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Culture meets Flows: The Cultural Dimension of Urban Metabolism

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ABSTRACT

Cities play a key role in the transition towards sustainable development, with the majority of the world population living in cities by the end of the century. A successful transition therefore must involve a fundamental transformation of existing production and consumption patterns in cities. Recently, the concept of urban metabolism has gained increasing attention for its potential to develop alternative understandings of the functioning of cities derived from comparing cities to natural ecosystems, therein proposing new urban development pathways. In an urban context, the metabolism can be holistically seen as the result of social relations, power and discourses, and their connection with flows of resources, materials and energy. This definition can be extended to include culture in order to address the important question of consumption patterns. This paper aims at providing a cultural perspective on urban metabolism. By focusing on consumption of individual agents, we aim to open the “black box” of the city, to better understand the role of culture in influencing metabolic stocks and flows. Therein we will address how culture influences people's choices of certain flow, examine the relationship between the urban cultural landscapes and individual agents, as well as possibilities to expand sustainable lifestyles beyond cultural niches.

Keywords: Urban Metabolism, Lifestyles, Urban Cultural Landscape, Consumption Patterns

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1. INTRODUCTION

Cities have become significant centres of consumption and processing of resources. They use around 75% of global resources and 80% of global energy supply, and are responsible for about 50% of the total global waste production and 75% of total carbon emissions (Hoballah & Peter, n.d.). In the last decade, cities have been growing particularly fast. Since 2007, more people were living in cities than rural areas (Swilling & Annecke, 2012), and it is expected that by 2050, 66% of the global population will live in cities (UN, 2014). Fragkias et al. (2013) predict this number to reach 90% by 2100. This trend will continuously increase the global pressure for natural resources and waste disposal, which appears to increase proportionally in accordance with cities' size (Fragkias et al., 2013). Ultimately, these developments can compromise the maintenance of urban populations and therefore threaten other functions that cities provide to the entire world (Bettencourt, Lobo, Helbing, Kühnert, & West, 2007). Aside this background, a better understanding of the internal mechanisms of cities is required to develop measures that can appropriately address cities' hunger for resources.

There are arguably a large number of components in a city that together produce a determined behaviour. One fundamental aspect to consider is the way that cultural norms dictate people's' behaviours in regards to individual consumption patterns. These actions repercute in a city's resource demand and waste production. Some authors have even advocated that using the perspective of consumption patterns commits to the interpretation of city's flows based on a human-focused framework (Keirstead & Sivakumar, 2012). Following this notion, this paper pursues the idea that the overall pattern of behaviour of a particular city results from the interactions that occur among different actors at different levels. These interactions are subject to controls derived from bottom-up and top-down forces that operate simultaneously and are constantly changing due to feedback processes that reinforce certain behaviours. This constitutes a dynamic process from which a particular behavioural pattern emerges.

However, the intervention of such processes with the purpose of changing undesired behavioural patterns requires a profound understanding of the dynamics within the city. Looking at the city as a complex system allows us to identify the root causes of problems (Meadows & Wright, 2008), as well as seeing new opportunities to address unsustainable trends in urban systems. The concept of urban metabolism is a promising approach through which we aim to understand the dynamic processes that occur within a city from the perspective of urban lifestyles, consumption patterns, and cultural norms.

We propose a combination of existing theoretical approaches to understand consumption patterns, at a city level, as the visible manifestation of dynamic cultural norms and values. Thinking of consumption patterns as part of the city's urban metabolism shows how interactions between various levels of cultural groups (micro to macro) can shift dominant cultural paradigms, and result in different top-down and bottom-up mechanisms reinforcing the new cultural norms.

