Special Issue 1.2024

What transition for cities?
Scientific debate, research, approaches and good practices

This Special Issue intended to wonder about the possible transformations for cities towards the sustainability transition. Hence, contributions coming from scholars as well as from technicians have been collected around three main topics: methodologies for prefiguring possible sustainable transitions; urban policies and drivers of the transition; possible projects and applications for sustainable transition. Reflections and suggestions elaborated underline the awareness that the transition process, above all, needs cooperation among decisions, information sharing, and social behaviour changes.

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Land Use, Mobility and Environment

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TeMA

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Contents

Spatial-cognition ontology models in policymaking: dealing with urban landmarks in literary narratives

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Abstract

Urban complexity is expressed through multiple and multiform directions and dimensions. With the aim of operationally managing such complexity, scholars have recently started uneasy research toward the construction of system architectures to support informed and aware policymaking. In particular, agent-based modelling efforts have been developed using the so-called applied ontologies. These models appear promising towards supporting complex relational and cognitive interactions in processes of urban decisions. Increasing simulation and experimentation activities are now oriented towards the support of ontology-based spatial planning processes in the real world. In the current planning context, where natural discourses and narrations are embedded in participatory plans, useful answers can also be provided by the narrations of some literary works, in the aforementioned sense. The work we have carried out explores the spatial representations included in those narratives, trying to develop ontological analyzes based on complex structuring characters and features of the represented urban spaces. The work is based on multi-agent experiments carried out with university students, who have extracted some passages from literary works dealing with urban environments. In particular, the paper analyzes some narratives focused on the urban square (or 'piazza'), with the aim of drawing out an ontology of it including aspects of literary semantics.

Keywords

Knowledge Management; Decision Support; Urban Planning; Ontology; Literary Works.

1.   Introduction

A city is an open and very dynamic multi-agent system: new properties always emerge from such complex dynamism (Portugali, 2011; Papa et al., 2021). Human agents characteristically contribute to complexity in terms of relations and behaviours, which are explicit or tacit, stable or uncertain but fundamental in city evolution (Simon, 1991; Borri et al., 2013). Multi-agent models, supporting complex cognitive exchanges and decision-making, today appear as possible system architectures and technology becomes a determining factor in characterizing a smart city as such (Geertman et al., 2015; Pereira et al., 2016).

Today, this concept of smart city represents a multi-agent entity (an 'agency') connected autonomously but intimately intelligently. This multifaceted conversion of complex knowledge into planning and dynamic decision-making has been recently tackled by an ontology-based approach, as a formalization model behind smart city management architectures (De Nicola & Villani, 2021; Stufano et al., 2018; Borgo et al., 2021).

In spatial planning, a traditional social inspiration often involves aspects of storytelling and narrations (Goldstein, 2015). In this direction, different literary genres have always grappled with the representation of spaces: prose, poetry, novels. We explore these spatial representations with the aim of using the knowledge encapsulated in literature works for developing and empowering an ontological analysis for the city (Caglioni & Rabino, 2007: Falquet et al., 2011).

This is carried out in a future perspective of building an ontology for the city that could be useful to operationally support planning and decision-making as well as designing activities in urban regeneration or development processes.

We have taken a starting analytical step from a multi-agent experimentation carried out with university students, in which literary works have been selected and analyzed with the aim of singling out representations and salient aspects of urban environments - according to the judgment of each student (Stufano Melone et al., 2019). In particular, the present research work focuses on one of the main city landmarks - the urban square (Lynch, 1960) towards a future perspective of building a planning-oriented ontology of it.

This was carried out by comparing a taxonomy of literary semantics with a more traditional taxonomy coming from urban planning manuals.

The rationale was to investigate actual differences in catching spatial-cognition complexities from a technical vs. a literary reference perspective - thus implying that they are both useful in their different aspects (Dodi, 1972; Moughlin et al., 1999; Tagliaventi, 2007) and at the same time useful in a joint use. Beyond the present introduction, chapter 2 deals with the substantial background framework of the research, whereas chapter 3 briefly discusses possible roles of ontologies in city planning. Chapter 4 then introduces and discusses relevant parts of the experimentation, leading to the conclusion chapter with brief final remarks and follow-up perspectives.

2.   Research background: how and why we looked at literary works

In this chapter, we offer a brief recap of our specific experimental research path, so as to better locate and frame the research layout.

The aim is to set up a clear description of this experimental work, toward the ontology-building future perspective. In our previous research we focused on the concept of the sense of place, a sort of look at the genius loci in a structured and analytical way.

The relevant objective was to build a knowledge system that was as rich as possible, in order to offer the possibility of supporting planning and organization decisions for the territory, the city, the environment that could cross a wide range of aspects while not neglecting the collective and individual experience that stratifies and characterizes (or vice versa is characterized by) a specific place (Stufano et al., 2017).

We have developed a taxonomy of levels that tries to highlight the composition of the place at the agent level, space level, artifact level and cognitive/social level (Stufano Melone et al., 2019).

Along this path, a first result was therefore a list of ordered levels, shown in fig.1, of an informative nature. A strong contextual aspect is inherent in the way we live in places, as human beings. At the current stage of research, we have reported a description (often implicit) of a place that includes at least what we can consider some relevant elements in it (Stufano et al., 2017).

Anyway it is important to point out that relevant literature explored the support of ontological analysis and applied ontology for the city, as well as land management and planning, often in different and at times alternative directions. As a matter of facts, some literature looked at just compiling taxonomy aspects (Meijer et al. 2014), others spent efforts trying to use a more organized and aware approach toward the complexity concept and its huge potentials (Ballatore, 2012; Calafiore et al., 2017; Acierno et al., 2017).
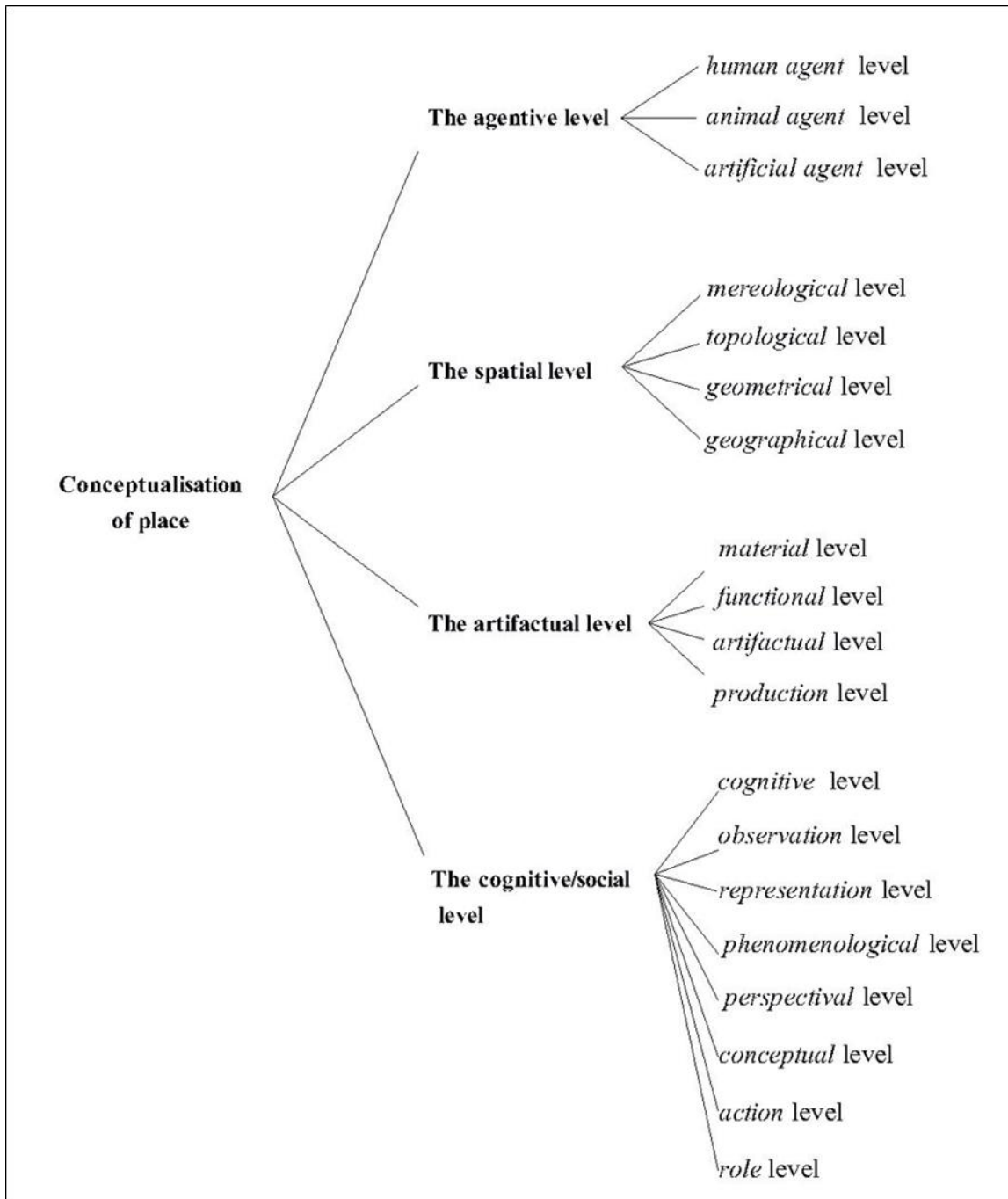

Figure 1 Conceptualization of place in terms of ontological levels (updated from Stufano Melone et al., 2019)

2.1 Narrative literature as a source of knowledge about the city

We said that the work is oriented toward a future perspective of building an ontology for the city. an ontology that could be an effective, inclusive and disambiguated knowledge support for decisions in planning processes (in the writing, monitoring and applying phases of a plan).

We know that in order to populate an ontology, it is necessary to collect knowledge (that is, in this specific field, to arouse elements and relationships related to the city system and its elements), also using known different techniques to achieve this goal (Asim, et al., 2018).

Previously we worked by eliciting knowledge from questionnaires answered by citizens involved in the participation of a planning process.

One of the most interesting processes concerned the city of Taranto, southern Italy, where we were part of a team charged of drawing the Master plan for the city (Stufano Melone et al., 2019). We reached a huge amount of knowledge about the 'places of the habits' or landmarks. Yet we became aware of how this was a limited part of what could be said about the city, as that type of 'narration' often appeared as somehow misled by strong impetus of rage or revendications.

It was not a question of right or wrong answers, but the primitive readability of the concepts risked being undermined. For sure questionnaires for eliciting a kind of knowledge translatable in our ontological-base system prototype should have to be built in a different manner and with a different frame of interaction. We thus started to explore alternative knowledge sources. In this light, literary products (i.e., romance, poetry, and narrative works in general) looked potentially helpful in integrating the conceptualization about the city in a wider sense.

The choice to look at literature texts arose while working with the protocols grabbed from the participants to a university class experimentation, and at the same time from the awareness that in literary creations nuances, aspects, relationships capturing precious moments and/or events are rather usual – whereas they slip away from the common narration of a citizen responding to a formal questionnaire in a planning process(Khakee et al., 2002). Aspects of conception, reflection and description about space often emerge in novels and poems. They can lead to interesting insights relating to a specific city or, as mentioned previously, relating to general aspects about the urban layout and about the relations of agents developing in manifold dynamics.

The tendency to enclose artistic, communicative or scientific expressions in watertight compartments, apparently distant from each other, can entail significant risks. In fact, it can lead to an incalculable impoverishment of the potential that a transversal synergy could offer to the various practices relating to different disciplines and disciplinary sectors. Books such as novels, poems, essays, or new form such as blogs are repositories of knowledge, they are often overlooked when dealing with practices related to actions such as planning, which are traditionally seen to be more linked to 'hard' disciplines – like economics, management, political science (Schon, 1983).

We reported the first explicit reflections in this direction in a preliminary work (Stufano Melone et al., 2019). Below we recall the very first two excerpts reported from two Italian works (fig.2 and fig.3), centered on the narratives of spatial environments. That first work can be considered an initial reflection proposal of our research group, about the integration of narrative texts in the context of knowledge elicitation aimed at planning and organization actions.

The two excerpts are very different from each other.

The first (fig.2) is the work of a contemporary author, Michela Murgia, recently passed away. It is taken from the novel Accabadora (Murgia, 2011) set in the early 1950s between Soreni, a small fictitious village in Sardinia, and the city of Turin.

Maria […] went out alone into the streets whenever she could, cautious but fascinated by the great city. Signora Gentili had told her the strange story of the rectangular street plan of Turin which seemed to have been designed in advance to fit the areas the streets were intended to lead to, on the principle that the citizens had had first to decide where they wanted to go, and only then to start planning and building their houses, squares and apartment blocks; the apparent illogicality of this led Maria to describe it in her first letters home to her sisters as an amusing novelty. This planning down to the last millimetre offended her good sense, convinced as she was that the only meaningful way to plan streets was the way it was in Soreni, where they seemed to have emerged from the houses like a seamstress's discarded scraps, clippings, and misshapen remnants, taken piecemeal from the spaces accidentally left over after the irregular emergence of the houses, which seemed to prop one another up like elderly drunks after a party given by their patron. Marta Gentili explained to Maria that the real reason for the geometrical plan of the streets of Turin had been security, since a royal capital must not offer rebels or enemies convenient places to hide, but this merely reinforced her view that to construct anything so deliberately on the basis of straight lines could only be an admission of weakness: who would ever take the trouble to design such straight streets unless they were trembling with fear?

Fig. 2 Excerpt from Murgia (2011), p.57 (original English edition)

We quickly cross the whole modern city: too westernized, too «Milanese», for our desire for the East. We end up in a long, wide, calm square. It is familiar - to me a provincial citizen - as if I had really crossed it, many years ago, a day of school walk «in a row».
We enter, through alleys, the old city; alive and at the same time remote, full of childhood.
An irregular square, strange, wonderful. On the one hand small houses in various movement and colors, a bit like a scene (in the ground remains of vegetables are scattered, after the market); and, opposite, the austere, simple, clear, bulk of a stone castle. Swabian castle (or Norman: names that make you dream). On the first ramp children run playing, shouting.
The Duomo, with its majesty, looms over another small, cheerful village square.

Fig.3 Excerpt from Romano (1960), p.118 (unofficial authors' translation)

The second excerpt (fig.3), written by Lalla Romano, a 20th century author and taken from some travel reports and published for the first time in 1960, reports the impressions of the author on her trip to Greece, passing through Bari (to which the excerpt is dedicated) (Romano, 1960).

Both passages are descriptions and reflections. The first concerns places imagined back in time with respect to the author's time,. The second narrates the author's impressions as a traveler who meets the urban reality of the city of Bari, Italy, contemporary but unknown to her. It is a southern Italian city, at the time full of an unknown and intriguing life for the author who perhaps prejudicially was looking for exotic aspects in southern Italy in the 1960s. The analysis of these passages provides a type of knowledge that is subjective, concerns the senses, perceptions and personal understanding of subtle aspects such as the intersections of lights or perfumes. These are elements that are part of what humans may consider their vision of a city, or more generally of a place (Stufano Melone et al., 2019).

2.2   From literary text to ontological analysis: some reflections

Let's start from the two excerpts shown in fig.2 and fig.3, focusing on what the excerpts actually tell. In both texts, interesting categories of perception and reflection on the urban layout emerge. The first text reports the reflections of someone not used to the right-angle layout of the streets, a reflection that may seem bizarre, in the eyes of those who live in western cities, or work with urban planning and/or design materials.

The right-angled layout is almost an automatism in both urban perception and conception, starting from Hippodamus of Miletus (5th century B.C.) passing through the Roman castra, reaching Ildefonso Cerdà (1867) and beyond. This makes us reflect on how our choices are based on social and cultural habits and/or automatisms and brings us back to reflections such as those left by Camillo Sitte (1889), in relation to the preciousness of the 'spontaneous' urban spaces of the European medieval city.

In Murgia's story, the objects that make the Soreni village (i.e. the buildings, that are mainly dwellings) actually create the map: there is not a functional distribution, decided and drawn down according to a pre-established scheme,to position the objects.

Certainly, such reflections enrich the knowledge base and allow for a wider, more aware and creative reflection and decision-making activities (Hofstadter, 1995; Stufano Melone & Rabino, 2014; Stufano Melone, 2019).

Yet they can be essentially prodromal to an ontological analysis, which is aimed at the disambiguation of knowledge and at the highlighting of objects, attributes and relationships in both static and dynamic aspects. Streets and houses, for example, clearly pertain to an ontological level of artefacts: however, they also pertain to a spatial and cognitive/social level. In this case it is possible to refer to the explanatory layout shown in fig.4.

In the second text, instead, everything is more centered on perception and cognition, on cognitive aspects, expectations, memories, sensations. They appear to be aroused by the place and by the naming of the large square, the narrow streets, the cathedral, the Swabian castle - both as a landmark and as an object of the imagination. Objects and relationships remain described according to strictly subjective attributes (Fig.5).
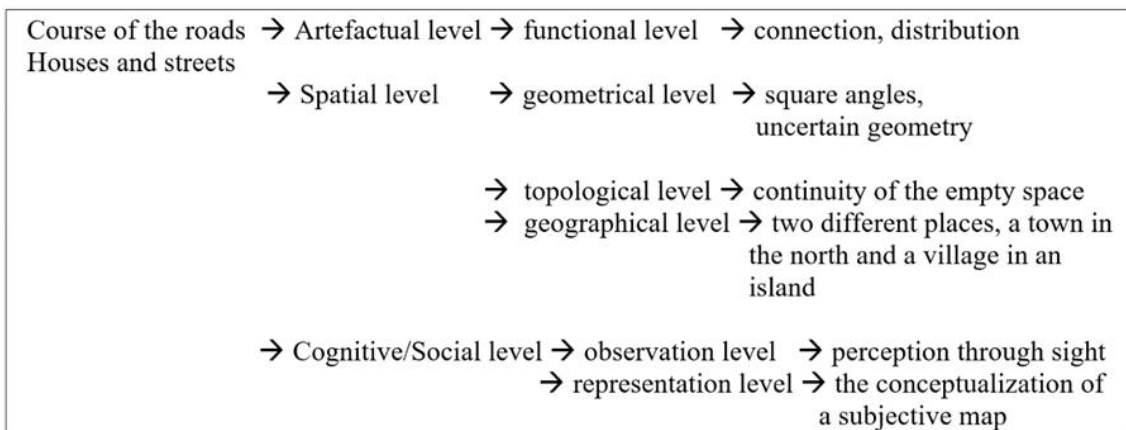
Figure 4 Reflexions prodromal to an ontological analysis about the excerpt in fig.2
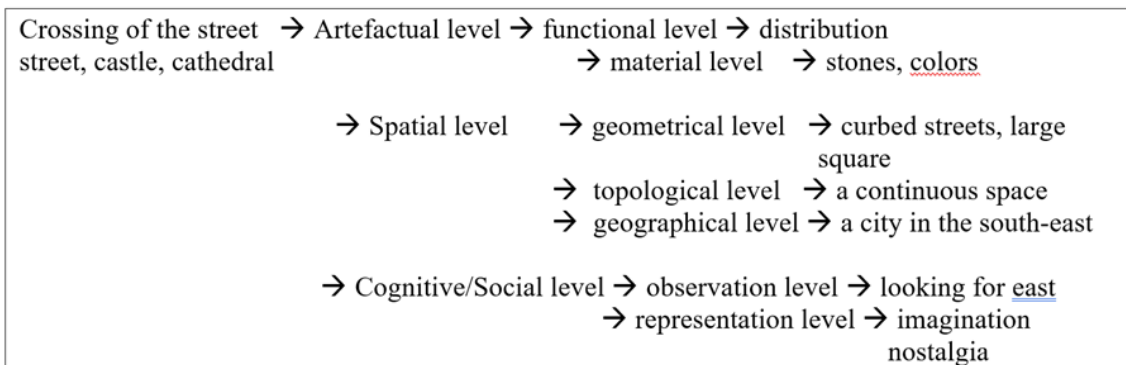
Fig.5 Reflexions prodromal to an ontological analysis about the excerpt in fig.3

3.   Ontologies and urban landmarks in city planning

Our knowledge of the city greatly builds communication made of words - mainly natural language. Implicit meanings and semantics often do not reach the level required by inherent activities. Such complex richness and dynamics have always been a challenge for planners having only limited modelling methodologies and techniques to manage a great variety of information and points of view.

Formal ontology aims at bringing together different views, sharing disambiguated meanings, involving different agents of a process, with their behaviours (Masolo et al., 2003; Guarino et al., 2009). Our knowledge of places is a 'subjective knowledge', coming from intentions and experiences in individual and relational knowledge. It becomes a kind of representation of places, varying from agent to agent and even during an agent's life. In such sense, it is significant to refer to knowledge elicited from natural-language works.

Ontological analysis helps our reading of the knowledge domain, clarifying and organizing places, in terms of objects, properties and processes (Borgo et al., 2021).

The approach used here aims at supporting spatial planning and managing decisions in such integrated-knowledge perspective. With this aim, this paper draws its materials from a collective exercise carried out with the students of the Urban planning course at the Polytechnic University of Bari.

It was carried out by administering an interactive questionnaire with Google forms, through which each student was asked to select from their usual readings three literary passages that dealt with the city. Of course, we obtained a huge amount of material whose topics were the wider possible aspects, locations, landmarks of a city. Therefore, we tried to limit and contextually focus the analysis, by referring to the concept of square (or "piazza"). This assumption is in fact in line with well-known literature (Lynch, 1960) and refers to an element genetically embedded in a city. The purpose of the work was to explore the potential of structuring an ontology starting from the experimentation on Italian literary works.

Therefore, let's now dwell a few lines to argue and focus our attention on the important "square" landmark.

Squares are urban spaces of variable shape, of more or less precious architectures, and more or less large, surrounded by blocks of buildings, often located at the crossroads of several streets.

The square is a collective urban space, in some sense it can be considered the primary node of the shape of the city. The urban system is made up of closed spaces and open spaces.

They are public places and private places: full (built) and empty (streets, greenery, squares), since the time of Agorà (in Greek ἀγορά, from ἀγείρω = to gather, i.e. a term used in Ancient Greece to indicate the main square of the polis, the city, where to meet and debate).

They are components of the urban tissue. Historically, in fact, the square can be defined as a space of public use and of significant architectural and urban planning quality, the barycenter of a specific urban area (Feraboli, 2007).

It is important to underline the social role of the square or system of squares. It is typically a heart of European cities and often by itself a chosen place to represent the centrality of the presence of civil and religious public institutions, as it is frequently delimited by the main city monuments with significant historical memories and privileged public function. From a cultural, historical and scientific point of view, the squares produced within the urban culture of the West constitute the formal space of the settled community, the spatial nucleus where the intersection of civil history, cultural movements, artistic tendencies, where material culture takes place, collective imagination, symbolic projections, consolidated rituals, popular traditions and behavioral habits (Dardi, 1987; Madanipour, 2003). In the object (organism) 'piazza' we can typically grasp the deep interweaving that links the civil history and the urban history of a city.

In the context of the European urban landscape, the squares of Italy typically represent an episode of richness and complexity, almost a cultural model. For example, just from the study of these 'piazze' Camillo Sitte built his theory of civic and urban art, at the end of 19th century (Sitte, 1889).

The great lesson of the Viennese historian lies precisely in the attention he reveals to the art of space, i.e., to squares as a masterpiece of urban art. Cities, anthropized places in general, feed themselves with, and live on, the life and awareness of those who inhabit them, who shape the character of them with their own cultural and social identification.

Conversely, from this point of view, unlived places embody an error that is not simply a planning one but a conceptual one, an error of political strategy.

Choices made in unlived places hardly include creative openings towards life situations to be developed: rather, they are rigid choices able to generate unexpected and unexpectedly aberrant life dynamics (Scandurra, 2001; Borges et al., 2014). In our case we are reporting literary texts that belong to the category of essays, specifically about architecture and urban issues, evidencing how critical and even political reflections in an essay can shape knowledge bases underlying planning decisions.

4. A literary-based experimentation

Having clarified the research reasons of focusing on the 'piazza' concept, we will now look in more detail at the actual experimentation. Out of 480 literary excerpts selected by 160 students, after eliminating double citations (i.e., many students citing same readings), as well as uncontextualized or undescribed squares, finally seven passages appeared adequate. They were four from novels/essays and three from poems. Relational graphic maps were drawn out to highlight the conceptual elements in each case.

An example is shown in fig.7, where the analyzed poem of the experimentation is Piazza Sarzano, a square in the city of Genoa, by Dino Campana (1989) (represented in fig.6). Aiming at a final ontological formalization of the square reported in the poetic/narrative literature, we started to explore ways of creating an effective taxonomic description of it. First of all, following a more consolidated approach to architectural research, we tried to analyze primitive elements and relationships that were mainly physical and spatial in nature.

Fig. 6 Piazza Sarzano (Sarzano square), Genova (© Google maps)
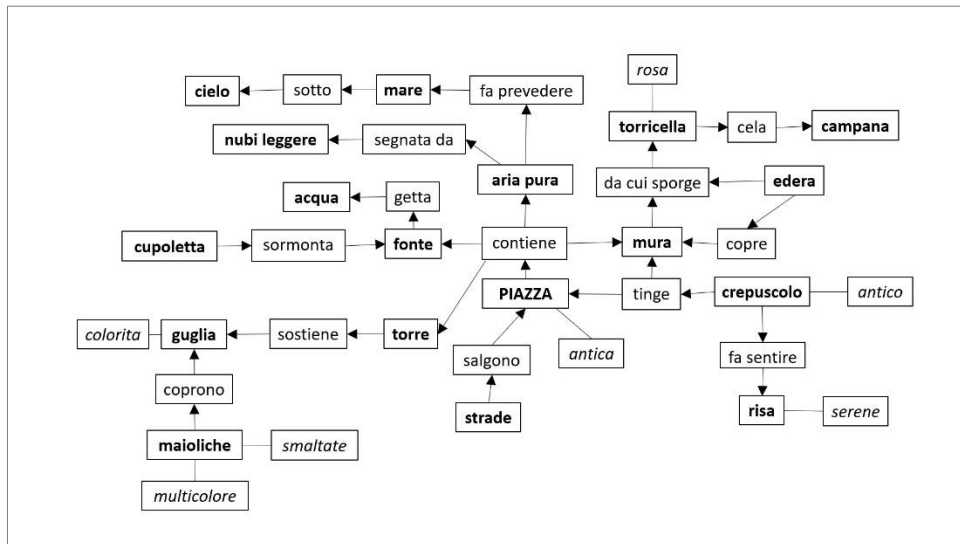
Fig. 7 Example of a relational map of the 'literary' square (original Italian language maintained to ensure consistency of meaning and of syntactic links. As a quick reading guide please consider: bold=nouns, locutions; italic=adjectives; other=verbs).

In this sense it is possible to trace some interesting analytical studies carried out on the constitution and spatial organization of monumental artefacts and historic buildings, occasionally or permanently frequented by residential or tourist agents (Cantale et al., 2021).

A good number of these studies refer, in particular, to conceptual models such as the CIDOC-CRM and the European data model (EDM). Specifically, the CIDOC-CRM ontology is related to the ISO 21127:2006 international official standard for controlled exchange of information in cultural heritage since 2006 (Doerr, 2003). EDM, instead, is an ontology useful to collect and connect cultural heritage information in order to support knowledge organization systems such as vocabularies and classification schemes (Isaac, 2013). Our first effort at ontological structuring partly followed this path, because it seemed to appear more responsive to the structure of the square as an artefact. From the analysis of the related database, a visible result emerged through the use of the Protege application software - a classification extract of which is shown in fig.8.

Fig. 8 Excerpt of the CIDOC-inspired ontology using Protégé software–Cidoc

In terms of mapping representation, the overall result is schematized in fig.9., showing the huge number of elements involved in the description and variously related, that take part in the building of the ontology. The classification is actually quite simple, defined through the use of tangible vs. intangible elements.

The tangible elements are basically referable to the elements mentioned in the texts of a physical type, such as water, clock, bricks, floor, window, bell, etc. In this group 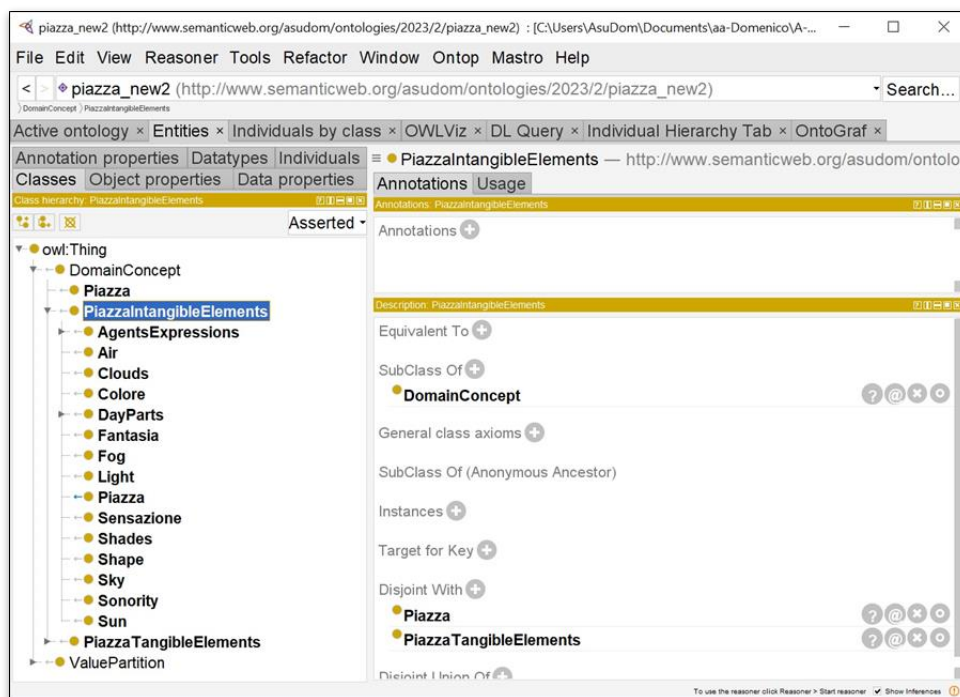of classes, and related inherent and relational properties, a substantial coherence with the CIDOC system can be observed, even in the particular condition of open and extended space rather than of closed and confined monumental element. In fact, the conceptual model prepared by CIDOC makes essential reference to tangible aspects in the artistic, historical and archaeological fields. It also takes into account the cultural environments of location, thus partially including also the intangible heritage - especially in terms of traditions and cultural aspects (Biagetti 2016). However, the literary representation also transfers a large number of typically intangible elements in a very rich way, consistently with the multisensory and profoundly interpretative attitude of the writer.

Among the classes of non-tangible elements we find physical elements, such as air, fog, clouds, but also a significant presence of abstract, ethereal, behavioural, emotional elements. Some of these are visible, such as shadow or light, but others such as sensation are perceivable in other ways. Some are objectively shared characteristics, such as color, others are purely individual, agent-based, such as behaviors, expressions, crying, laughter, etc.

Especially regarding the elements we have called intangibles, therefore, the CIDOC system seems not very representative and coherent with the complex essence of a square. Furthermore, another aspect that seems little adherent to the deep expression of the text is the dynamic dimension of elements evoked by the writer. In fact, although this initial attempt at ontological modeling includes temporal variables, they are not structured through their dynamism - which in many cases is instead essential to represent the element. For example, the chromatic variation of parts of a square can constitute a structural characteristic of the square itself: it is an intrinsically dynamic intangible character, but limited both in configuration and in time, hard to be described by the static formalism of the CIDOC system. Ultimately, the square contains concrete, abstract, but also temporally concrete and temporally abstract elements, whose special structure can be a distinctive element of this socio-spatial, urban and environmental landmark. In this framework, a model -perhaps even only partially-reticent with respect to these complex aspects runs the risk of not including the management of that 'rich' knowledge (Meyer, 2001) useful for supporting the planning and/or organizational creativity and effectiveness beyond the operational skills formally acquired by professionals and decision-makers (Schön, 1983).

Following this reflection, we decided to go beyond this ontological modeling approach, more traditionally consistent with architectural and heritage aspects, albeit typically codified. We have therefore tried to use ontological models that structurally include temporal dynamics within them, as well as maintaining an operation-oriented approach, rather than just a descriptive one. We therefore used DOLCE ontology lite version, as a structure, being notoriously conceived as an ontological framework particularly suited for intangible and dynamic concept issues and properties (Borgo & Masolo 2010). An excerpt of the taxonomy of the square that includes all 7 maps of the literary works is shown in fig.10.

The taxonomy thus structured allows to maintain and highlight the representative complexity of the concept of square in terms of subclasses (as 'classes' are already formally defined on the ontological root of DOLCE).

