The Perception of Central London by Night

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Introduction

Several studies (Downs, 1977; Golledge, 1999; Lynch, 1960; NATO, 1987) suggest that the legibility of a city and the ability of successfully finding the way rely in memorizing and recognizing certain visual patterns, or urban elements. In his work, Lynch (1960) isolated five distinct elements which act as reference points to read and have a sense of orientation in an urban environment.

Landmarks are considered (Downs 1973, 1977; Golledge R. G., 1999; Lynch, 1960) to be a fundamental component of the mental representation of a known environment, or cognitive maps. Spatial knowledge and efficient navigation rely on detecting and recognizing landmarks, because these act as references that enable to travel from one point to another. A traveller can therefore follow a sequence of landmarks and be able to make choices at decision points. Landmarks can also help to organize large scale spaces, and may provide references with which to calibrate distances and directions (Sadeghian & Kantardzic 2008).

A landmark is characterized for being prominent and attracting attention. Characteristics that contribute to the visual saliency or singularity of an object include having a sharp contrast with the surroundings and having memorable or unique features (Lynch, 1960; Sadeghian & Kantardzic, 2008). Visual contrast may be achieved through a difference in shape, colour or luminance. But, according to Sorrows & Hirtle (1999), a landmark may also be acknowledged due to its underlying meaning, or structural salience.

However, elements visually salient under natural light may not be seen as landmarks at night, where lighting conditions are necessarily different. Artificial light, or its absence, may reduce an object's visual saliency in different ways. It may break its luminance or colour contrast with the background, for example if it is dimly lit or lit by a poor colour rendering source, or with a colour similar to the surrounding environment. Additionally, the shape of an element may also be transformed through lighting, thus modifying its conspicuity, for example if the element is only partially lit.

Research on urban legibility, has been mostly developed considering only day lighting conditions. However, as described, objects and environments can be quite different during the day and night-time. In fact, elements acknowledged as landmarks during the day may not be recognized as such during the night, and new landmarks may emerge, as studies by Yuktadatta (2002) and Winters, Raubal, & al. (2004) have shown. Thus, it can be deduced that artificial lighting transforms the appearance and perception of the cities, and may influence its legibility and way finding.

The main objective of this paper is to evaluate how the perception of the most recognizable elements of a city can be modified during the night. It will be hypothesized that the most recognizable landmarks of a city may lose visibility at night, and perceptual hierarchies may become distorted.

The exercise follows a methodology similar to that developed by Kevin Lynch (1960), applied to London's city centre, with an added night-time dimension and a luminance pattern assessment.

It is expected that the results may contribute to complete Lynch's findings and to better understand the role of lighting in urban perception and legibility.

This study is part of a larger research project, involving the analysis of other cities and other stages of Lynch's methodology (1960). It is being replicated in Lisbon, a city

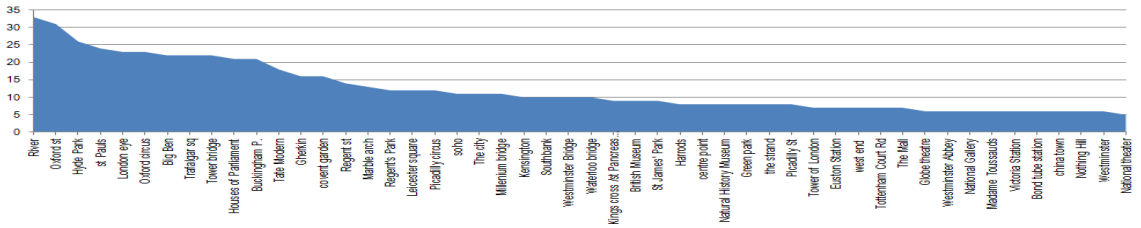

Fig. 1: The fifty most distinctive elements of London in decreasing order

with a different culture, light, morphology, urban shape and architecture. In the long term, the comparison between both cities' results should provide interesting clues, about the effect of artificial and natural light in the perception of similar urban elements, located in different contexts.

Methodology

The experiment comprised three stages, partially following Lynch's methodology.

In the first stage, thirty volunteers were questioned individually, in a closed room. Subjects were all residents in London, aged between 20 and 65 years old. An equal number of males and females were interviewed.

