Expressing Urban Development Concerns within a Domain Ontology

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Abstract. A regional survey, with the continuation of the study of [31] for the much discussed King’s Cross area in London, provides first answers to the question ‘when’, ‘why’, ‘who’, ‘for whom’ and ‘how’ is space produced and used. It is proposed to model space for land management and planning purposes with a methodology of ontology development that relies on Patrick Geddes Civics: as an applied sociology, acknowledging the relationship between the social and the technical. A paradigm follows with references to Athens and three preliminary taxonomies on the urban and rural planning and real property rights that apply in Greece. The approach contrasts with and draws on strengths of currently known information system models for the Cadastre, borrows from experimentally work in semiotics and pays particular attention on the spatial and geographical aspects of the entities under study.

Keywords: Ontology, Urban Planning, Rural Planning, Cadastre, Greece, London, Patrick Geddes.

1 A regional survey at King’s Cross in London

It is argued that London has being a planned city but that it was not until 1963 that an attempt was made to match metropolitan plans with a corresponding government structure [15, p.93-94] and that The London Plan, finalized in the year 2004, marks an important change of direction since a new growth is heralded as a sign of the capital’s vitality as an ‘exemplary sustainable city’. In this plan King’s Cross is distinguished for having [35, paragraph 5.37]: «the best public transport accessibility in London. This will improve further with the completion of the Channel Tunnel Rail Link (CTRL), Thameslink 2000 and the Cross River Tram. Construction of the CTRL will release 20 hectares of underused land. Its central location and unique public transport accessibility offer particular scope for high-density business development, as well as housing.»
1.1 The geographic survey

The rural character of the area around the station in the 18th century (e.g. Rocque’s map) was strengthening by a new canal scheme promoted that was to be named Regent canal. The famous architect John Nash would incorporate it as a decorative feature in his design of the homonymous park with the most important endeavour, amid this complex of actions, being the new Regent street, conceived in 1811, the year in which the future George IV formally assumed power as Prince Regent, to match the grandiose style of Napoleon’s Paris with the vast undertaking of connecting the terraces of houses, villas, markets and landscaping of the park to the palace of Carlton House in St Jame’s. The report of John Nash was thorough and it was bold. The new street would provide «a boundary and complete separation between the Streets and Squares occupied by the nobility and gentry, and the narrow streets and meaner houses occupied by mechanics and the trading part of the community» [6, p. 64 – 69].

Much later, in 1904, Patric Geddes presents the view that every scientific survey involves a geographic and historic exploration of origins and social types and characteristically differentiates the English and French mentality according to the social character of farmer and hunter (open houses/villages - fortified and big walls for the city) [11, p. 137 – 138]. He insisted that designs that do not take into account the genius loci fail, as did John Nash’s plan for Regent street [37, p. 114], most probably referring to the act of segregation performed, seen as unnatural for the English tradition.

At the junction of Gray’s In Road, Petonville and King’s Cross Road, in 1836, was erected the monument which resulted in the name of the locality being changed to King’s Cross. It depicted the four patron saints of Britain and at the top was a statue of George IV and according to [16] it provoked such unfavourable comment that the statue was taken down in 1842 and the rest three years later. The serious frictions that were taking place at this period of change are also illustrated with graffiti in the nearby area.

1.2 The historic survey of recent time

The station was built in 1851-2 and when it opened it was the biggest station in England [16]. The registered land use in the years between 1931-1935 (Dudley general survey in [7]) is that of «chief urban area», which means that at the time the greater area of King’s Cross was well integrated, yet not necessarily with a loss of its newly acquired social character and role. Indicatively are noted some of the trade unions that were found in the area and may relate to this past: at Euston Road the Unisar, Public Service Union, and at Chalton road the National Union of the Rail, Maritime and Transport workers.
1.3 Citizenship and housing

The ‘unsavoury’ reputation of King’s Cross was established before the construction of the railways and it is in the edge of Somers Town, the old slum, and the so-called opportunity area on the other side, where the British Library is standing today (erected in 1998). For the sociological condition at King’s Cross as a place to live, Charles Booth’s map of London poverty [5] at the end of 19th century was compared with the contemporary axial map for London [17]. On the west side of the railway lands, the Camley street, is unclassified in Booth’s survey, being at the time a coal ward and depot area and on the axial map it appears in light blue colour and with the bounding streets highly unconnected to the surrounding region. The two areas of Barnsbury in the east and Maiden Lane in the upper north, of the railway lands, are also not well integrated in the urban fabric, evoking the question, especially for the first case, whether the character of the public housing residential area that is infamous curiously here withstands time. The Regent’s canal acquires with the new redevelopment plan [18] three bridges for improving the connection to the surrounding region and for revitalising its walking channels, though they may prove insufficient at smaller scale.

