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Survey methodologies of urban land uses: An oddment of the past, or a gap in contemporary planning theory?

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ABSTRACT

The primary objective of this article is to review the evolution of urban land-use survey methodologies during the last century, with a special focus on the methodologies concerning *field surveys* that are conducted for *urban planning purposes*. Our review reveals, on the one hand, that there has been a steep decrease of interest in the further development of these methodologies over the last 50 years, and, on the other, that they have been seriously trivialized, as shown by the simplistic and empirical approach to land-use survey methodology in contemporary textbooks. Next, the article explores three possible explanations of the contemporary situation: (a) there is no potential for further development of field survey methodologies of urban land uses, (b) urban land uses are no longer significant to the analysis and planning of urban space, and (c) technologies, such as remote sensing and crowd-sourcing geo-platforms, have rendered field surveys of urban land uses obsolete. The article concludes that none of the above explanations is true, thus there is an obvious gap in contemporary urban planning theory with regards to the survey methodology of urban land uses, and this omission has a strong negative impact on the potentialities of urban analysis.

1. Introduction

In the field of urban planning, there is a strong tradition of survey and analysis of urban space as a pre-requisite procedure to formulate urban plans (Breheny and Batey, 1981). In this analytical phase, primary and secondary, qualitative and quantitative, spatial and non-spatial information is collected in order to analyze and understand the structure, character, problems, and possibilities of a study area. This information primarily concerns urban land uses, but also extends to ecological, social, economic, and traffic dimensions, which constitute some of the most useful views on urban space for established urban planning practice (Lagopoulos, 2018a, p. 5). Contemporary planning theories, such as collaborative planning, which has been based on postmodern approaches that emphasize relativism and personal experience over scientific methods of reasoning (Taylor, 1998; Lagopoulos, 2018a), broaden the above horizon, suggesting, for example, the analysis of urban space through the analysis of literary texts and other artistic creations (Healey, 1997, p. 29), or through careful listening to practice stories (storytelling) (Forester, 1996; Hulst, 2012; Sandercock, 2003). Irrespective of any ancillary or supplementary perspectives in the analysis of urban space, "*the object* of spatial planning is human activities in space and their environment" (Alexander, 2016, p. 107), thus any analytical work prior to spatial intervention should start with a systematic inventory of these activities in space, on the basis of which other sources of spatial information are structured and start to make sense.

This need to survey and map *urban activities*, which are the functional and dynamic elements of urban space that take spatial expression in the form of *urban land uses* (Browning, 1965, p. 31; Chapin, 1965, pp. 221–226, 255; Pissourios and Lagopoulos, 2018), is directly connected (and therefore critical) to the usual final product of urban planning. In particular, urban planning has been (more or less, and with different local interpretations) a land-use planning practice (Akimoto, 2009; Hirt, 2018; Hirt and Stanilov, 2009; OECD, 2017) for over a century now[1] and, because of this practice, the survey of urban uses for the preparation of an '*existing land uses*' map still comprises the backbone of most urban development plans internationally.

The survey is not isolated but constitutes one of the aspects of planning theory. As urban planning is an applied field, any planning practice has to resort to some form of theory, or even better, to be guided by a methodology. According to Andreas Faludi (1986, pp. 12, 23, 115), although in science methodology is secondary to theory, as it allows us to move from theory to application, in the applied fields, such as urban planning, the emphasis is on methodology, since these fields

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[1] Based on the 1916 New York City zoning ordinance, which comprises an essential milestone in the development of zoning and other forms of contemporary land-use regulation; see: Hirt, 2018.

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aim to be operational and achieve real-world efficiency (see also: Lagopoulos, 2018a, p. 2). For this very reason, the survey of land uses, just like any other urban planning practice, needs to be guided by a specific methodology.

Considering their key importance for urban planning practice, it is interesting to note that so far, the historical development of these survey methodologies has not been specifically studied.The study *Selected References on Land Use Inventory Methods* by Robert A. Clark, published in 1969, i.e., almost 50 years ago, is an exception. If we look at similar studies offering relevant research information, those focusing on the general development of urban planning methodology (see: Batey, 2018; Breheny and Batey, 1981; Lagopoulos, 2018a; Muller, 1992) do not usually specifically cover the particular subject matter of the survey of urban uses, and studies focusing on the development of land-use maps (see: Balchin, 1985; Biesheuvel, 1956; Blake, 1981; Coleman and Balchin, 1979; Hewitt, 2012; Wallis, 1981), due to their cartographic viewpoint, do not focus on the methodological framework, but on the final product of a survey, which is the land-use map; indeed, their interest is not usually specifically focused on urban space at all.

In light of the above, this article aims primarily to review briefly the evolution of field survey methodologies of urban land uses over the last century, occasionally in conjunction with the relevant practice, when these two have progressed together. The interest is strictly focused on surveys that are conducted as part of the *urban plan making procedure*. This entails that the paper does not review survey methodologies and survey practices that fall either within the scale of *regional planning*, as the means that are utilized to survey regional space record the cover rather than the use of the land,[2] or within the scale of *urban design*, as in this scale the 2-dimensional concept of land use is insufficient or irrelevant to the urban design's 3-dimensional approach to space. Based on this review, the article highlights the lack of progress of these methodologies over the last 50 years, especially after the paradigmatic shift of planning theory towards postmodernism in the 1980s, as well as the simplistic approaches to field surveys in contemporary textbooks. In order to understand this contemporary situation, the article explores three possible explanations: (a) there is no potential for further development of field survey methodologies of urban land uses, (b) urban land uses are no longer significant to the analysis and planning of urban space, thus there is no need for their survey, and (c) technologies, such as remote sensing and crowd-sourcing geo-platforms, have rendered field surveys of urban land uses obsolete.

2. The emergence and early progress of urban land-use survey methodologies

Already at the end of the 19th century, Patrick Geddes (1908, 1915) proposed for the first time the systematic survey of urban space prior to its planning (Batey, 2018; Hall and Tewdwr-Jones, 2011; Muller, 1992).This '*survey-before-plan'* principle soon came to be recognized as a key element in urban planning methodology (Breheny and Batey, 1981), as well as the first and most crucial step towards the development of a land-use survey methodology. This methodological approach by Geddes, as well as his proposal for preparation of '*surface utilization plans*' (nowadays known as '*existing land-use maps*') was strongly supported in the following years by Raymond Unwin (1909, pp. 140–141) and Patrick Abercrombie (1915, pp. 85–86, 1916, p. 187), both of whom were leading planning practitioners in Great Britain during Geddes's time.

The momentum for urban surveys created in Great Britain during the 1900s and 1910s, together with the outbreak of World War I and the resulting growth of unemployment among architects and surveyors, led to the implementation of the *Civic Survey of Greater London* program, mainly as a prevention and relief of distress initiative (Hewitt, 2012). The survey began in 1915 and continued until late 1919, involved over 80 architects and planners, and delivered over 300 maps and diagrams (Hewitt, 2012). Land-use surveys were also conducted, but on a larger scale, from 1933 to 1943 in the US by the Works Progress Administration (Bremer, 1975; Clement, 1971).Under these work-relief programs, massive land-use field surveys were conducted and thousands of detailed land-use maps were produced. For example, the Chicago land-use survey employed during its duration about 10,000 people, and covered over 20,000 city blocks and 212 square miles of urban area (Hauser, 1975, pp. 239–240). This lively surveying activity seems to have promoted developments in the field of land-use methodology, creating the conditions of transition from empiricism to a more structured and sophisticated approach to land-use survey and mapping. This is most evident with the surveys conducted by the Works Progress Administration, as a number of handbooks were drafted and circulated among engineers and surveyors between 1935 and 1938 (see: Los Angeles County Planning Commission, 1941; Works Progress Administration, 1941), and a respectable number of articles and critical reviews on land-use survey methodology were published afterwards (see: Howard, 1941; Melvin, 1941; Young and Filley, 1941, 1942; Wilkens, 1941).

With the approval of the Town and Country Planning Act in England in 1947, the obligation to survey urban space prior to its planning was established (see Section 5 of the Act). For the purpose of training planners on the new town planning legislation and the techniques it entailed, the Ministry of Town and Country Planning prepared and published handbooks on these new techniques, two of which specifically focused on survey issues (Ministry of Town and Country Planning, 1948, 1949) (see also: Davies, 1998, pp. 139–140; Keeble, 1952, pp. 88, 153–155). Similar textbooks were also published in the US during the same period (Public Administration Service, 1948; Wilkens, 1948).

Due to the above developments in urban planning legislation, which were followed by an abundant publication of circulars and handbooks, as well as due to the developments on transportation studies, which require detailed land-use surveys (Ballabon, 1964, p. 117; Clark, 1969; Urban Renewal Administration and Bureau of Public Works, 1965, p. 1), the survey methodology of urban space in general and urban land uses in particular took a pivotal role in planning theory and this was reflected in the relevant literature. Typical examples are Lewis Keeble's *Principles and Practice of Town Planning* (1952), which was the standard textbook for the new planning in England (Davies, 1998; Marshall and Masser, 1981, p. 125), and John N. Jackson's *Surveys for Town and Country Planning* (1963), which focuses solely on the subject of surveys. Characteristic of the volume of relevant literature produced at the time is the work *Selected References on Land Use Inventory Methods* by Robert A. Clark (1969); Clark's discussion of the state-of-the-art of land-use methodology includes 83 references, almost all of which date in the 1960s.

Almost all contributions mentioned above are essentially structured formulations of logical observations and generalized empirical approaches which, having been tested in practice, reflect the accumulation of knowledge gained gradually and over time by conducting urban surveys. However, in addition to the aforementioned contributions, there are studies that take a more scientific approach to the land-use survey process. Such contributions appear to emanate from two approaches which have a different starting point.

The first one comes from the work *Urban Land Use Planning* (1st edition 1957, 2nd edition 1965), in which Francis Stuart Chapin builds on the earlier theoretical work of Ernest W. Burgess, Homer Hoyt, Roderick McKenzie, Chauncy Harris and Edward Ullman, and Walter Firey on land uses and attempts (especially in the 2nd edition of his book, see Berke et al., 2006, p. vii) to bring together in one book the theoretical background for land-use planning and to summarize the techniques the city planner employs in diagnosing the problems and needs of land development (see: Chapin, 1965, pp. 3–4). The fact that his work elaborates all levels, from framework theory (specifically

[2] See the *Technological progress and field surveys* section of this article.

systems theory), to land-use theory, to methodology, to applied techniques in the survey and analysis of land uses, renders his contribution invaluable.

The second approach is based on research conducted by academics, individual practitioners, and governmental agencies specifically on the classification of urban land uses. The first specialized studies on the subject date back to the early 1920s (see: Lovejoy, 1925), however, the first explicit theoretical bases were established in the late 1950s by Robert Sparks, Irving Shapiro and Albert Guttenberg. In particular, Sparks (1958) stressed the need for the development of a classification system that will be comprehensive, consistent and flexible, and will render comparative research on urban land-uses possible, while Shapiro (1959) criticized land-use classification schemes for mixing economic, legal, and architectural properties with land-use properties in the same classification scheme. Nevertheless, it is the systematic work of Guttenberg (1959) that synthesized all the above theoretical and practical concerns and delivered a series of classification schemes, among which one was strictly focused on the actual use of urban land (i.e., on urban activities).

At the same time, the matter of urban land-use classification was also developed dynamically by government agencies (e.g., see the *Land Use Classification Manual – LUCM –* of the Land Classification Advisory Committee of the Detroit Metropolitan Area, 1962). Also, the joint efforts of the Urban Renewal Administration and the Bureau of Public Works delivered in 1965 the *Standard Land Use Coding Manual: A Standard System for Identifying and Coding Land Use Activities –SLUCM –* one of the most comprehensive classification and inventory manuals of land uses to date. This monumental work provided planners with a very detailed catalog of 772 different urban land uses, structured in four hierarchical levels, so as to allow: (a) the selection of different levels of detail, and (b) the regrouping of uses into a variety of different classifications that fit the needs of special studies. Last but not least, it included application guidelines, accompanied by illustrated examples of field inventories and of field listing forms.

Based on the review of land-use survey methodologies presented above, two main conclusions can be drawn concerning their evolution from their emergence until the late 1960s. First, apart from the 1920s, a period in which many of Patrick Geddes's ideas were put aside by the planning practitioners (Batey, 2018, p. 50), from the early 20th century to the late 1960s, land-use planning theory and practice is characterized by a continuous and growing interest in the issues of the urban land-use survey. Second, in the 1950s and 1960s, the methodological framework of the urban land-use survey was developed with particular intensity and also took a more scientific approach. This turn towards a scientific approach has been widely recognized in various fields of spatial studies and has been attributed to the influence of positivist philosophy upon the social sciences in general, and geography in particular, after the 1950s[3] (Adams, 2001; Hall, 2006). Indeed, this influence is much evident in many milestone contributions of this era in urban and human geography (e.g., see: Chorley and Haggett, 1967; Haggett, 1965; Harvey, 1969; Mayer and Kohn, 1959). Irrespective of the origins and influences of positivist philosophy, the final outcome and impact of it on survey methodologies was that, by the late 1960s, planners had a well-structured arsenal of sophisticated theories, methods, and techniques at their disposal to face the theoretical and practical challenges in the survey of urban land uses.

[3] In this context, it should be noted that, while the literature reviewed in this section (as well as in this article generally) is planning oriented, the article deals with a stage of the planning procedure that is not normative, as is planning practice as a whole, but analytical. As such it fully coincides with the aim of urban geography when the latter is oriented to the functional analysis of space, thus multiple interconnections are evident between these two fields.

3. The exclusion of urban land-use survey methodology from scholarly research

The proliferation of planning theory witnessed after the mid-1960s and the gradual turn of these new theories away from positivism, especially after the mid-1970s, is accompanied by a general and rapid decline of interest in urban land-use survey methodology, especially on the part of scholars. For example, Brian McLoughlin proposed the *Standard Industrial Classification – SIC–* (US Bureau of the Budget, 1957) as a guide for land-use typology (1969, p. 131), even though the *SIC* was already out of date after the publication of the 1965 *SLUCM*. Also, he did not delve into survey methods and the ways this classification could be used in practice by planners (something that was offered both by *SLUCM* and by Chapin in *Urban Land Use Planning*). Most interesting is that in other well-known planning books of the era, such as those by George Chadwick (1971) and Andreas Faludi (1973) – or by John Ratcliff (1974) and Margaret Roberts (1974), the latter having a more practical orientation than the textbooks authored by McLoughlin, Chadwick, and Faludi – land-use survey methodology was a totally absent topic. According to Ron Blake (1981, p. 51), this is clear evidence of the diminished status of the land-use survey.

Generally, after the 1970s, planning theory is separated from practical planning by becoming highly abstract and by providing fewer and fewer links to practice through methodology, resulting in the distancing of planning theory from planning practice, which is well-known in planning literature as the '*theory-practice gap*' (Alexander, 1997, 2016; Breheny, 1983; Harrison, 2014; Muller, 1992; Pissourios, 2013; Watson, 2008). This alienation of methodology coincides with the paradigmatic shift of planning theory towards postmodernism (Taylor, 1998), which is well known for being hostile to science, to common assumptions and objectivity, to already produced knowledge, and of course to any methodology, while embracing relativism, meaning and communication and valuing personal experience and difference (Allmendinger (2002), pp. 155–157; Lagopoulos, 2018a). In this context, it became common among academics to characterize land-use planning *per se* as 'modern' or at least as part of the project of modernity (Allmendinger (2002), p. 168), without, however, being able to provide (neither then, nor now) an alternative to the established land-use planning methodology (Allmendinger (2002), p. 180; Lagopoulos, 2018a).