Among other questions, people were asked to draw a map of what they considered to be London's centre and its main elements. They were also asked to name and describe what they thought were the most distinctive and recognizable elements of the city centre. Afterwards, they tried to explain which characteristics made these elements distinctive.

The results of the interviews provided one hundred and sixty eight distinctive elements, which could be classified under Lynch's nomenclature as *landmarks, nodes, paths, edges* and *districts*. This number resulted from the account of elements drawn and described as distinctive. The sum of the total of times these were mentioned and drawn allowed them to be ranked in a certain order. The highly ranked element was the river Thames, which was mentioned and drawn 33 times. There were dozens of elements which were only mentioned or drawn once, making them the lower ranked elements. Only the first fifty highly ranked elements were considered for the next stages of the study.

In stage two, each element was photographed in agreement to what the subjects described as being its most recognizable features. Consequently, for example, Hyde Park was pictured from an angle which included the lake and the horse track.

Two pictures were taken for each element: One during the day and another during the night. Both were taken exactly from the same position. Additionally, luminance pattern was measured in order to later have an objective assessment of the luminous environment.

The third and final phase of the experiment involved presenting subjects with the photographs in an interview, following again Lynch's methodology. This group was composed by volunteers who declared having a good knowledge of central London, half of which had participated in the first part of the experiment. The main differences to the methodology described in "The image of the city" is that the city is additionally portrayed at night, and that the photographs only represent fifty carefully selected places, instead of systematically covering the entire city.

The interview consisted in presenting London's day-time photographs to fifteen subjects, and the night-time pictures to a different group of fifteen people. Two photographs from Lisbon were inserted in each collection as a control. The interviews were performed in a closed room, individually, and consisted of three tasks. First, the individual was asked to classify the pictures in whatever groups seemed natural. Secondly he was asked to identify as many images he could and to describe which clues he used to do so. Next, he was asked to

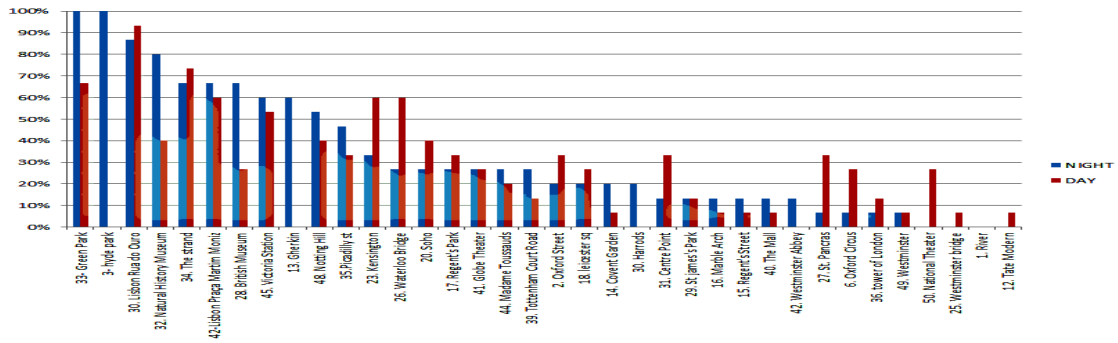

Fig. 2: Graphic representing the day and night-time percentage of unidentified and misidentified elements.

display the photographs in a large table as if he was placing them in the proper position in a large map of the city. Finally, he was presented with either the day or night-time photograph version of those elements he was not able to recognize.

Results

The analysis of the data provided by the experiment consisted in appraising the level of recognition of each element for day and night-time responses. It also comprised comparing the features described as being the most significant clues that enabled the recognition of each element. Finally it entailed examining the order in which these clues were described.

The recognisability of each element was assessed by evaluating which was the main element recognized in the photograph, the number of times the element was correctly identified and the level of certainty of this identification, that is, if subjects were sure or unsure of their answers.

The results showed that the highly ranked elements were also the most recognizable elements during the day, but not necessarily during the night. Oxford Circus, was however an exception. Ranked as the sixth most distinctive element of London, its day-time image was expected to be recognized by all participants. However, in day interviews 27% participants did not recognize it, against 7% in its night version. This result seems to be related to the perception of the existing buildings' curved shape, which was found to be one of Oxford Circus' most recognizable features. The curved shape is more evident at night than day due to the high luminance contrast between the top edge of the buildings and its background, almost non-existent under day light.

As expected, night environments with low luminance contrast became almost unrecognizable in the night. Hyde Park, which was considered the third most distinctive element of London, was recognized by all subjects, but became totally unrecognizable at night. A quarter of the inquired stated that the element in the picture was the river, after perceiving reflected lights on a body of water (the serpentine lake). The Gherkin, mostly recognized due to its shape, was always correctly identified under day lighting, but became imperceptible to almost all participants faced with its night image. Those working in the City were the only ones able to identify it, even if unconfidently, by noticing the red aircraft warning lights that line the building. Additionally, the main day--time recognition clues for the City of London were both the Gherkin and Saint Paul's Cathedral, but at night, subjects failed to acknowledge any other elements apart from the Cathedral.

There were elements which were consistently confused with others at night. It was the case of the Natural History and the British Museums, respectively confused with the National Gallery and the Houses of Parliament or Westminster Abbey. The British Museum and the National Gallery main recognizable features are similar, having both an exterior portico. The main differentiator factor stated by subjects after being faced with the day version of the photograph was the fact that the British Museum has a recessed façade, which

appeared flat under artificial lighting. Additionally, the space in front of the building became too dark to identify.

Sixty per cent of the participants confused the night-time photograph of the Natural History Museum with the Houses of Parliament or Westminster Abbey. The main reasons for this result seem to be related to the similar architecture style between the two buildings, and to the colour appearance of the Museum's façade. The façade was described as white and blue during the day, but yellow at night. Being lit by RGB LEDs, tuned to white, it is possible that the colour rendering may be affecting perception.

Another interesting difference between day and night interviews was the order in which the recognition clues were described, suggesting that perceptual hierarchies may be transformed under artificial lighting. For example, when observing the day-time photograph of Tate Modern, which included the Millennium Bridge, subjects recognized first the art museum, due to its distinctive chimney, and secondly the bridge. However, in the nigh-time photograph, the unlit chimney became invisible. As a consequence, the primary element the participants recognized was the brightly lit Millennium Bridge, and then assumed that the almost unlit building in front had to be Tate Modern.

The Waterloo Bridge, which was recognized by less than half the participants during the day, was recognized by more than seventy per cent subjects at night, mainly due to the unusual pink colour and brightness of the National Theatre façade, located next to it. The National Theatre was the primary element recognized at night, after which the bridge would be identified, inverting the day-time hierarchy.

Expectation also played an interesting role. Places expected to be filled with people, such as Covent Garden or Soho were less recognized when presented empty, such as in Soho's day-time image. Some subjects who confused the Natural History Museum with the Houses of Parliament pointed Big Ben and a statue, which did not exist, because they expected to see it near the Parliament. Others found difficult to recognize the Tower of London because they expected to see Tower Bridge next to it.

The importance of distant lit landmarks seems to gain importance at night, to provide geographic orientation. Although most of the parks are in almost complete darkness at night, the existence of distant brightly lit landmarks, such as the BT Tower and Centre Point in Regent's Park, and Victoria Memorial in St James's Park, enabled these parks recognition.

Fig. 3: Images of Saint Pancras Station. From the left to right: day-time image, night-time image and luminance pattern image generated by imagelum software from measurements collected in the field.

Conclusions

The study confirmed that luminance and colour contrast affect the way highly recognizable objects are perceived at night. It suggests that it may enhance, create new landmarks or "erase" them. Also, the transformations introduced by lighting in an object's shape and colour appearance may help or compromise its correct identification, and expectations may facilitate or hamper recognition. Distant lit landmarks, which may not be recognized as such during the day, gain particular importance at night, for recognizing and geographically positioning low luminance environments.

In conclusion, the experiment showed that the image and perceptual hierarchies of some of London's main landmarks becomes transformed at night and not always in a positive way. As a consequence subjects were less able to place them in their correct geographic position, suggesting cognitive mapping may also be affected at night. However, further investigation is needed to better evaluate the consequences on legibility and orientation in the city.

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