1.4 The applied sociology of the present

In the Development Plan for Greater London of the year 1963 the roads in the area were examined by way of easing pedestrian movement with the relocation of a mixture of uses that allow human interests to interact with the place and not only pass through and by it. Such an interaction was found at Judd Street and its surrounding quarter, while from descriptions in the ‘Survey of London’ [33] it is noticeable that this land is private. Where the major works for the Human City are going to take place, the land owners are the London and Continental Railways. Close to the railway trucks there is available space and this availability sustained the planning policy impetus for a large-scale development on the strategic position of King's Cross.

1.5 The present and future of King’s Cross

In 1988 the London Underground Consortium (LRC) presented a master plan with a large-scale urban park (25 acres) at its heart and two alternative solutions for the lower, triangular area. This plan also proposed a mixed use development and a great glazed vault for the CTRL on the assumption that the CTRL would come into King’s Cross station underground. It is probable that the decisions have changed due to the lethal fire at King’s Cross underground railway (tube), a year before the proposal’s submission. After the terrorist attacks of the year 2005 the reality requires to be studied more thoroughly in respect of further transportation opportunities and alternatives. The canal opens possibilities of movement that can foster the inhabitants’ sense of well being, boost their confidence and drag them outside a segregated shell, to the opportunities that the city offers (vocational, recreational, educational, cultural, tourist etc) to citizens of Europe as an answer to a long persisting planning question.
Under this optic, the re-examination of the master plan of 1988, with the park, the pastoral scene dominating King’s Cross Central becomes also relevant. Which of the two proposals, or a third one to be examined, better suits the *genius loci* of King’s Cross and what is the incipient future that emerges?

![Fig. 1. The proposal of 2004 with representational troops like the white swans, a sign of calmness and cleanliness amid modernity. The proposal of 1988 foresees as a central function the 25 acre park in the shape of a heart, a sign of pulsing organism that controls the circulation of people and functions.](image)

### 1.6 Literature of civics and incipient character

Around the hub of a *pluriethinic city* which is forecasted to attract 60 million of passengers every day by the year 2020, comparable to the number of passengers at Heathrow airport (Argent King’s Cross, [18]), was and is still added much to the urban form, urban type and urban space’s perception via published maps and images, but the essence of the character of the place remains baffling. Is this a lie or a failure to understand it?

A vertical section of London’s life inside the houses of King’s Cross Central, and one is that from the roof depicted on Mike Leight’s movie [23], can enhance the conclusions on the type of social classes present in the area and the greater immigration patterns that do not necessarily relate to the previous imperial character of Great Britain. In Camden Borough almost one third of residents come from black or minority ethnic groups, one in ten of the population is Muslim, and there are significant new and refugee communities, including from Somalia [4, p. 26]. It is interesting to examine the current practice in relation to the relief work of Patrick Geddes in Cyprus, because he had not anticipated that the Armenians refugees might not want to stay there permanently [34, p. 55].

### 2 Land management in the context of regional surveys

The current document places in the centre of interest the realization of regional surveys, for enabling urban and rural planning and programming. As an initial categorization for the sitting and development of human settlements A. Aravantinos [1, p. 32 – 35] recognizes the following criteria:
(a) The climate-natural environment. The human quest for a natural environment that will not be against the physiology of his organism and which in the same time will satisfy him psychologically is one of the primary reasons that make him chose certain places and repel others.

(b) The material for the coverage of immediate needs. The commerce and the different communication and transfer networks have reduced the significance of this criterion. However the negligence of these basic relations of humans and nature is being paid off from the residence of the city (e.g. cases of embargoes due to wars).

(c) The defence. The strategic, especially the defending, geographical position was in the past an essential criterion for the development of a settlement.

(d) The communication. The need to secure communication between the settlement and other, more distant places drives the installation as closer as possible to a vantage point in relation to the traffic network, terrestrial, maritime, aerial.

(e) The pre-existing human endeavours. To certain extend the parameter of chance affects the location of the first human endeavors (e.g. movement of populations) and the later sitting of settlements.

(f) The distance from other settlements. For cases that do not appear to have any particular physical advantage in relation to adjacent sites the explanation maybe in the structure of the greater area and in particular in the combinatorial position of other small and big settlements of the geographical region in which it belongs.

