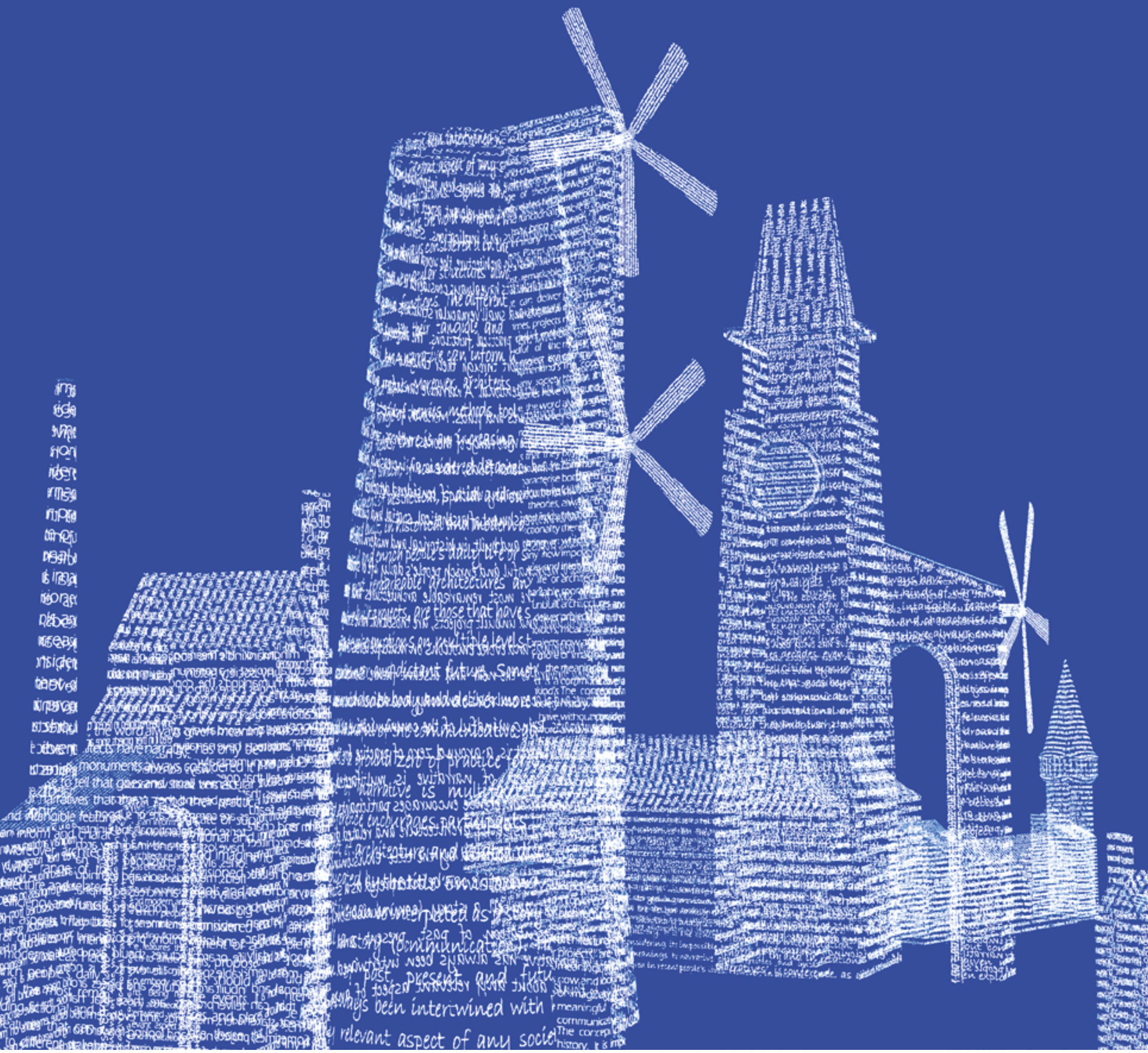
Envisioning Architectural Narratives



Edited by
Danilo Di Mascio

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Emotional clustered isovist. Representing the subjective urban experience

