of offices and housing on multiple levels. Numerically, the functional mix of the block, as well as, the functional mix within the streets is analyzed through the distribution of the housing/office function. On the level of the block, it is determined what percentage of all
housing/ office area size is located in each street. On the level of the street, it is determined what percentage of the area size of the street is occupied by housing/office, as well as, what percentage of buildings located in that street are occupied by a housing/office function, in order to understand if the function is spread out over many buildings, or clustered within a few. Moreover, this research looks at the evolution of the spread of housing/office functions by determining its geographical distribution in maps. Lastly, the grain size of the functional structure is calculated to understand if this is an indicator for functional mix. This is done by two components: the unit size in square meters and the average number of floors occupied by one function in a building. When calculating the last component, only buildings that actually incorporate the function (either office or housing) are included in the research results.

3. Results
This paper focuses on the evolution of office and housing functions on the Keizersgracht and Herengracht (Fig.1); these streets represent 83% of the total area size of the building block. Furthermore, in 2010 95% of all offices are located on the two canals; in 1959 this was 80%. Likewise, in 2010 81% of all housing is located on the two canals; in 1959 this was 77%. The Leidsestraat (Fig.1) represents 9% of the area size of the building block, and did not exhibit strong trends when it came to these functions. The Nieuwe Spiegelstraat (Fig.1), showed a strong decline of office functions and a strong increase of housing functions, but represents only 8% of the total area size of the building block [Van den Berg and Bruin, 2013]. These two streets are not taken into account in this paper. The presented graphs include a polynomial trend line, the markers show the actual data values. The last section of the graph is a prediction based on the trend line.

3.1. Functional mix in numbers
Most of the housing area (m²) of the sample block is located on the Keizersgracht (Figure 2). The amount increased over the years from 54% in 1959 to 70% in 2010. The share of housing area on the Herengracht dropped between 1959 and 1979 from 23% to 11% and remained stable since. The graph shows

Fig.2 - Functional mix of the block F20, showing what percentage (of m²) of all housing (dot, dashed)/ office (triangle, continuous) in the F20 building block is located on the canals (Amsterdam, the Netherlands)
that most office area of the building block is located on the Herengracht. The amount increased over the years to 71% in 2010. The share of office area on the Keizersgracht fluctuates around 25%, reaching its lowest share in 2002 (22%) and 2010 (24%).

Fig.3 - Functional mix of the canals in the F20 building block, showing what percentage of the m2 of a canal (black) is occupied by housing (dot, dashed)/office (triangle, continuous); and what percentage of buildings within the canal (grey) are occupied by a housing (circle, dashed)/office (open triangle, continuous) function (Amsterdam, the Netherlands)

The functional mix within the canals was analyzed with by variables (Figure 3):

1) The black lines show what percentage of the area size (m2) of a street is occupied by housing/offices. On the Keizersgracht, the share of offices grew up until 1994 (to 42%), and then declined in 2010 (to %), showing an overall downward trend. The share of houses shows, with the exception of 1994, a strong increase in 2010 (to 64%). The functional balance on the Herengracht is significantly different from the one at the Keizersgracht. On the Herengracht the share of offices remained consistently high up until 2002 (around 70%), then dropped slightly in 2010 (to 63%). The percentage of housing on the Herengracht remained limited over the years: no more than 10%, with a slight increase in 2002 (to 7%) and in 2010 (9%).

2) The grey lines show what is the percentage of the number of buildings of a canal occupied by housing/offices. The amount of office buildings on the Keizersgracht decreased steadily in 1959 from 53% to 33% in 2010. The amount of housing buildings increased from 42% in 1959, to 70% in 2010. The amount of office buildings on the Herengracht remained consistent around 75%; the amount of housing buildings decreased up until 1994 and then increased again to 25% in 2010. The Keizersgracht exhibits stronger fluctuations in both functions than the Herengracht. The share of office buildings declines on both canals, but much more strongly on the Keizersgracht. The share of housing buildings increases on both canals, but very little on the Herengracht and very much on the Keizersgracht. Despite this, the Herengracht shows the largest difference between the two functions, even though the gap decreased between 1994 and 2010 (from 73% to 54%). On the Keizersgracht there
used to be more office than housing buildings, but between 1994 and 2002 this balance flipped and the gap between the two functions became 42% in 2010. Concretely, the graph shows that over time office/housing functions are shifting location. Office buildings tend to move to the Herengracht. Instead, housing buildings tend to move to the Keizersgracht.

3.2. Geographic distribution of functions

The amount of housing buildings on the Keizersgracht increased significantly (see figure 4). At the same time, the amount of office buildings declined. In 2010, the office buildings are clustered and located near the corners. The amount of mixed buildings decreased as well (both an office and a housing function). In 2010, 4 out of 7 mixed buildings are located close to the corners. Figure 2 shows that on the Herengracht the amount of mixed buildings decreased significantly from 9 in 1959 to only 1 in 2010. The only housing building in 2010 is located near the corner, which was also the case in 2002 (3 buildings). Though the Herengracht has been an ‘office-street’ during the entire timeframe of this research, this has become more exclusive after 1959, when housing started to disappear. In 1959, the Keizersgracht was a very functionally mixed street; in 2010, this street shows a high amount of housing buildings. Office buildings again tend to be located at the corners.