![Fig. 2. The framework of hierarchical settlements and their space of influence according to Christaller (1933).](image)

2.1 Areal unit of reference and historical, social, legal framework.

As an areal unit of reference the guidelines of UNECE [8] characteristically see as suitable the land parcel, though this unit excludes the possibility to examine the elements that semantically make up an urban form, from within and not only from without (descriptively), but also globally and back and forth in history (following Henri Levefre’s distinction in [21, p. 37]). It is proposed to use a quasi object that encompasses the intimate relationship between the social processes and the spatial form, central to the method of regional report with the intention to yield an overall perspective of an area’s social ecology and very schematically of a relation of the type:

PLACE... WORK... FOLK
That originates from the simple biological formula:
ENVIRONMENT… CONDITIONS… ORGANISM
That had to be applied and defined by the social geographer to become:
REGION… OCCUPATION… FAMILY-type and development
And which with slight variations lead to Le Play’s simple phrasing in the beginning [11].
This practice was seen as able to face the threat of planning being concerned exclusively with a simple ordering in the physical environment Hellen Miller [27, p. 174 – 182]. Patrick Abercrombie, who later became responsible for the development of the County of London Plan, was much influenced and his plan (until the making of the third generation of New Towns) is about a cellular city where the basic element of planning is not the vaguely defined urban space, but the green background in which individual communities, each consisting of smaller cells or neighbourhoods appear as islands of urban development. It is also very interesting to notice that according to Geddes what was seen as being lost in the development of London were the villages and hamlets.

Fig. 3. We are making no plea for over-centralisation; on the contrary we are inclined to think that many ganglia maybe needed to maintain the health of so vast and multi-radiate a body politic… (after [12, p. 28-29]).

Peter Halls links and analyses of the County of London Plan see the: «insistence of Geddesian survey methods to tease out the elusive community structure of London, that metropolis of villages. Then there is a brilliant combination of Perry’s neighbourhood-unit principle with Stein’s and Wright’s hierarchy […] in a solution that imposes order on the world’s least orderly great city; but in a way so natural that no one would notice […] The County Plan used the new road system, to create a cellular London: the new order was to be implicitly organic. The plan of 1944 met several changes but as Peter Hall puts it, it somehow survived and London is one of the few places where it is possible to see the Howard-Geddes-Mumford vision of the word made actual. [13, p. 187].

2.2 The CIAM and Team10

The IV international congress of modern architecture (C.I.A.M.) examined the situation of 33 cities from the national teams each of which encompassed 3 plans-
maps: (a) one with indications of the areas of housing, working and recreation, (b) one with the traffic network and (c) one with the city and its larger region that represented the four functions together [20, p. 8]. The outcomes of the analyses, as presented in the «Athens Charter» include, among others, the observation (No 11) that what is lost by the city’s development are the green spaces, that only constructions with some height could satisfy with success major legal requests and (No 28) the challenge for the authorities to establish a ‘regime of land’ (No 29).

Geddes has influenced the work of Le Corbusier [20, p. 14], but there exist another decisive difference between the two movements in their pursuit of a therapy to the ills of the city. In the first case the ultimate unit was that of the cell of neighbourhood, while in the second the unit of residence of plausible size (e.g. Unité d’Habitation in Marseilles, 1947-1952) with a parallel adoption of a normative model in planning that is easily recognizable and decomposable (e.g. theory of the 7Vs road system). As George Candillis says [20, p.125 – 132], the recognition of the four major functions in city planning was something outrageously new in the period. In the end of the war those responsible in Europe were not ready to face the implacable problems or redevelopment and in the perplexity they discovered the small book of the «Athens Charter», which became the ‘handbook of the good planner’. Millions of towns and villages in France, England, Germany, Italy acquired their regional plan with the schematic and non well understood criteria of it.

In the congress of the Aix-en-Provence, in 1953, was presented an opposition to the conformist policy of the C.I.A.M., primarily from the young architects and the next congress, the 10th, was to be organised by them who later were self-called: Team10 [20, p. 126]. According to Volker M. Welter [38] the concept of a heart of the city was part of the intellectual baggage Team10 was prepared to shed; Peter Smithson’s impression on the meeting of the VIII C.I.A.M. was about a formalistic implantation of a heart into modern urban context and of a similar formalism growing in the standardized council housing without any regard for the particular conditions. For an alternative the Smithsons turned to the Valley Section, but in a manner and purpose very different from that originally presented by Geddes.