Introduction

The contribution presents a method that associates psychological data to isovists. Urban maps usually depict the physical environment or other objective characteristics, while the interpretation of the urban experience is an indirect reading by professionals. Only few solutions, e.g. apps currently available for participatory processes (Piga et al., 2021), aim at identifying citizens' perceptions and emotions. Moreover, in literature, there are only few attempts associating the emotional reaction of an environment to isovists (Li et al., 2016). Anyhow, these approaches work exclusively in positional terms, usually linking the user's responses only to a specific GPS position and rarely linked to a 360° isovist, without, for instance, considering the influence of the visual direction and target. In other words, the emotional response is seldom connected to isovists, and when it happens, it is related to the 360° isovist generated from the user's position (Franz et al., 2005; Knöll et al., 2018). This approach can induce a fundamental bias: to believe that a single opinion or a set of opinions can always be traced back to a 360° experience of the space, thus attributing the value of a single perspective to the totality of the surrounding environment. As described in the paper, our research adopts view-specific partial isovists coupled with a subjective assessment of environment-related emotions. The case study application shows how changes in users' orientation in space affects space perception, and how the city characteristics influence users' emotional reactions.

State of the art

The idea of representing emotions as spatial and geographical qualities can already be found in the Carte du pays de Tendre, designed by Madeleine de Scudéry in 1654 (Bruno, 2018). This idea and its further developments in the following years, although not strictly scientific, highlighted the need to introduce the psychological dimension in the geographical representation, focusing on the subjective perception of space (Asger & Debord, 1957; Debord & Asger, 1959). This seminal approach gained scientific popularity from the 1960s with the progressive introduction of new investigation tools and methodologies (Lynch, 1960; Rentfrow & Jokela, 2016; Rentfrow, 2020). Among the representations describing the relationship between the observer and the experienced environment, the isovist is of particular interest for our purposes since it enables to “the set of all points visible from a given vantage point in space and with respect to an environment” (Benedikt, 1979, p. 47). Recent studies investigated the correlation between the geometric characteristics of isovists and the positive or negative emotions perceived and recorded in a specific place (Wiener & Franz, 2005; Meilinger et al., 2012; Li et al., 2016; Knöll et al., 2018). Although this type of analysis explores new research directions on the link between psychological effects and the urban layout, its main limitation is that it neglects the actual view of a single observer in a specific moment. According to this approach, subjective reactions are usually correlated to the whole spherical panorama potentially explorable from a single point (Piga & Morello, 2015), underestimating those perceptions can change significantly even looking around from the same position (Leduc et al., 2010). The literature presents other methods to describe the emotional qualities of space related to a whole area, such as the polygonal tessellations or the heatmap representations (Pánek, 2018), but these are questionable tools for opposite reasons. As the former presents a problem of resolution of the discretization process, the latter may result in a confusing display depending on the radius of influence of each point on the map. Such representation tools are crucial not only to depict the current condition but also to inform the transformation of places. Indeed, in the design process, it is important to consider the man-environment relationship by associating the physical dimensions with places' perceptual experience (Holl et al., 2006; Böhme et al., 2014; Piga & Morello, 2015). According to this perspective, the place can be conceptualized in its atmospheric meaning, an *ambiance* connecting space to individual and social experience (Thibaud, 2002; Griffero, 2014; Piga et al., 2016). Therefore, the narration of places should focus on the relationship between people and the environment in terms of space and time. Different models developed in the psycho-social sciences can be adopted (Boffi & Rainisio, 2017) to describe the subjective experience that contributes to characterize this relationship. One of the most widespread is Russell's circumplex model, which represents emotions on a Cartesian plane (Russell & Pratt, 1980): on this plane, the level of the emotional reaction of the individual to a specific place can be positioned, allowing to describe the emotional quality that characterizes the place. This paper presents a method that combines the literature on isovists with the research on the emotions associated with places, offering an innovative way of representing the urban experience from a psychological perspective. Moreover, through the clustering procedure, it demonstrates that this method is more discriminative and informative in identifying the emotions associated with places than those currently available, based on individual 360 ° degree or partial isovists.

