

## Knowledge of places: An ontological analysis of places and their semantic stratifications

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### Abstract

Talking about place, we make a sort of addition to physical space, as a place is an interpreted space. This paper tries to interpret places through place perception, by looking at the work of artists and other spatial agents. Geographical places offer a good stance in dealing with complex spatial environments using different paradigms. Ontologies seem to be useful in this sense, to look at place cognition with an analytical and organizational aim in complex spatial environments, for decision-support purposes.

The final rationale of this paper is twofold. On one hand, ontological levels are useful for complexity modelling aims: yet they are still informative, and our understanding of space cannot be reduced to these ontological elements *per se*. Therefore, deeper studies and research are needed to develop formal frameworks for modelling purposes.

### Keywords

Spatial cognition, Ontological analysis, Cognitive modelling.

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## Introduction

Physical places are complex entities. Nonetheless, we should first distinguish a concept of space from a concept of place. Each of these concepts has different declinations and for each declination there is a possible definition. For example, mathematicians and computer scientists are accustomed to treat physical space as a 3-dimensional subspace of a high-dimensional abstract vector space. From a cognitive or a designer's perspective space is instead conceived as something different, at least not explicitly a 3-dimensional subspace (Freksa *et al.*, 2014).

Therefore, we can define physical space as a set of mental images, spaces of representation, and the architecture of cognitive processes in vision theory. When we talk about place we are operating a sort of addition to the physical space. A place is an interpreted space, a reasoned space, a space with feelings, a result of an aesthetic fruition of a physical space. The essence of place lies in the quality of being somewhere specific, knowing that you are "here" rather than "there" (Rapoport, 1977) for example enclosure becomes a very important aspect of place-making which also seems, in some way, to be related to the concept of territory.

Places are landscapes as seen from far away, places are cities lived from inside or cities imaged from outside: are they ecological ecosystems too? We intend to focus our attention on lived places.

We can assume our being in a space as an objective proposition according geometrical rules/indications. Our being in a place can be defined by a richer description. We know that we 'read places' we live in: in fact we understand places through cognitive contexts. According to every single context we select and have assumptions about what is important and what is not.

Every single person that stays in a place has at least one subjective point of view. Points of view and contexts are results coming out from a historical – cognitive- cultural selection.

Our knowledge of places can derive, for instance, from news about places that structure partial ideas about places, or instead from a steady habit that ‘hands down’ paths: these also fix partial structures and ideas about places. Human agents do not need to be conscious of the different levels that they use but a careful analysis could individuate and distinguish them. And this can be extremely useful for a more strategic interpreting a place and its ramification and fallout, from a designer's or planner's point of view, as well as from an inhabitant's point of view.

But when we talk about ‘subjective knowledge’ of places what are we really dealing with? ‘Subjective knowledges’ are representations of places, and representations can vary not only from different subjects, but even during one subject’s life (Orr, 1992, p.130).

"Knowledge of a place—where you are and where you come from—is intertwined with knowledge of who you are. Landscape, in other words, shapes mindscape".

In literature there are many attempts to get a definition of representation of space. Many knowledge domain areas dealt with it from the social representation of a space (that of course is a “place” in some sense) and they need a defining a representation of it. Ontologies are increasingly seen as an appropriate method and tool in this sense, being typically specified in languages that allow abstraction away from data structures and implementation strategies. In practice, in terms of expressive power, the languages of ontologies are closer to first-order logic than languages

used to model databases. In computer and information science, ontology is a technical term denoting an artifact that is designed for a purpose, which is to enable the modelling of knowledge about some domain, real or imagined (Gruber, 1993).

## **Place perception and communication**

### ***Artistic examples of place perception***

Often artistic production can offer different subsequent images or narrative of a place representation. As an example, we can consider the Rouen Cathedral 'cycle' by Claude Monet (figures 1-2).

We can recognize here an interesting illustration of how the perception of a city landmark varies in different environmental conditions and we can see that paintings register the different moments (dawn, midday, afternoon...) as the artist saw them. To describe this series of pictures, we refer to Georges Clemenceau's words, he wrote in 1895 on *La Justice*: this visual evolution makes our world's perception more penetrating and thinner.

Let's consider the further example of Saint-Victoire, "Cezanne's Mountain", a wonderful example of an artist's place perception through a long time interval (fig. 3). Cezanne continues to re-draw a mountain during all his life, which is a landmark in relation to the territory in which it "exists". But we can derive that, at the same time, Saint Victoire Mountain is a subjective landmark too, for each of the inhabitants belonging to that land.