Fig. 4. Geddes’ Valley Section and adaptation of different types of housing to the local conditions at the various levels of the valley, by Allison and Peter Smithson (after [38])

2.3 Comments on the development of modern Athens

According to [26, p. 17, ref.: P. Zepos, Ownership per floors, Athens, 1931] the development of the institution of horizontal ownership (an exception to the roman superficies solo cedit rule) relates to the concentration of population to towns with limited possibilities for expansion (e.g. Genova and Naples in Italy, Cyclades in
Greece), due to narrowness in enclosed with walls or protected areas (e.g. medieval German towns, Grenoble in France, Corfu in Greece). In the capital city the rate of population growth was dramatic. From 453,037 people in 1920, it soared to 801,622 in 1928, in Athens and Piraeus and the development of housing happened in a manner and in a social, economical, historical and political framework that lead to the super intensive exploitation of the urban land. [26, p. 16 – 71].

Fig. 5. With dots, is shown the development of multi-storey buildings of Athens between 1919 – 1941 [after 26, p. 115] that follows closely the Kleanthous and Schaubert plan, in 1833 (with the exception of the quarter of Agora, Plaka, Psiri) and expands mainly to the north and west.

Of prime importance is however the damage that results from the use of the legal instrument of usucaption outside the core of the city. As I. S. Makris highlights [25, introduction] it is the massive change of the land use character from that to be used by displaced persons (i.e. allotments) to that of immiscibly residential that makes today so pressing the need for developing a new agricultural legislature in Greece. The writer examined two recent and typical claims of ownership with the legal instrument of usucaption, though without access to the complete set of records and the spatial data. The first one is about an inheritance where the argumentation develops around the successive acquisition of the ownership. The compulsory law 431/1968 does not recognize that the beneficiaries possess (in the meaning of usufruct) the allotment unless the possession is factual and thus this land maybe acquired by usucaption also from third parties. The second case is about a land use character change. Here the decision calls again for the compulsory law 431/1968 and the argumentation seems to contradict the Greek civil code which with its article 1055 prohibits the acquisition of rural land of the type of allotment via usucaption (whether foreseen or unforeseen). The reference to the agricultural code and the compulsory law, which comes from the years of the dictatorship in Greece (1967-1974), enters to an amount of detail that overlooks why the current legal framework for sustainable development treats the
urban and rural land as one whole (Law 2508/1997). By assuming that the land parcel was disseminated by the Greek state to be used by refugees, it can further be argued that the intention was not to support a policy (in its civic meaning) for 30 or the most 50 years that does not amount to half the life-cycle of a generation. According to [22, p. 154 and 377] «the Fund for Refugee Assistance was set up hastily to deal with the emergence in 1922-25. Meanwhile, however, the Refugee Settlement Commission (RSC) was established in 1923 by the Greek government in agreement with the League of Nations as an autonomous supra-national body to administer the permanent settlement of urban and rural refugees in residence and productive work. It launched an epic enterprise and was dissolved in 1930, when its funds were spent».

Fig. 6. On the left, the refugees settlements in Attica, 1923-26. Greece (League of Nations, 1926, unique map. After [22, p. 157]. On the right, the expansion of Athens plan 1836-1971 [22, p. 49].

An area in Northern Athens that is becoming highly urbanized was selected for examining the spatial factor. What was found interesting in the allotment plan, which is until date used for eliciting the land parcels’ boundaries, are the natural, almost free hand lines, on top of the diagram. According to the official regulations of surveying works of the year 1954, the cadastral details to be included in a (cadastral) diagram are, among others, the resolving lines of cultivations and different types of land and specifically of fields, grasslands/pastures, diverse plantations, heaths and sandy/barren areas, swamps, lakes, bushes, forests and other trees [29, p. 26]. For the forest and mountainous lands the same regulations [29, p. 30] specify that perimetric surveying is usually taking place to end with the boundary of the agricultural area of the village to be used for the animals grazing. The conclusion drawn was that these lines depicted the limits of a forest, or of a land to be used for grazing. A contemporary image of Google Earth verified the first assumption.
3 Ontology development with presentation of the first taxonomies

Taxonomies allow to hypothesize that though it would be extremely surprising to find today an agricultural holding, with its common meaning, untouched from the 19th century at an area like King’s Cross, it may not be entirely surprising to locate a type of allotment, that seems to have been common also in the British tradition after the war, though not necessarily as an adjunct to apartments in building blocks, as it happed in central Europe [1, p. 189], or as a piece of land disseminated in rural or forest areas, as in Greece in the early 20’s, but for the relevant purpose of land to be used for agricultural work to betters one’s every day living conditions.

3.1 Real property rights and cadastres

Different law systems analyzed in [9] reflect the status of major legal families and the current study intends to focus more on the impact of Germanic law in civil law systems with roman roots, like the Greek one and on the England and Wales’ traditions.