Method

Participants and procedure

Data analyzed in this paper were collected during the “Experiencing Città Studi” workshop, held in October 2020, involving 38 international students of the Politecnico di Milano (POLIMI). The case study application is piazza Leonardo da Vinci in Milan, redeveloped in 2015 thanks to the ‘Città Studi Campus Sostenibile’ inter-university project by POLIMI and UNIMI (Morello & Piga, 2013), i.e. a former parking area transformed into a pedestrian area with large green spaces. The workshop was structured in three main phases. During the first phase, the POLIMI team presented the AR4CUP European project and the main features of the exp-EIA© method. The purpose of the workshop, that is enhancing a human-centred design, was shared with participants as well as instructions for the exploration and evaluation of the neighborhood through VR. In the second phase, after entering their socio-demographic data, participants answered some questions related to four predefined points of view (PoV) located in the case study area (Fig. 1). The PoVs, deemed important by the research team to describe the neighborhood’s imaginary, were available for virtual exploration through pannable spherical Streetview™ panorama (Fig. 2) (Feng et al. 2021). All points of view were fixed and the starting target of the navigation was pre-selected, except for PoV 3 that was presented with a downward visual to induce participants to choose freely the preferred visual to assess. At the end of the event, the analysis results were presented, allowing to inform a collective discussion on the characteristics of the neighbourhood.

Instruments

For data collection purposes, technical instructions were provided to virtually explore the neighbourhood and fill in the questionnaire concerning the subjective experience. The questionnaire aimed at assessing several variables, including the emotional experience associated with specific view angles. The items for emotions assessment are based on Russell’s model of emotions (Russell & Pratt, 1980), and represent a digital evolution of the Self-Assessment Manikin (SAM, Bradley & Lang, 1994), as suggested by Betella and Verschure (2016). The answers are provided on a nine-point Likert scale. Thus, the assessment tool allows placing each participant’s spatial experience on a spectrum composed of 16 main emotions, organized around a horizontal (pleasantness/unpleasantness) and a vertical axis (activation/deactivation). In total, 148 questionnaires associated with the four selected PoVs were collected.

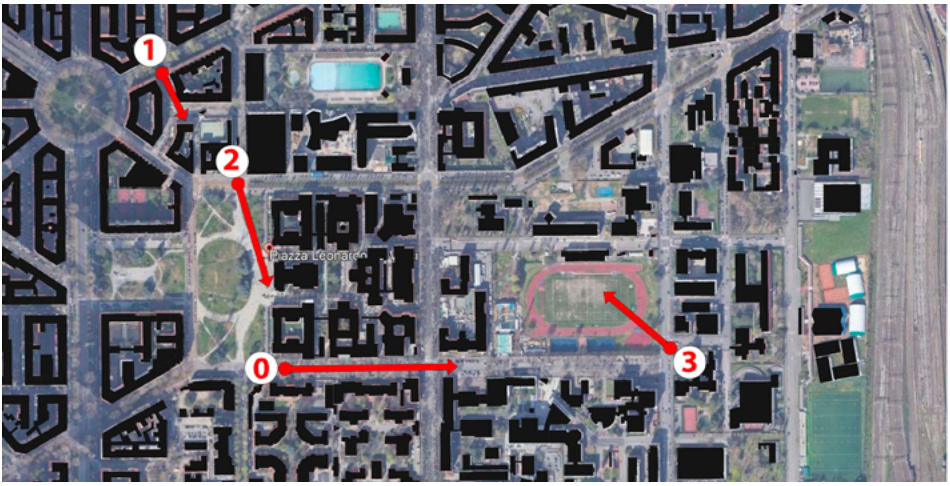

Fig. 1. Keymap of the four pre-selected PoVs.