3.3 Size of the functional mesh (unit size)

Fig. 5 Size of the functional mesh in average unit size (left) and average no. of floors (right) of the F20 block (Amsterdam, the Netherlands)
Fig.5 shows that the average unit size of offices has increased on both canals and peaked between 1979 and 1994. The increase was stronger on the Herengracht, with an average unit size of 2898 m² in 1994. On the Keizersgracht, offices are smaller; in 1979 the average unit size was the highest at 951 m². On both the Herengracht and the Keizersgracht office size has decreased in 2010 to 1535 m² and 295 m² respectively. The average size of a house increases over the years on the Herengracht to 725 m². This is probably due to the fact that there are only a few houses on the Herengracht, but that they are in fact very large. On the Keizersgracht the average size of a house decreases from 155 m² in 1994 to 116 m² in 1979, peaks in 1994 with 303 m², drops in 2002 to 163 m² and then increases to 188 m² in 2010.

The average number of floors occupied per function increased for both canals and both functions. The increase is felt stronger at the housing buildings on the Keizersgracht (from 1.8 in 1959 to 4.2 in 2010), followed by housing buildings on the Herengracht (from 0.8 in 1959 to 2.3 in 2010) and office buildings on the Herengracht (from 3.1 in 1959 to 4.2 in 2010). Offices on the Keizersgracht show the smallest increase (from 2 in 1959 to 2.8 in 2010). In terms of both average size and number of floors, the functional mesh of office and housing buildings has decreased for both canals. On the Herengracht, units are considerably larger than on the Keizersgracht. On the Keizersgracht the graph show a strong increase on the average number of floors per housing building, which could also be related to the increase of housing buildings [Van den Berg and Bruin, 2013].

4. Conclusion and Discussion

This research has proven the suspected dynamics of functional developments in the canal district of Amsterdam. The F20 block is very dynamic in terms of functions, but such developments are not necessarily related to hotels, as feared by the local stakeholders and referenced in the Nomination File. This case study evidences the role of functions such as offices and housing in the trend towards mono-functionality. In fact, the building block F20 contained only one hotel, in 2002.

Considering functional developments in housing and office buildings, the Keizersgracht is more dynamic than the Herengracht. The size of the grain of both functions has decreased for both canals because the size of individual units increased. Change of function in one unit, will thus have a bigger impact on the ratio. Throughout the investigated period, the Herengracht always showed an emphasis on offices, but this became more strong, while the share of houses dropped. The Keizersgracht used to be more mixed, but has since 2002 strongly profiled itself as a ‘housing-street’. In general, it can be confirmed that both streets have become more mono-functional. The original buildings on the Herengracht are ‘double houses’, which are two to three times larger than the ‘city houses’ (stadshuizen) on the Keizersgracht. This may explain why companies tend to favor these buildings, while the original city house typology of the Keizersgracht remains better fitted for housing. Previous research hints that the trend of mono-functionality is negatively impacting the typology
of both types of buildings, considering they have to undergo (mostly internal) changes due to the growth of housing and office functions and their needs in amenities and facilities [van den Berg and Bruin, 2013, Swart and Claus, 2012]. More research is needed to reveal the impact of mono-functional developments on tangible attributes such as typology in detail. This research shows that offices now dominate the Herengracht, which in its original 17th century plan only allowed for houses, and that this tendency has become more prevalent over the past 50 years.

The BBD adapted a different method for documenting the functions in 2010, that dataset did not include maps like the datasets of previous years. Due to this changed method the data was increasingly more ambiguous and could not be compared per floor, only per building. Furthermore, the CAD map currently used by the municipality is less detailed than the maps used for the original BBD. This difference of the baseline data can obscure changes, or downplay the significance of changes as it gives an incomplete overview of the current situation in terms of buildings and annexes. Without the BBD, this research would not have been possible. Unfortunately, this monitoring practice and the consistent collection of information has been discontinued. The municipality has indicated there are no plans to reactivate this monitoring practice in the future. As this research evidences that the mono-functional developments are negatively influencing the integrity of the intangible attribute ‘functional mix’ of the canal district of Amsterdam, and hints that this development affects other attributes as well, the researchers recommend that the BBD should be reinstated, if possible in cooperation with academic institutions, so that changes can be closely monitored and the OUV of the canal-zone can be adequately monitored and protected.

References
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Abstract

World Heritage Cities, like other cities, need to keep evolving in order to meet the needs of their current and future communities. This evolution often requires urban (re)development. The challenge lies in finding development solutions that comply both with the sites community as well as with protection needs for current and future generations, including the safeguarding of its cultural significance of Outstanding Universal Value.

Attributes of cultural significance can be tangible and intangible. The aim of this paper is to identify and discuss the protection of the intangible attribute ‘functional mix’, through the analysis of the evolution of functions. The trend towards mono-functionality in protected urban areas is further discussed. The canal district of Amsterdam, inscribed on the World Heritage List since 2010, is taken as case study as it has ‘functional mix’ as one of its intangible attributes of Outstanding Universal Value. The analysis considers a timespan of fifty years and focuses on one building block located inside the protected urban area. The changes in this building block are assessed, quantitatively, both in terms of area size distribution and unit size, as well as, geographically. The impact of these changes on the integrity of the building block is assessed. Results show two types of mono-functional trends, considering housing and office functions on two different streets. The research indicates that the current functional developments have a negative impact on the integrity of the functional mix; also, in relation to previous research, there is reason to believe that the functional changes negatively impact more tangible attributes such as typology and morphology.