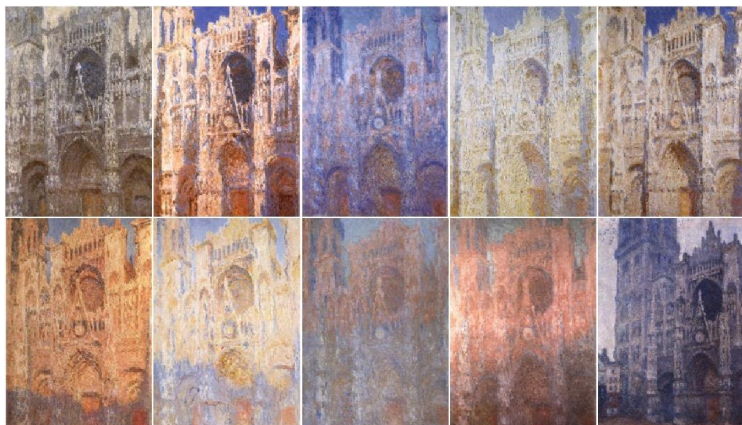


Figure 1 - Rouen Cathedral 'cycle' by Monet (I)



Figure 2 - Rouen Cathedral 'cycle' by Monet (II)

Through his art, Cezanne is able to transmit his own interpretation of Saint-Victoire, an interpretation that changes over time. Landmark representations by a younger Cezanne are closer to the photographic image of the mountain, then these representations report a more and

more dematerialized mountain, until Cezanne represents it as a sort of a cloud in the sky.



Figure 3 - Saint-Victoire, “Cezanne’s Mountain”

Another artistic example is the narrative way of ‘communicating’ places. In a first step we have to distinguish the narrative form (a) building a fictional place (or a description of a real place) from (b) indication in the fiction to find a place. In Hemingway’s *For Whom the Bell Tolls*, Robert Jordan, during the Spain war in the 1930s between communists and fascists, has to send a companion to a military headquarter whose existence somewhere in the surroundings is known while location is unknown: to drive Martin, Robert provides a virtual image of the military headquarter, an abstraction of the form-function entity (Hemingway, 1941, p.327).

### ***Other examples of perception***

There is a large number of examples related to art and to visual interpretation, but we can refer to other kinds of example, i.e.: (i) selective maps we make in our head about

a city or about a territory: these maps make unavailable/hidden some parts of the city and these are excluded a priori, we don't see them anymore; (ii) the perception of dangerousness linked to some parts of a city; (iii) beyond the physical perception of a place and the knowledge of its physical 'asset', a knowledge of places does exist, which is inherent to very local action protocols, protocols about how to move, where to go in certain situations or in specific environments.

We can now put down some questions. Coming back to the Saint Victoire Mountain and Cezanne's representations of it, we see that the mountain became an abstract object, a concept, beyond which there is the 'real' mountain. The mountain is a real place full of stratified memories that accumulate as time passes. Is the variability in interpretations something relevant? If it is so, what is going to influence and/or affect the understanding of the place? By asking these questions we focus on the tasks of a model. A model starts from objective data and cognitive data: we assume that the model keeps objective data and is enriched by cognitive (personal, social, cultural?) data.

Therefore, now we should point out some issues, for an intentional conscious form of interpretation:

- of places;
- of stratified meanings that insist on every geographical object (natural and/or artificial) that is a place;
- of relationships that exist between all the different objects and leads to the individuation of the different levels 'nested' in the places' representation.

Through an ontological analysis we aim to make these levels in objects and relations available for a deeper knowledge of places. The shared and disambiguated knowledge will be a useful tool for an effective, transparent and inclusive planning effort.

## Carving up geographical places

Humans live, move in and observe complex spatial environments using different paradigms. The interaction of humans with space is sophisticated. It continuously changes over time and relies on a variety of information types that can be classified in terms of topology, geometry perspective, dynamics, affordance, society, culture and so on. Perhaps due to the richness of this interaction, humans are not aware of how their understanding and interacting with space is realized. Ontological analysis, the study of what is at the core of our view on reality, can help to recognise, clarify and organise the essential elements and features of space that is crucial to humans in terms of objects, properties and processes. Searching for a general framework where to discover and organise this kind of information, we can list a few levels that seem quite relevant. Without aiming at an exhaustive list, we propose to subdivide these levels as follows: spatial, artifactual, cognitive, social, cultural and processual. These levels, in turn, can be subdivided in finer levels as we show for some of them.