Source of the basemap: GoogleEarth™

Fig. 2 The four StreetView™ preselected views: 0) via Giovanni Celoria; 1) via Francesco d'Ovidio; 2) Piazza Leonardo da Vinci; 3) via Camillo Golgi.

Source: Google StreetView™

Analyses

In a first step the collected data allows detecting the emotion experienced by participants in a specific place and related to a certain vista. In a second step, this information is aggregated to identify general trends describing the average emotional reaction to a specific place. The data aggregation for each PoV is performed through a process of clustering with the DBSCAN method (Birant & Kut, 2007; Stancato & Piga, 2020) and Scikit-learn 0.22 and Python 3.8 libraries, based on the participants' points of view and targets. This clustering makes it possible to aggregate groups of users based on homogeneous views, distinguishing between people looking in different directions while occupying close spaces. As a result of clustering, which excludes the outliers, the compilations are distributed as follows: PoV 0: 24; PoV 1: 30; PoV 2: 22; PoV 3a: 19; PoV 3b: 7. Finally, the clustered data are positioned on a Cartesian plane, organized according to Russell's model of emotions framework (Russell & Pratt, 1980). The result is a map of isovists, including: PoVs, average targets, and average emotional reactions (exp-EIA©). Therefore, this method of data processing allows to spatialize and georeference of the emotions of the observers, representing them on two-dimensional maps. Each produced representation considers simultaneously for each PoV: i) the average visual direction of the persons; ii) the average visual field involved in the observation; iii) the average related emotional dimension. The following paragraph illustrates the results of applying this procedure to the case study described above.

Results

The general results show how places that are geographically close can be linked to very different emotional experiences (Fig. 5), and how the method has strong discriminating power for the type and intensity of place-related emotions. It provides both subjective perspectives and the average feelings emotions related to a place, also offering a representation of the environment-related emotions on a cartesian plane (Fig. 7). For the same emotion, it is possible to identify different intensity levels, distinguishing the PoVs that elicit more intense reactions (i.e. closer to the perimeter of the plane) from those that evoke milder effects (i.e. closer to the center of the plane). For instance, PoV 2 has the highest intensity, and it is associated with the "elated" emotion. In contrast, the other PoVs are less intense and are placed in the left half of the emotional field, corresponding to unpleasant emotions. Moreover, the observations recorded from PoV 3 led to two different clusters 3a and 3b, respectively qualified by the emotions "sad" and "depressed".

Furthermore, to test how informative the new method is compared to existing ones, the collected data were analyzed by comparing three forms of representation: two traditional isovists, namely isovists 360° (Fig. 3i) and individual partial isovists (Fig. 3ii), and the proposed clustered isovists (target-specific partial isovists of clustered experiences, Fig. 3iii). In general, the outcomes (Via Camillo Golgi case study, initial PoV 3) clearly show that different fields of view from the same location can induce different emotional reactions, normally "underdetected" (isovists 360°) or "overdetected" (partial individual isovists) (Fig. 3).

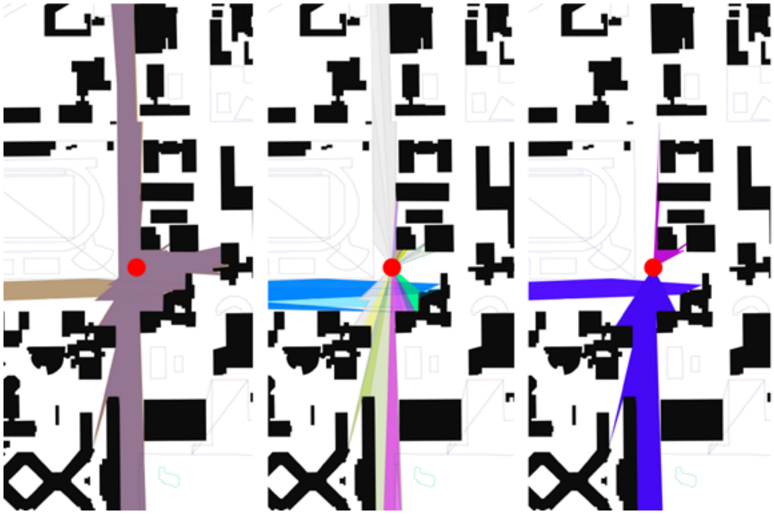

Fig. 3. Different data representation of POV '3' data collection. From left to right: (i) 360° isovist colored according to the emotional average value; (ii) view-specific partial isovists colored according to emotions perceived by a single user; iii) clustered field of view (30°, the screen) colored according to the emotional average value.

Fig. 4. The two different clusters generated by the PoV 3 data collection. On the left: view toward via Bernardo Ugo Secondo (north-east); on the right: view toward via Camillo Golgi (south).

Source: Google StreetView™

Addressing the informative potential, the first representation (Fig. 3i) tends in fact to cancel the different qualities and levels of emotional intensity perceived from the same position (underdetection); the second (Fig. 3ii) accurately illustrates how emotions change according to the target but, as the number of users increases, the readability of the collective interpretation of the place becomes more problematic, effectively generating a poorly informative representation (overdetection). The clustering system (Fig. 3iii) is instead able to identify the prevailing visual direction and the average emotion associated with it, keeping together the need to differentiate between the targets with that of having insights on the collective perception of space. It is important to underline that this system can recognize a significant change of visual direction even if the viewpoints of the observers coincide; in fact, in the case of the starting point '3' the system recognizes two different prevailing targets (Fig. 4; Fig. 5; Fig. 6).

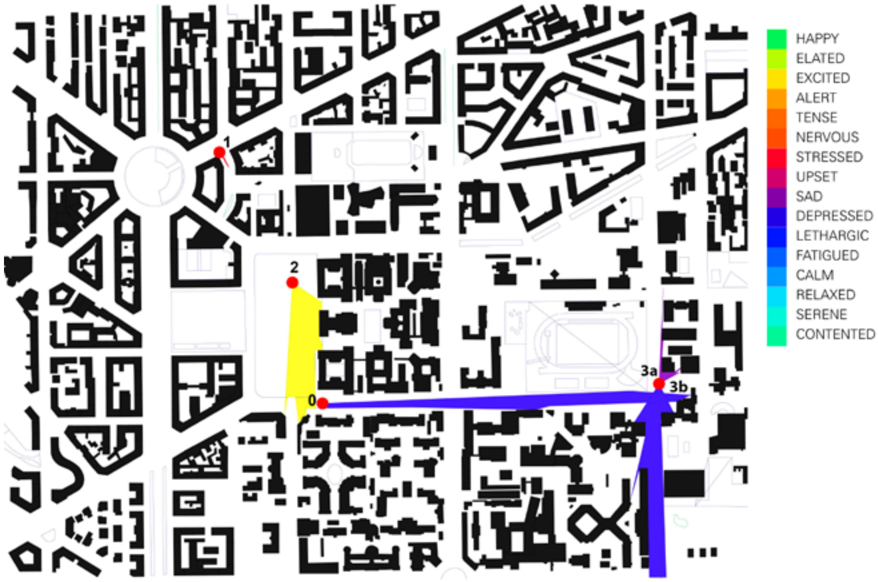

Fig. 5 Clustered PoV. Starting point '3' is duplicated into two different PoVs. The different view-specific partial isovists (field 30°) colored according to the quality of the assessed emotion.