Contrary to the development of planning theory towards abstraction and the distancing of urban land-use survey methodology from scholarly research, the interest and efforts of governmental and professional bodies to produce better land inventory systems remained strong. However, these efforts have been limited to the core issue of land-use classification. In the United Kingdom, in particular, the *National Land Use Classification – NLUC –* (HMSO, 1975) was developed during the early 1970s to meet the needs of planners for the new style of development plans introduced by the Town and County Planning Act of 1968. Also, the Department of Environment in the early 1980s developed the *Land Use Change Statistics – LUCS –*(ODPM, 2004) classification, which is mainly a modified and significantly simplified version of the 1975 *NLUC* (Harrison, 2006). Similarly, in the United States of America, the Research Department of the American Planning Association, with the participation of six other federal agencies, initiated the *Land-Based Classification Standards – LBCS–* project to update the 1965 *SLUCM* (which was still in use), a project that was delivered in 2001 (APA, 2001). All of the above classifications are suitable for urban land-use survey purposes. Nonetheless, none of them elaborates on the preparation of the surveyor, on the practical part of the on-site survey, or on the mapping techniques of urban land uses in the way the 1962 *LUCM* and the 1965 *SLUCM* did.

Similar omissions also characterize the overall contemporary land-use planning literature, as well as the more specialized site analysis/planning textbooks (e.g., see: LaGro, 2008; Russ, 2009). Indicative of this landscape is the fact that even the most contemporary 5th edition

of *Urban Land Use Planning* (Berke et al., 2006) has omitted the landmark contribution of Chapin to these topics. Some contemporary textbooks do include an introduction to the general topic of urban land-use survey (see: Center for Land Use Education, 2005; Schwalbach, 2009), however these textbooks are an exception to the rule and only provide an elementary and quite empirical approach to the issue.

As for the contemporary practice of surveying and mapping of urban land uses, it is also characterized by significant weaknesses. As a case in point, we can mention the problematic organization of the urban land-use classifications used both in England[4] and in Greece[5], although a thorough and systematic review of international practice is outside the scope of this article.

4. Urban land-use survey methodology: open questions and challenges

As seen in the previous two sections, research on the survey methodology of urban land uses reached its peak in the 1960s, while since then there has been a steep decrease of interest in their further development. This latter development by no means entails that no possibilities exist for further development of this methodological framework. On the contrary, the fact that contemporary research is not interested in further reviewing, updating, or evolving it, means that several questions and challenges have been left open. Most of these are of a technical nature and too detailed to be discussed here (e.g., the problematic survey of circulation and access areas, especially when these areas serve a mixture of different uses). However, there are two issues of great importance for land-use survey and, to a large extent, for land-use studies that we feel are particularly urgent:

(a) *The use of technology in field surveys*, especially the use of Geographical Information Systems (GIS). Such a research topic might include: i. the ways GIS can help with the actual (on-site) survey work (a potential that has been revealed with the recent proliferation of the processing power of Tablet PCs), ii. the development of specialized software for land-use surveying and mapping (e.g., as add-on extensions to commercial GIS packages), and iii. research on the optimal geometric topology and the structure of urban land-use information within a GIS environment, in order to maximize the interpretative potential of data obtained by 2D and 3D analytical tools and processes (an introductory approach to this issue can be found in: Wang and Hofe, 2007, pp. 289–295).

(b) *The methodological steps required to produce an 'existing land-use' map*, especially in the case of dense city centers, where there are multiple uses, that is, a wide variety and mixture of uses in every multi-storey building. Although the primary methodological approach is based on the identification of the predominant use and its assignment as a land use (Ballabon, 1964, p. 118; Chapin, 1965, p. 255; Jackson, 1963, p. 108, 112–113; Keeble, 1952, p. 124), few publications have elaborated on the exact methodological steps and the quantitative, though relatively arbitrary, criteria these steps entail (see: Robinson, 1973; Lagopoulos et al., 2009), which have attracted very limited attention from scholars.

The generally limited contemporary research on urban land-use survey methodology, even by researchers that certainly do not embrace postmodern approaches to planning, together with the pending aforementioned challenges in urban land-use survey research, raises the question whether this contemporary landscape is in some sense produced by, or associated with, a possible lack of interest in land-use mapping and land-use planning on the part of planners and contemporary planning systems. This question is investigated in the following section.

5. Spatial planning and land-use planning practice

Given the fact that nowadays urban land-use survey methodology is not a popular research topic, one might assume that contemporary planning practice has managed to free itself from the need to prepare land-use maps and land-use plans. Strangely, quite the opposite is true. Present-day international planning practice is (more or less, and with different local interpretations) a land-use planning practice, which makes the survey of urban activities and the preparation of land-use maps necessary. OECD (2017) surveys the planning systems of 32 OECD member countries. The report differentiates three broad functions that spatial plans have in the policy-making process: they may serve as '*policy guidelines*', as '*strategic plans*', or as '*zoning/boundary plans*.' In the latter category of '*zoning/boundary plans*' fall all plans that specify the intended land-use in a specific sense, i.e., they show what type of use is intended or permitted for a given location and they usually contain a map-based part. The report concludes that almost all local spatial plans at municipal and sub-municipal administration level (i.e., the main scales in which urban planning is exercised) contain zoning/boundary plans, while 87% of all local plans are generally legally binding and 52% of them fall under the strictest form of land-use planning, in which no or only rare exceptions to the permitted uses of the proposed land-uses are allowed. In other words, international urban planning practice today (at least among the 32 OECD member countries) is mainly quite a strict land-use planning practice, and, as such, begins with the recognition and analysis of existing land-use patterns, which allows the evidence-based planning of future land uses, and the operation and enforcement of the very core function of urban development, i.e., development control of land uses.

This generic need for recognition and analysis of existing land-use patterns does not imply that each individual country or planning system (with its unique planning culture, infrastructure and availability of means) organizes and performs surveys in a predefined and identical manner. Indeed, most probably, the opposite is true. The existence or not of previous records of the same area, possible budget restrictions, differences in the planning procedure and in the desired level of detail of the urban plan produced, as well as differences in the character of the surveyed area and/or in the objectives of the intervention program, lead to the survey of different land-use attributes.

The need for land-use analysis on the one hand, and the very limited contemporary research on urban land-use survey methodology on the other hand, together with the flourishing research on remote sensing techniques in the survey of urban space (e.g., see: Huang, 2018), might lead to the conclusion that the technological progress of the last decades has rendered obsolete the conducting of field surveys, as well as the need for the relevant methodologies. This position is investigated in the following section.

6. Technological progress and field surveys

Land information/administration systems (i.e., land registries and cadastres) of certain European and other western countries include detailed land use data and/or statistics that are appropriate for urban

[4] The Town and Country Planning (Use Classes) Order of 1987 organizes urban land uses in three hierarchical levels (groupings of classes, classes and their uses). However, some of the groupings are heterogeneous and do not cover any recognizable use category, while the contents of some classes does not belong to the same level of detail (see: Pissourios and Lagopoulos, 2017, p. 9).

[5] Greek planning legislation (Official Government Gazette, Presidential Decree 166/D/6.3.1987) provides a classification of urban land uses, which the planner is required to use in order to regulate urban development. However, this classification is presented in the form of an empirical listing of uses in a one-dimensional catalogue, instead of a theoretically consistent hierarchical classification. The result is a quite problematic confusion, with inappropriate and heterogeneous elements presented linearly and empirically in arbitrary order (see: Pissourios and Lagopoulos, 2018, pp. 3-4).

land use planning. For example, in England and Wales, land-use data are collected by Ordnance Survey through field and aerial surveys, categorized by use of urban and rural land types, and supplied to Communities and Local Government for policy making purposes (UNECE, 2014, p. 98). However, land administration systems, at least among the 56 countries of the region covered by the United Nations Economic Commission for Europe, focus predominately on ownership, burdens and rights affecting land (UNECE, 2014, p. 38), and do not record existing land uses, or are not able to maintain such information up-to-date at all times (UNECE, 2005, 2014). Thus, other sources of land-use information that will allow the study of the existing functional structure of urban space and will support the administration processes of development control and enforcement have to be sought. Two such sources are: (a) the various online and open-access land-use databases, and (b) the various crowd-sourcing geo-platforms, which contain urban land-use information among other spatial information. Both sources have been enhanced by the recent technological progress and are reviewed here, as they provide affordable alternatives to land-use pattern insights, compared to the costly approach of traditional field surveys.

Land-use databases, especially when they cover a wide geographical area, are usually constructed with the use of image classification techniques (supervised, unsupervised, or object-oriented classification), which assign each pixel of a satellite image to a certain class, such as: forest, agriculture, urban etc. Certain land-use databases, such as the *Urban Atlas* (EEA and Copernicus Land Monitoring Service, 2017), or the *Canadian Urban Land-Use Survey* (Zhang et al., 2010), focus on urban space and, thus, use classes that make more sense within the urban context, such as: continuous urban fabric, low density urban fabric, industrial, port area etc.

These latter databases are particularly suitable for the purpose of studying large-scale urban phenomena that affect the *land cover*,[6] such as monitoring of general urban development trends or urban sprawl (e.g., see: Bhatta, 2010). However, as the diversification of uses within an urban area is not accompanied by or does not result in significant differentiations in their immediate natural or man-made environment (Anderson et al., 1976, p. 4; Bibby and Shepherd, 1999, p. 954), these land-use databases become less useful when they are called upon to assist typical urban land-use planning purposes. As clearly indicated by Thomas Bauer and Klaus Steinnocher (Bauer and Steinnocher (2001), p. 25), "urban land use is an abstract concept – an amalgam of social, economic and environmental factors – one that is defined in terms of *function* rather than *form*. Thus, the relationship between land use in urban areas and spectral responses recorded in images is very complex and indirect, precluding the use of traditional classification approaches." As a result of the above, land-use databases that have resulted from image classification techniques are rarely useful for urban land-use planning purposes, as: (a) the recorded/estimated land uses are not presented accurately and in adequate detail, and (b) the rationale and classification of these land uses are incompatible with the rationale and classification of the ones that are used in land-use planning (see also: Berke et al., 2006, p. 206). An example of the above incompatibilities is well illustrated in the following maps of Amsterdam (as well as in the respective land-use classifications that accompany these maps), which present:

(a) The proposed land uses of the Amsterdam land-use plan (*Bestemmingsplan*) (see Fig. 1) (Ministerie van Infrastructuur en Waterstaat et al., 2018). As discussed previously, such land-use maps are the main outcome of urban planning, and are produced with striking similarity by the planning systems of most OECD member countries.
(b) The existing land uses of the Urban Atlas database (Fig. 2) (Copernicus Land Monitoring Service, 2018), which are produced by the visual interpretation of Very High Resolution satellite imagery for reference year 2012 (EEA and Copernicus Land Monitoring Service, 2017). Even though the Urban Atlas is specifically designed for urban areas, its usefulness for urban land-use planning purposes is very limited, due to the fact that (see also Montero et al., 2014, pp. 117–118):
(c) A large number of categories represent land cover, not land use (for example, see classes 11100–11300).
(d) Due to the presence of land cover classes, in which the overwhelming majority of urban space is indeed recorded, the produced map is presented in low detail, compared to the detail necessary to allow planners to understand the functional patterns and to design the proposed future land uses.
(e) Class 12,100 is too wide and functionally disparate to be useful for urban land-use planning purposes, as it merges industrial, commercial, public, military, and private units in a single class. Usually, in urban land-use classification schemes, each of these uses constitutes a unique class (e.g., see: NCTCOG, 2017; Pissourios and Lagopoulos, 2017).