2. A MULTI-LEVEL FRAMEWORK FOR URBAN METABOLISM

The concept of urban metabolism emerged from the ecology field as a way to link environmental and human development (Golubiewski, 2012) by theorizing and describing the existing networks and flows of a city (Broto, Allen, & Rapoport, 2012; Hoballah & Peter, n.d.). It was originally adopted from the field of systems ecology, where it was created for the purpose of studying an entire ecosystem as a unit (Odum, Odum, & Andrews, 1971). The analogy is that ecosystems are "super organisms" that interact with their environment to support life (Patten &

Odum, 1981). In practice, this concept has frequently used in the field of industrial ecology as an accounting method for the input-output of material flows (Hendriks, Obernosterer, Müller, & Kytzia, 2000; S. L. Huang, Lee, & Chen, 2006; S.-L. Huang & Hsu, 2003; Sahely, Dudding, & Kennedy, 2003). However, this approach only depicts a momentary condition of a city and explains little about the internal dynamics that shape it and therefore it provides no sound evidence base to formulate and implement strategies to transform the urban context, e.g. towards sustainable city development.

In nature, the metabolism determines most of the important events of an organism's life (from creation to death). At the level of an individual organism it therefore sets the demand for environmental resources and its allocation for survival, growth and reproduction (Brown, Gillooly, Allen, Savage, & West, 2004; West, Brown, & Enquist, 1997). At an ecosystem level, the added effect of metabolisms from different individuals produce overall features that determine a large part of population dynamics and the structure of populations in community organization. Following this, the metabolism is a control factor that operates at the individual level but causes impacts at higher levels of organization such as populations and ecosystems. The link between the performance of individual organisms to the ecology of populations, constitutes the foundation for the metabolic theory of ecology (Brown et al., 2004).

At the organism level, metabolism depends on two interacting processes determined by body size and temperature (Savage, Gillooly, Brown, & Charnov, 2004). We argue that these two factors operate through different mechanisms: inside and outside mechanisms. Inside mechanisms are self imposed by organisms and cause a constraining effect in which the use of energy and materials is optimized with the purpose to minimize energy losses (body size). Outside mechanisms are based on the relation between the organism and its environment (temperature). Inside and outside mechanisms can also be seen as bottom-up and top-down forces, respectively. Interaction between these two forces determine the appearance of patterns at the organism level, which influence a dynamic behaviour of certain variables. Very often, these variables also act as factors that respond to but also influence, the occurrence of patterns at higher levels. For example, it is well known that bigger organisms exhibit lower metabolic rates than smaller ones. This pattern has a lowering effect on other variables, such as reproductive rate. The effect of this variable constitutes a factor that lower numerical abundance of bigger organisms, contributing to the emergence of a pattern at the population level. The same situation applies at the ecosystem level: differences of weights and numerical abundance of different species determine to a large extent the relations between predator and prey that conform the trophic organization in a community. We suggest that inside and outside mechanisms are different, but sometimes related.

Understanding ecosystems as complex systems (Chase-Dunn & Anderson, 2005) and using this understanding to compare cities to complex ecosystems, we argue that internal elements of cities are organized as in nature, in a structural way that affect each other and together produce an effect that differs from the added effect of individual elements on their own; and therefore contribute to emergent patterns at higher levels. Thus, patterns (e.g. flows of materials and energy) at the city level are the visible manifestation of the city's dynamics, resulting from interactions between top-down (outside) and bottom-up (inside) mechanisms at lower levels of organization in the city.

In urban field studies, Bretagnolle and co-authors proposed a theory of organization of cities and systems of cities as multilevel networks (Lane, Pumain, van der Leeuw, & West, 2009). According to them, emergent properties of a city can be a consequence of dynamics occurring at internal levels, which resembles the previous arrangement discussed for natural ecosystems.

Following this notion, organization of urban systems is proposed to occur at three main levels (Figure 1): micro level, comprising individual agents (individual people, firms, institutions) that interact with each other in a city; meso level (the city itself as a geographical entity with defined boundaries); and the macro level that is defined as the system of cities built up from a large number of towns and cities that interact under unified control (e.g. national political territory or global economic network) (Lane et al., 2009). In this paper we propose to extend the aforementioned three-level approach with a fourth, intermediate aggregated level which better characterises how the interactions among individuals and groups at the microlevel emerge and become apparent at the city level. The analysis of these levels will allow for a better understanding of the significance and larger effect of the interactions among aggregated individual agents with regard to their influence on a city level (e.g. effects on supply chains or socio-economic stratification).