The comparison between the ontology built on the poem and the one built on the manual reveals a different richness in concepts and focus. Literary taxonomy (LT) contains 121 subclasses. 63 subclasses appear as endurant, i.e. as something having no conceptually distinguishable temporal parts and thus existing in its entirety at each instant of its existence (e.g., being F at time t and nonF at time t+n) (Cresswell, 1986). Other 51 subclasses appear as perdurant, i.e. entities extended in time by temporal parts, that are partially present over time but may be not necessarily present along the entire time (e.g., one phase of a whole which is present now may not be present in the future) (Guarino et al., 2002).
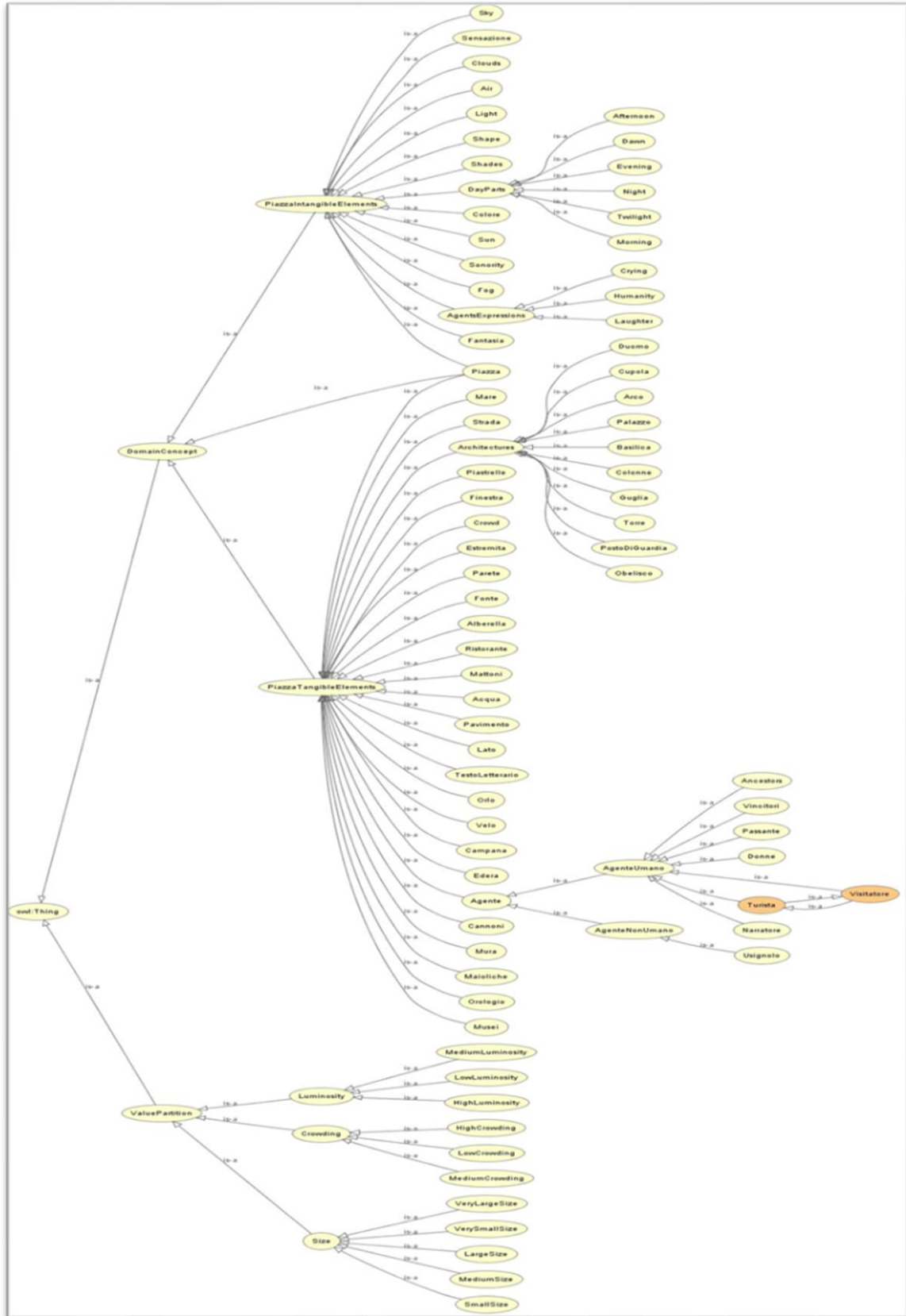
Fig. 9 OntoMap drawn from the CIDOC-inspired ontology using Protégé software (potential disaggregation highlighted with different color selection)
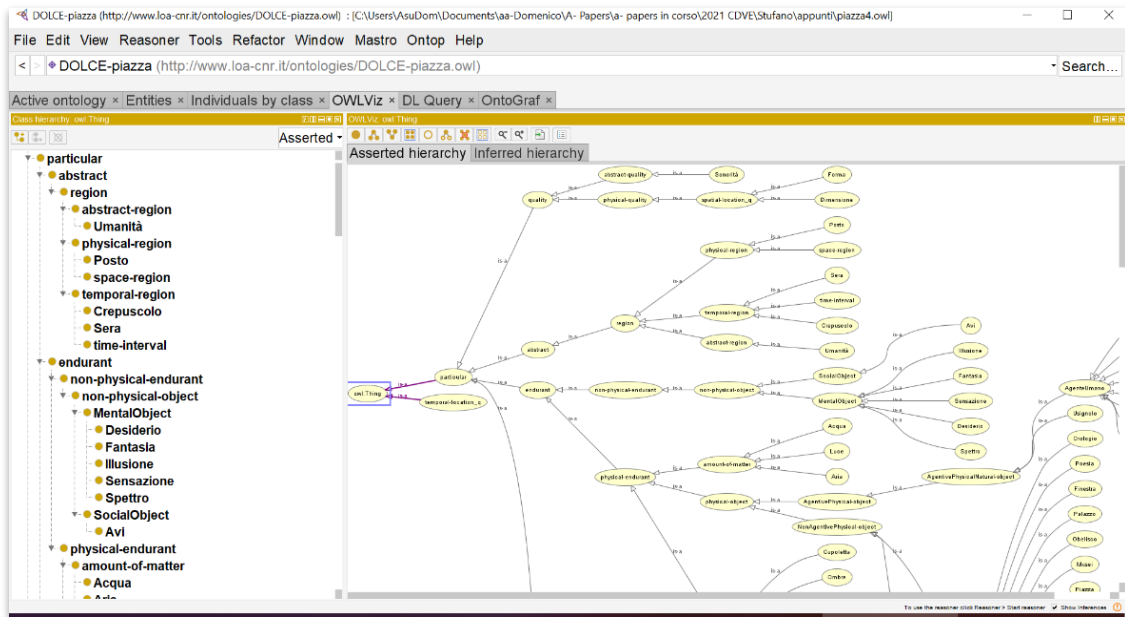
Fig. 10 Excerpt of the taxonomy of the square including maps of the literary works (Protégé)

The rather numerous amount of endurant and perdurant suggests that in LT the elements of dynamism of the square (particularly perdurant) are fundamental to characterize its conceptualization. This seems to be in line with the role played by the square in the spatial and social organization of the city (Madanipour, 2003).

In this regard, a comparative analysis was carried out with texts from traditional urban architecture and planning manuals (Dodi, 1972; Moughtin et al., 1999; Tagliaventi, 2007). An excerpt of the 'traditional' square taxonomy (TT) is given in fig.11.

Along this representation, TT contains only 23 subclasses, with 17 endurant (essentially physical elements) and only one perdurant ("observing") subclasses. Comparing LT and TT, an imbalance between endurant and perdurant seems evident, so at least suggesting that the role of time is very limitedly considered in TT, while it seems a great value in LT. A physical and static vision emerges in TT, basically excluding 'piazza' from the flow of life of a city. This circumstance is also confirmed by the absence of agentive components in TT (in LT they are 10) and of temporal regions in TT (in LT they are 2). Concerning mental objects, as part of the non-physical nature of endurants, there are 5 in LT (individual perceptions, sensations, active motions), while they are 2 in TT with a focus on generalizing a subjective interpretation rather than on individual aspects of perception. This suggests an underestimation of the intrinsic complexity of the urban 'piazza' in TT.

The disproportion clearly reflects intrinsic characters, where the sober TT derives from an articulation coming from non-descriptive but design needs, in which much is typically left to the sensitivity of the designer and many elements of abstract characterization are considered implicit and embedded in the effect of the final composition. Yet LT has the merit of making a large part of those tacit elements explicit, limiting the interpretation of the planner or designer to a more intimately creative or 'artistic' part towards the achievement of more aware and informed decisions, suitably reducing operational discretions without constraining them (Stufano Melone, 2019). In general, since a large part of the subclasses of TT are possibly articulated within LT, a single integrated ontology can be drawn in some cases. Once the ontology is complete (with properties, instances, data, etc.) many examples could be cited in an implementation-oriented perspective. For example, a design task of a square stimulating sense of security in socialization during twilight ('sense', 'security', 'socializing' and 'twilight' are in fact represented classes) could be supported by an ad-hoc query made on the square ontology. A useful design support would be guaranteed especially referring to LT, since the use of TT alone would in any case imply a high degree of interpretative discretion on the part of the designer, which might not guarantee an adequate response to actual needs in a complex operational context.
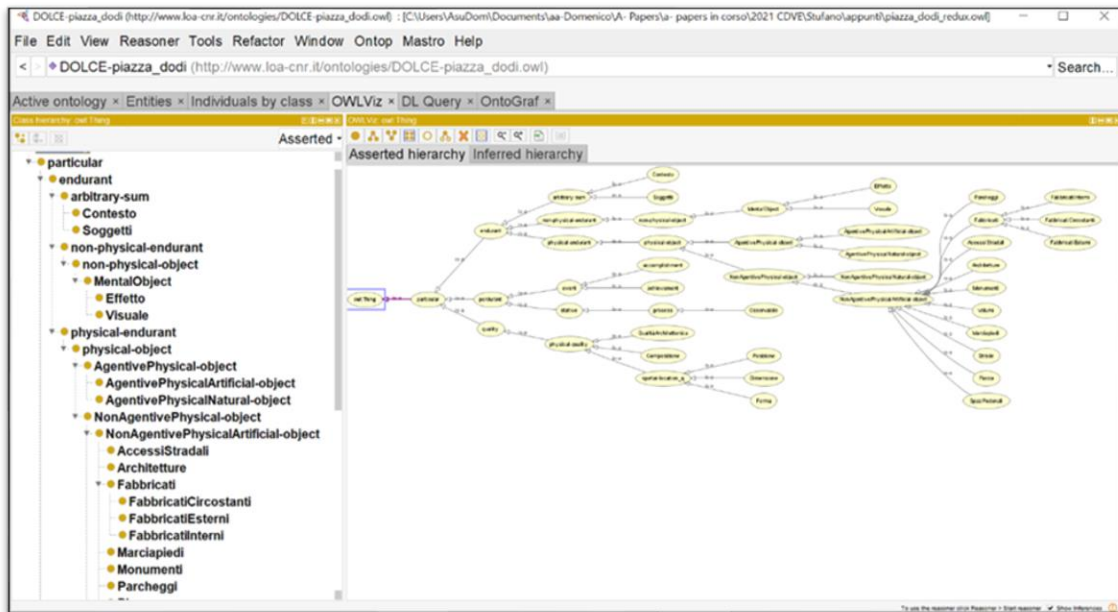
Fig. 11 Taxonomy of the square taken from manuals, on DOLCE lite ontology (Italian excerpt from Protégé 5.5.0)

5. Conclusions

Our previous and still ongoing research activities refer to the management of diffused multiagent and multisource knowledge. The present work tried to explore the usefulness of building ontologies (in perspective) based on literary narratives, using various conceptualizations of the urban square within an experimental approach. The ontological analysis of the literary square has shown a fair possibility of building a coherent taxonomy, rather rich in concrete, abstract, situational, dynamic and agentive elements, to interestingly represent the square role in the city complexity.

Based on the results, it is likely that such an approach could be extended to other landmarks or important elements of the city, so figuring out a perspective of extension of the approach to the city as a whole. Dealing with the elicitation of 'wicked' (Rittel & Webber, 1973) knowledge elements that are not always easy to draw, decision-support models and systems (DSS) can appropriately benefit from ontologically integrating literary narratives. In a context such as the urban one, where social and environmental complexity is pervasive, the possibility of developing complex models becomes precious. Although a complex system is made up of parts whose interconnections are as relevant as the parts themselves, the construction of partial but intrinsically complex models is itself clearly valuable. The possibility of creating ontological models of an urban element, which includes a material and immaterial multiplicity of characters and relationships, shows up as a guarantee of complexity, albeit partialised. Indeed, partialised models require relevant successive efforts towards an integrated urban ontology, possibly guaranteeing unitary visions of the analyzed context. And this is oriented towards supporting progressively aware and systemically effective urban decisions and policies. However, the ontological approach does allow processes of horizontal scalability and interoperability within its own methodological roots. In this sense, modeling approaches applied and/or applicable in real cases have also been developed (Falquet et al., 2011; Husain, 2011).

As a follow up, the ontological construction of the square will be completed including properties, instances, formal relationships, thus enabling an ontology-based DSS (Decision Support System) functionality. Subsequently, an attempt will be made to extend the ontological structure to other urban parts, up to targeting the entire city system if possible. This longer-term, ambitious perspective is in line with the current debate about urban digital twins (UDT) models, whose current complexity limitations can be challenged by exploring ontological approaches.

Authors' contributions

Within a common research work, jointly conceived and carried out by the two authors, chapters 2,3 have been written by Maria Rosaria Stufano Melone, whereas chapters 1,4,5 have been written by Domenico Camarda

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Image Sources

Figg.1, 7, 8, 10, and 11Stufano Melone et al. (2017) and (2021)

Fig.2: Murgia (2011)

Fig.3: authors' translation from Romano (1960)

Figg.4, 5 and 9: original content

Fig.6: collage from Google maps images

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