The non-residential uses (Niet-woonfuncties / Functiekaart), surveyed by the City of Amsterdam (Fig. 3). As clearly stated on their website, the produced map is based on field surveys and is used regularly by the Department of City Planning and Sustainability (Ruimte en Duurzaamheid) in order to make planning decisions (City of Amsterdam, 2018). It is also clear that this map, unlike the Urban Atlas map, makes it possible to identify existing land-use patterns in a way that is useful in the planning of future land uses and confirms the position of Ron Blake (1981, p. 50, 54), who supports the on-site approach to land-use survey over the one which involves remote sensing, as the latter fails to pick up all the nuances of the land-use relationships.

A second option for studying urban land uses is to use the information available in several crowd-sourcing geo-platforms, such as Open Street Maps and Google Maps. These geo-platforms provide an editable map of the world, containing various transport, land use, natural and other physical elements of the world in digitized form (see Fig. 4). They are open source (i.e., permit users to modify, disseminate, and use the data in any manner) and also allow individuals to insert, structure, and update the spatial information (Plantin, 2018). Specifically regarding urban uses, Google Maps, for example, allows individuals to add the location of their 'business' (by selecting one out of 3950 different 'business categories', not all of which –such as abbeys or cemeteries– are actually businesses), along with some category-specific attributes (e.g., hotel listings are prompted to add the class rating and also list the amenities offered by the hotel) (Google, 2018). The quality of the overall spatial information included in these geo-platforms is exceptional for urban planning purposes in terms of spatial geometry and coverage, but problematic regarding the urban land uses included, due to the fact that:

(a) The survey and mapping of land uses is selective (e.g., over-representing the appearance of recreational and commercial uses compared to other categories of land uses; see bottom Fig. 4), resulting from the crowd-sourcing nature and the commercial orientation of these geo-platforms.
(b) There is no possibility of (re-)classifying and mapping land uses in a manner different to the one already presented in the respective geo-platform, so as to organize the uses into categories according to a specifically urban planning or cartographic logic.
(c) There is no accompanying information of significant urban planning interest, e.g., neither the area size of a certain use, nor the floor where it is located are documented, nor can they be calculated afterwards, nor is there any systematic distinction between private

[6] Land use and land cover describe different dimensions of the land surface: *land use* relates to the activity or socio-economic function for which land is used, whereas *land cover* relates to the physical nature or form of the land surface (Harrison, 2006, p.16).

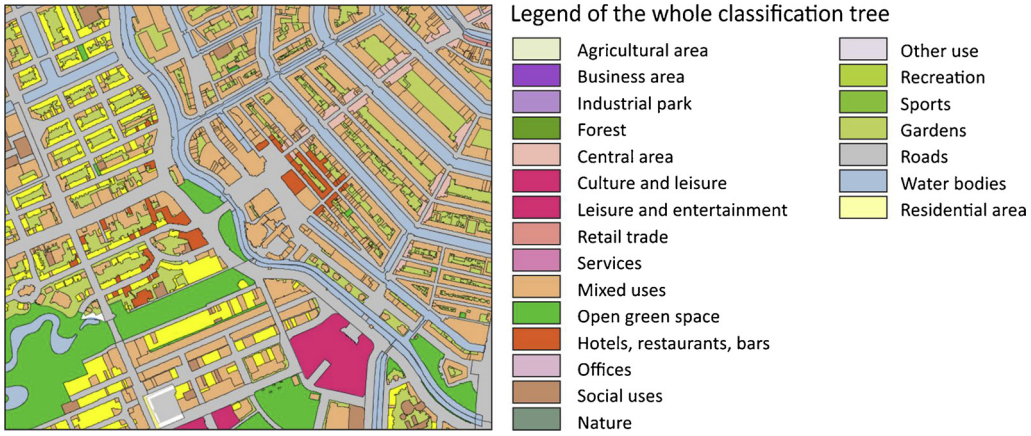

Fig. 1. Excerpt of the Amsterdam land-use plan (Bestemmingsplan).
(source: Ministerie van Infrastructuur en Waterstaat et al., 2018).

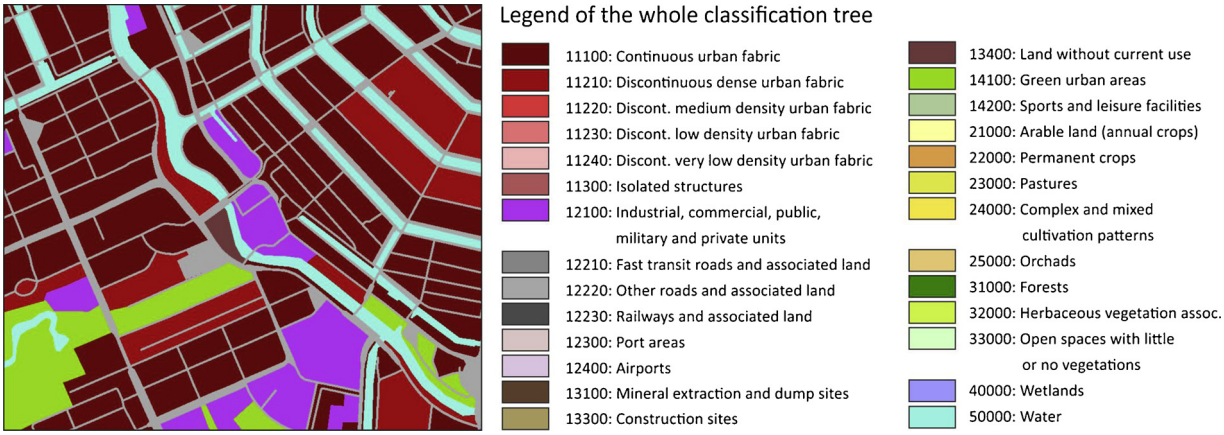

Fig. 2. Amsterdam's existing land uses, based on the Urban Atlas database.
(source: Copernicus Land Monitoring Service, 2018).

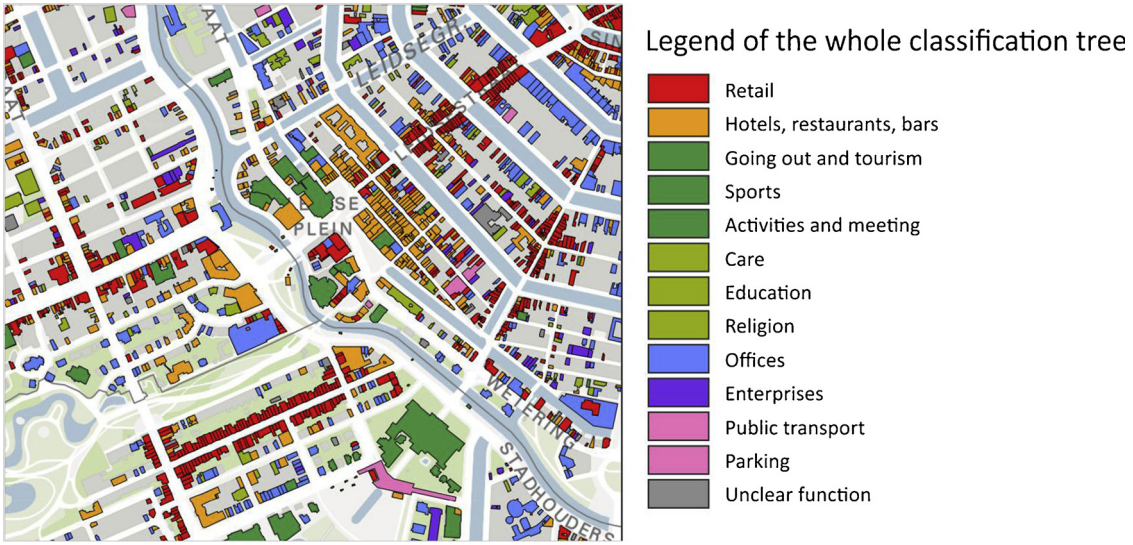

Fig. 3. The non-residential uses (Niet-woonfuncties / Functiekaart) of the City of Amsterdam.
(source: City of Amsterdam, 2018).

and public uses.

(d) There is a need to cross-check any information before it can be considered valid and ready to use to plan future land uses, since no specific certification or control procedure is followed at the time of their initial documentation, nor do the users of the geo-database know the exact time in which these urban land uses were surveyed and imported in the geo-database.

(e) To sum up, it appears that land-use databases, produced with the

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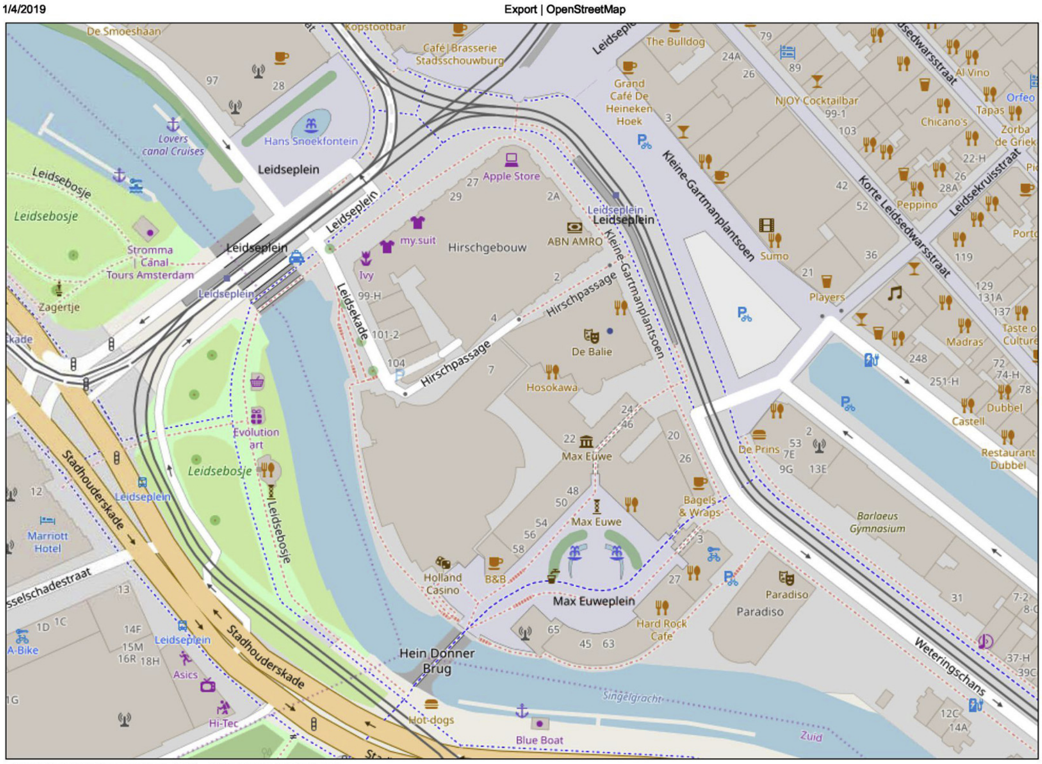