Based on the appraisal that links metabolism to dynamic processes in nature, we propose to use a parallel approach to describe the dynamics of cities in terms of how aggregated effects of individual consumption patterns (the inside and outside mechanisms) affect structures at each level of organization and result in a dominant expression of culture at the city level. Thereby, we highlight the relevance to characterise urban metabolism through different urban levels and the patterns occurring along them.

We proceed as follows. First, we establish cultural norms and values as a key factor in people’s individual and collective consumption patterns. Second, we introduce lifestyles as the aggregation of these collective consumption patterns. Third, we propose that the interaction between lifestyle groups lead to the emergence of an expression of culture visible at the city level, which affects the city’s overall metabolism.

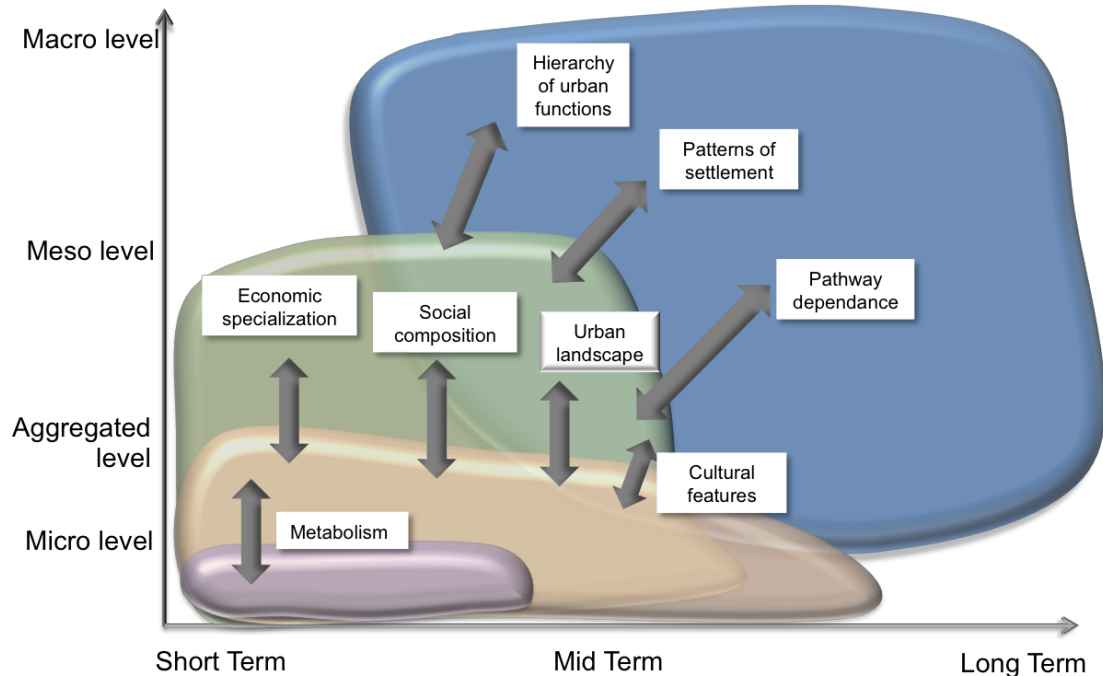


Figure 1: A proposed multilevel framework for Urban Metabolism distinguishing four interacting level of analysis.

3. URBAN CULTURAL LANDSCAPE AND CONSUMPTION PATTERNS

Culture in and of itself is a constantly changing concept: its transient and mobile nature can be seen historically, as dominant cultural norms shift from place to place and from one time to

another (Ohnuki-Tierney, 2005). UNESCO defines culture as a shared pattern of beliefs, attitudes, knowledge, and practices among a group of people.

As described by Lo & