The cognition of space in outdoor context: Notes from an urban spacescape experimentation

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Abstract

Spatial behaviours often shape spacescapes, but because of dynamic complexity they are hard to be simulated in AI-based environments. Thus, degrees of uncertainty often emerge in describing spaces, when trying to give shared significance to structural, fundamental, peculiar spacescape qualities.
This paper explores space ontologies built by human agents. Students of the Technical University of Bari have been invited to explore an urban commercial street using app features of personal smartphones. Relevant results achieved in the context of spatial cognition were then analysed and discussed for environment planning and management.

Keywords

Spatial behaviour, Spacescape, Urban planning.

Introduction

The so-called spacescapes have been studied by many scholars over time (Golledge, 1998; Lloyd, 2009; Lynch,

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1960). Both landscapes and townscapes are knowledge-intensive entities that humans adapt for their life. Because of their dynamic complexity, spatial behaviours are hard to be simulated in AI-based environments. Therefore, a question arises about the basic features, or 'fundamentals', of spacescapes by agents who live in and move through them. In fact, from one hand, common sense claims that well designed space architectures make space more meaningful for humans than amorphous spaces. Conversely, the drama of social marginality in cities also depends on the abundance of landmarks and symbols, often inappropriate and alienating to poor people.

Therefore, a degree of uncertainty often emerges in describing spaces, when trying to give shared significance to spacescape structural, fundamental, peculiar qualities (Goodman, 1951). This sort of ontological representation of space is essential for artificial intelligence and robotics, because of the inherent need of fine-tuning the characterization of space in planning automatic navigation. As there is circularity between AI and cognitive science, it is evident that developing robotic devices may in turn increase knowledge on human behaviours in space. Therefore, space imaging can be of great interest in strategic spatial planning, too, because it enhances the representation of the structural, invariant, resilient characters of the environment, for the development and management of human spaces.

The present paper looks at space ontology as made by human agents. In doing this, it follows a spatial cognitive approach drawn on an experimental urban layout. In particular, students of the Spatial Planning course in the Technical University of Bari (Italy) have been invited to explore a commercial street of the urban center of Bari. In order to develop this task, they were asked to take photos of significant places (according to their sensibility) and take notes on sensations and perceptions along the street, as well

as register their path by using an automatic route-log software. Data were collected using app features of personal smartphones. After this introduction, the second chapter deals with research background and aims, the third chapter describes the experimentation layout, the fourth chapter carries out data analysis and discusses relevant results achieved in the context of spatial cognition. Some final remarks are therefore developed, extending the outcomes with particular reference to broader perspectives of complex environment planning and management.

Research background

Visitors, explorers, pedestrians spontaneously use all their senses to immerse themselves in the urban space experience. It implies the perception and recognition of some particular elements available in the surrounding environment.

The study of the spatial cognition using a photographic tool is aimed to explore and possibly understand what are the fundamental elements of urban space.

In fact, the visual experience often imprints in people the first impression of space (Rashid, 2012). This is even more interesting in the particular case of historic urban spaces, which are rich with architectural details.

The experimentation is mainly aimed at assessing:

(i) whether, when and why the pedestrians' attention is captured by significant features of the urban environment. Features are intended as significant when useful to accomplish a navigation task and/or when able of capturing the pedestrians' attentions due to their own characteristics. Knowing what scenes and elements are significant helps us understand people spatial experience.

(ii) if favourite spacescapes emerge from the quantitative analysis of (the) photo-taking locations.

The use of on-site experiment is oriented to collect measurable data in order to extract qualitative information about the urban context. In fact, we assume that features frequently taken may represent significant elements.
The next step could be the analysis of both collected pictures and preferred photo-taking locations in order to understand if and how the elements of the urban space could influence pedestrians explorative behaviour, i.e. their idea about space and their feelings during the experimentation.

Description of the experimentation

Almost 200 individuals, ranging from 20 to 26 years old, took part in experiment. They were recruited among the students of the Technical University of Bari. The experiment was carried out individually.

Figure 1 – The experimentation layout.

The study area is located in the city centre of Bari (Italy). The central area offers many services, offices and shops and it is usual to bump into public performances and recreational events.
The pathway runs between the station square and passes through the main square of Bari, Piazza Umberto, to end at the last block of Via Argiro.
In this pedestrian street it is possible to stroll comfortably.
All the participants had to start from the given starting point, the rail station square. Then they were allowed to walk freely, exploring the urban environment to reach a designated destination area, located in the last street block of Via Argiro. The total length of the pathway is approximately 1km.
Participants were not allowed to use navigation supports, in order to avoid them following the shortest path and so neglecting the urban context. In this way it is likely that the trail has been influenced more by the surrounding environment (Duckham and Kulik, 2003).
On the other hand, the start and the end of the trail were given to avoid an excessive dispersion of gathered data. It allows us to make ex-post statistical analysis.
Participants were asked to use *MyTrack* smartphone application (now dismissed) to record the path and to take photos. This application automatically registered information such as photo-taking time and photo–taking geographic coordinates. They were also asked to make comments on electronic sheets, when they felt that the features of the context deserved to be reported. The amount of photos and statements were not limited.
Moving through the urban environment, participants came across various scenes and cityscapes. They freely recorded what they considered interesting and relevant.
At the end of the experiment, writing comments and photos were filed and categorized for subsequent analysis.