### *The spatial level*

- Mereological level (where one understands space in terms of spatial parts), e.g. recognising the subdivisions of an area like a neighbourhood
- Topological level (where one understands space in terms of contact and unity), e.g. recognising the contiguity between neighbourhoods and the unity of a neighbourhood



- Geometrical level (where one understands space in terms of shapes), e.g. seeing the geometrical shape of a neighbourhood
- Geographical/morphological level (where one understands space in terms of locations and their descriptions), e.g. distinguishing being in a valley or having a radial/grid/linear pattern

### ***The artifactual level***

- Material level (where one understands space in terms of materiality), e.g. seeing the presence of wood, concrete, water
- Structural level (where one understands space in terms of qualified components), e.g. distinguishing natural vs manmade, residential vs production vs recreational area
- Artifactual level (where one understands space in terms of intentionality), e.g. looking at entities as planned/intentionally modified things like buildings
- Functional level (where one understands space in terms of functionality), e.g. understanding a building as a place for gathering or as a shelter
- Production level (where one understands space in terms of manipulation), e.g. seeing an object/material as needed to produce something else

### **The cognitive level**

- Cognitive level (where one understands space in terms of experience), e.g. perceiving how to move across the objects
- Representation level (where one understands space in abstract terms), e.g. perceiving the relationships among entities

- Observation level (where one understands space in terms of how it does or may change), e.g. perceiving the change of the relationships among entities
- Phenomenological level (where one understands space as a moving entity), e.g. perceiving space as an evolving situation
- Perspectival level (where one understands space as something where one is located in), e.g. perceiving space from a specific point in it
- Conceptual level (where one understands space as a collection of realised concepts), e.g. perceiving space as the manifestation of natural and artificial objects
- Action level (where one understands space as an entity in which to act), e.g. perceiving the changes that one can bring to it

### *The social level*

- Social level is the level of norms and social roles and includes the organisational level, the service level, the economic level and the political level.

### *The cultural level*

- The cultural level is the level of knowledge and meaning and includes the behavioural level, the living level, the knowledge level, the historical level and the community level

### *The process level*

- The process level is the level of temporal change and transformation, it includes the dynamic level, the

development level, the temporal level and the interaction level.

### **Conclusions: beyond ontology**

The previous levels are quite informative and yet our understanding of space cannot be reduced to these ontological elements. There is a strong contextual aspect in the way we live in places. Here, by context we mean a description (often implicit) of a place that includes at least what are considered the relevant elements in it. Typically, in discussing a place where we are, the context is what surrounds us and can be perceived; ideally, the set of entities that we see and (actually or only potentially) relate with. Thus, a context provided by a place is an information entity that contains: a (typically partial) description of the place, what there is in it and how the place is evolving (e.g. things moving, leaving or arriving, agents acting and transforming them etc.) and possibly the potential interactions between us and what is in the place. A ground context, as opposed to a generic context, is a context that refers to one or more actual/existing entities.

A context has to furnish the link between the ontological classification of what we use for understanding places and the actual place that we are experiencing. For this reason, the context has to include physical elements (e.g. location) with material components (e.g. enclosed spaces, object distribution); agentive figures (e.g. habitants, organisations, social roles) with the relationships across them and objects (e.g. generic dependences and actual goal or habits)

The listed levels and the contexts have a rich structure and are strongly interdependent.

A place comes always in a context and we need to be aware of the contribution of each ontological level when

evaluating the place and its context, including the understanding of how it may evolve and how changes may impact it.

Two crucial steps can be identified in this research:

- 1) to isolate and objectivise the most relevant levels (in ontology and in contexts);
- 2) to develop a formal framework for modelling levels and their interactions.

Finally, we need to be aware of a couple of further issues. The first one is the granularity problem, namely, the choice of what we take as paradigmatic viewpoint in the level descriptions may affect all information at each level we have identified earlier. The second one is the identification problem, namely, what deserves to be considered an object or a process from a certain level viewpoint and context.

In order to deal with these issues we need to include other conceptual tools which, unfortunately, are not well understood yet, i.e., the architectural types (classification of places/objects from a global perspective), and the architectural rules (from architectural structure to meaning and use).

To the study of such issues will be devoted a significant part of research efforts in the next future.

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