Fig. 8. Extract from real property rights taxonomy with emphasis on ownership, based on interpretation of Greek Civil Law.
3.2 Rural Planning

Rural planning as a perspective of land use is primarily meant to provide an understanding framework for the process of producing food, feed, fiber and other goods by the systematic raising of plants and animals. As a perspective of the triad, Work Place and Folk is meant to provide an understanding of the production and change of rural space.

Fig. 9. Extract of property rights taxonomy, based on interpretation of Greek Civil Law.

Fig. 10. Extract from the taxonomy for the consolidations, based on interpretation of Greek agricultural code and a typical environmental impact assessment and hydraulic works study.
3.3 Urban Planning

Different directions in planning exist worldwide that include the application of methods like the: Mixed Scanning, Disjointed Incrementalism, Urban Management, Corporate Planning, Participatory Planning, Advocacy Planning, Negotiation – Mediation and Self help and others [1, p. 103 -109]. The ontology with its code provides a framework of land use planning activities at different community levels of the built and social environment.

Fig. 11. Extracts from the taxonomy for the topographic works in rural areas.

Fig. 12. High level taxonomy based on the Greek law for the sustainable development of the cities and settlements of the country [19].
3.4 Related work

The explicit treatment of levels of reality, purpose and perspectives of this reality proved to lead to a system that fails to look holistically on the way settlements are developed, as shown on the following figure.

3.5 Geometry

The ontology of geometry can encompass the theory of sets [24, 36]. A landed property can thus be represented, according to some scale and theme of interest, as:

- `<parcel, polygon>` or
- `<parcel, point>` or both
- `<parcel, polygon>`, `<parcel, point>`

Landed property (here the term ‘landed property’ expresses the relationship: Real World – Model) after a consolidation is expected to benefit in the best possible way from the new development (here the term ‘landed property’ expresses the
relationship: Model – Computer representation) and questions of proximity are posed.
By representing these lands as polygons, or as unions of polygons and the irrigation
system as a union of lines, which in turn are produced as a chain of line segments, the
process of interpretation, inference and integration that constitutes Y. Newman’s [30]
transgradation can be applied, with the section and symmetrical difference of the two
sets being closer to what by intuition is understood as pertinent, for example, to the
spatial relation of touch.

Fig. 15. Higraph formalism for moving to the higher order of conceptualization (adaptation
from [30])

3.6 More on representation

M. F. Worboys [39] proposes a notation that distinguishes between the:
• Identity indiscernibility: The representation fuses the identities of objects in the
target domain (e.g. a collection of distinct trees (citrus tree, olive trees, pines etc)
that are merged into a single map object)
• Typological indiscernibility: The representation fuses the types of objects in the
target domain (e.g. when all these distinct trees are presented as distinct map
elements that are assigned the type tree.

3.7 Conflicts and constraints

The integration of the three ontologies of Rural Planning, Urban Planning, Real
Property Rights is expected to reveal conflicts, but it should be possible, in most
cases, to reach answers from the objectives set by the holistic sustainable
development. Consensual type conflicts are expected to lead to constraints as
illustrated with the experimental usage of Gottlob Frege’s classic notation of concept
writing [32, p. 10].
All buildings are physically connected to a land-parcel

Paraphrased to:

For every x, if x is a building, it is false that for all y, if y is a land-parcel, x is not physically connected to y

Fig. 16. Constraints with the use of sentential calculus

The instances of houses in the ontology are subject to the defined constraint. What would happen if the function of the ‘physical connection’ is substituted with that of an abstract one, like the ‘ownership’? Or if the term ‘building’ is substituted with the term ‘house’? The relation: ‘house’ is a ‘building’, is valid if all real world objects in the system are buildings and a method for treating successfully exceptions at different levels is also needed.

4 Conclusions and future work

The need to examine closer and more thoroughly the real life condition of villages, neighbourhoods, towns, cities, metropolis and their relation to the current and often problematic legislature was presented with a first approach of Athens and London and a first review of the elements that pertain to the three ontologies of urban, rural planning and real property rights. The focus in England and Greece, shows that the examination of different legal systems and planning traditions can help, instead of hinder, the elicitation of formal answers to questions that reveal in land management that are receptive of automation. However, the suitability of Patrick Geddes social ecology and schemata for the purposes of urban and rural planning and its presentations need to be further understood (e.g. their fashion of usage for defining the main subjects of a regional survey of a cultural landscape) with examples from both countries, especially in Greece, as a further means to judge its suitability for utilization in Geographic Information Systems that rely on sentential calculus for the modeling and production of spatial forms. In this line of work, there obviously exist an interest on the theory of fractals for utilizing the idea of self similarity in the way variation is repeated at one scale to another to model spatial patterns that are not ‘easily noticed’.

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