Experimental outputs

Firstly, we identified the most frequently reported elements in the photos. Basing on relevant quantitative frequencies, we then tried to infer qualitative information.
To this purpose, the elements in the photos were classified into typological categories such as:

- Landmarks;
- Long perspectives views;
- Small urban elements;
- Outstanding elements (interrupting the continuity of the spatial structure);
- Historical and modern facades;
- Street signals and advertisements.

The aim of the previous steps was to investigate about the reasons behind elements capturing, i.e.:

- because they are interesting to participants *per se*;
- because they support the progress of the movement task;
- because they satisfy both previous aspects.

We did not get any direct information from participants to answer this question: yet, we hypothesized a correlation with previously identified categories. We recognized that some of these categories are more strongly linked with one or more of the three suggested hypothesis. However, this assumption needs to be fully validated.
Some elements in the cityscape, i.e. benches, asphalt pattern, ornamental flower pots etc. identically repeat along the path, so appearing as hardly useful for spatial orientation. It could be more plausible that they were captured because of their peculiar appearance as small urban elements.

Conversely, other elements are unique along the path. Even if they may not look either significant in terms of their shape or estetically interesting from an esthetic point of view, they can be useful to accomplish the movement task, as in the case of road signs and advertisements. Moreover, they catch the pedestrian attention because of the written information they convey.

Finally, other elements such as historical and architectural facades could perform both functions at the same time. Further, we recognize that participants often interpret urban space at the scale of long perspective views. It allows them to catch macro elements such as facades, views of buildings and long streets, without capturing a specific detail. In facts, a large amount of photos captures sets of big elements structuring the surrounding cityscape: their approximate prospective field measures 10m to 30m. We hypothesize that these photos reveal the moment when the exploring participant tries to allocate herself into her mental path.

On the other hand, the attention is often captured by micro-urban elements, such as the type of pavements, the specific furniture, the zebra crossing, or the species of plants. In this case, the depth of the photo field shortens and it varies from 30 cm to 2 meters.

Interestingly, there is a photo subject repeated many times, which represents the scaffolding between two buildings. We speculate that it is a surprising occurrence, because the explorer suddenly comes across a vacuum along the curtain walls of buildings filled with a unexpected solution. (outstanding element).

Paying attention to the architectural composition of the prospects is quite frequent among participants. In particular, building fronts different from the monotonous constructions scheme, such as glass, modern and historical

facades, attract their attention. (historical and modern facades).
It is worthy to note that participants did not take photos of temporary elements, such as pedestrians, street artists, cars and animals, in fact they are not present in any of the above mentioned categories. Photos refer only to permanent elements.
We speculate that it is due to the fact that, moving towards a target, participants tent to focus their attention on characterizing elements of the surrounding space. In fact, the reported elements are easy to be located in a spatial cognitive map and therefore easy to be recalled in succeeding navigation.
From this point of view it must be said that elements belonging to the set named "interesting for participants *per se*" represent typical features of the local surrounding environment, although they did not help participants in the orientation task, as explained before.
Finally, we observed the preference toward certain photo taking points, in facts there is a high density of photos taken at crossroads and street corners. According to some literature (Conroy, 2001), it can be related to the circumstance that they represent decision points along the path

Conclusion \ Outlook

The present pilot study of urban spacecape exploration toward a target is an attempt to investigate and reflect on the mutual relationships between pedestrian and urban public space. We tried to bring out some aspects of the interaction, both implicit and explicit, between humans and the built urban environment, focusing on a target-oriented exploration.

The use of an electronic device to track the path aims at enhancing the correctness of results. In fact, it allowed us to know precisely each path, up to the proper precision of the instrument. Moreover it allowed us to geo-localize photos and notes, so allowing further analysis in future follow-up research.

The detailed analysis partly dealt with here, although qualitative, was aimed at identifying the typologies of photo subjects as well as linking them to the most likely reasons why they captured the observer's attention.

In fact, we hypothesized that the captured elements could support pedestrians' spatial orientation, or they captured their attention just because they embody distinctive aesthetical features or for both aspects.

This analysis may help us to infer to what extent elements of the urban environment would influence the pedestrian orientation task, which was compulsory for her/him, even if unconscious.

Moreover, this experiment suggests that pedestrian neglected almost completely to report temporary elements, i.e., those moving inside the urban space, e.g. other people, cars and so on.

We assumed that it happens because, during the process of building up the mental cognitive spatial map of the surrounding environment, mobile elements do not represent any stable point of reference.

Finally, in line with some literature, we find that photo taking points largely correspond to the pedestrians' decision-making points (Zhang and Lin, 2011).

This research rises interesting questions, whose answers require a more detailed and in depth analysis and new experimentations preferably made with a more heterogeneous participants sample, which will be developed in future works.

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