https://openstreetmap.org/copyright https://openstreetmap.org

Fig. 4. General view (top) and detailed view (bottom) of Amsterdam in Open Street Maps. (source: Open Street Maps, 2019).

use of image-based classification techniques, fail to discern the precise nature and details of land uses, while crowd-sourcing geo-databases are still in their infancy and are hardly able to provide any useful insight into existing land-use patterns. Thus, despite these technological advances, field (on-site) inventory of land use continues to constitute the main surveying method for urban planning purposes.

7. Discussion

The starting point for this article was to study the evolution of urban land-use survey methodologies over time. The main findings of this research suggest the following situation: the most important literature on both the theoretical and the operational aspects of urban land-use survey methodology is found in textbooks of the 1960s, some of which are now hard to find. At the same time, contemporary urban planning literature does not adequately cover the relevant methodological framework, nor is it interested in further reviewing, updating, or evolving it, while the limited number of textbooks that include such references take a particularly simplified and empirical approach to the subject.

In the interest of understanding the reasons for the alienation of urban land-use survey methodology from the concerns of contemporary urban planning research, even when the latter does not fall into or emanate from a postmodern approach to planning, three possible explanations have been investigated: (a) no further possibilities exist for development of this methodological framework, (b) the allegedly reduced contribution of urban land uses to the understanding of urban space, and (c) the possible existence of alternative methods to field surveys of urban land uses. With regard to these positions, our analysis revealed that, first, there are significant potential research paths and considerable space for further development and refinement of key aspects of the methodology; second, international urban planning practice today is actually quite a strict land-use planning practice and as such is very much based on the recognition and analysis of existing land-use patterns; and, third, technological solutions, such as land-use databases produced with the use of image-based classification techniques and crowd-sourcing geo-databases, cannot, yet, be a substitute for a detailed field survey of urban land uses.

Based on the above findings, the article concludes that *obviously there is a gap in contemporary land-use planning theory with regard to the field survey methodology of urban land uses*. It is also important to note that this omission is a particularity of the field of land-use planning theory. For example, there is a respectable tradition and vivid ongoing research activity on remote sensing techniques in land-cover studies generally (see: Lillesand et al., 2015; Todd, 1978), as well as flourishing research on remote sensing techniques in urban land-cover mapping specifically (see: Huang, 2018). Furthermore, in the field of transportation planning there is a vast contemporary literature on survey methods and techniques (see: Allen et al., 2012; Richardson et al., 1995). Last but not least, there is a whole field explicitly focused on the development of a general survey theory (see: Fowler, 2014; Franklin, 2010), with which land-use planning theory has felt no need to engage.

While this article has not investigated the exact reasons for this omission, it is my belief that itis related to more extensive weaknesses of contemporary land-use planning theory. Alexandros Ph. Lagopoulos (2018b, p. 1), for example, states that the whole field of land-use planning is currently characterized by a relative lack of systematic analysis regarding the theoretical and technical aspects of planning, a neglect of methodology (including land-use survey methodology), and a lack of interest in clarifying key concepts. It is precisely this lack of proper methodological development in spatial theories that is perceived as the theory-practice gap (Alexander, 2016; Breheny, 1983) and needs to be addressed.

It is my aim, and the main underlying objective of this article, to bring this omission into the spotlight of academic research. This is not a desire emanating from a personal whim regarding the agenda, scope, and orientations of contemporary urban land-use planning theory. It is an aim based on a pragmatic viewpoint and related to the *strong negative impact* this omission has had on practice and, all the more, on the potential of land-use analysis, as documented by the particularly simplified and empirical approaches of contemporary textbooks to the issues of urban land-use survey. With regards to the potential of urban land-use analysis, the international literature (see: Browning, 1965; Harrison, 2006) explicitly notes that the development of a consistent and methodologically sound approach to the survey and classification of land uses:

(a) will improve the quality of data collected and will minimize the surveying time and the resources needed,
(b) will allow the inventory of land-use information in a detailed, very flexible database with a standardized coding, with numerous post-processing capabilities,
(c) will allow the easy periodic update of existing surveys and thus the production of new datasets in a fraction of the time that is needed to perform an all-new survey,
(d) will allow the easy access of individual researchers and planners to large amounts of detailed land-use data across the globe, and
(e) will allow comparisons among cities and, even more important, will allow time-series analysis of land-use data.

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