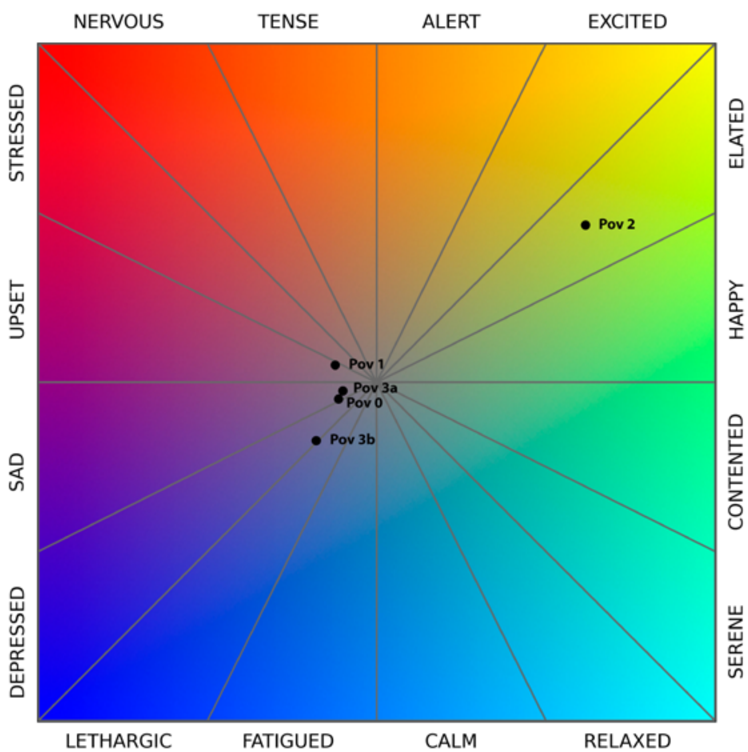

Fig. 6 The assessed points of view represented on the cartesian plane of emotions.

Discussion

The environment influences the quality of life of people, it is therefore essential to study the dyad constituted by the individual and the environment, beyond the mere sensory component. For a more comprehensive understanding of the urban experience, the physical and sensory data need to be integrated with the psychological dimensions that describe the individuals' experience. The spatialized representation of citizens' emotions, impressions and opinions allows to tell and show the reactions to the existing urban context and to future urban transformations. Thanks to the presented method, it is possible to identify the prevailing directions selected by citizens and highlight the prevailing emotion for specific views. It provides community interpretations, while preserving the specificity of the places.

The method is integrated into the mobile app CitySense™, a tool for public participatory processes. The app allows to explore places via Augmented Reality and Virtual Reality collecting reactions of citizens to the urban environment. This innovative tool acts as a facilitating element in the dialogue between public administrations, developers, and citizens so that the latter are an integral part of the urban development process. The method also allows to ensure the replicability and the comparability of the observations over time, as well as to compare different places or alternative urban transformation solutions. Furthermore, this method allows to receive timely feedback on the salient emotional characteristics of a place. This tool presents an interdisciplinary approach of architecture, environmental psychology, and computer science to establish communication between stakeholders based on reliable data.

The app developed with this method allow to act as a facilitator of participatory paths involving people no longer as simple users of a space but as citizens having a personal and emotional relationship with places. In this process, citizens are not considered as a mere source of information but as an active part in the dialogue. The experience they tell is the basis for a psychological and architectural analysis of the relationship they establish with urban places. The communication becomes bidirectional as citizens receive information about the city from public administrations and developers, and with the same tool citizens can report their individual experience of the space. The results illustrated here provide a representation of places in the neighbourhood shared by citizens. This representation constitutes the complementary element of the vision produced by the other stakeholders involved. The resulting narrative allows to visualize in a cartographic way the emotional, symbolic, identity aspects that otherwise would constitute the exclusive domain of a textual or numerical narration.

The goal is not only to evaluate the city in its current conditions but also, through Augmented Reality and the exp-EIA© method, to inform designers about their project proposals' perception before the project is implemented. Knowing in advance citizens' reactions is a very important element both to refine the developments of the project itself and to reduce potential future conflicts between the actors involved in urban transformations.

Limitations and future works

The individual's experience in space is not a static but a dynamic condition, which evolves over time. The differences recorded can be accentuated by different seasons, climatic and lighting conditions. The data presented in the current paper do not include such variables. The app will enable the collection of citizens-users' opinions and impressions directly on site via Augmented Reality. In this way it will be possible to filter the data and interpolate them with temporal and climatic information to investigate possible correlations. Furthermore, it will be possible to profile users to identify how different types of citizens react to the same environment.

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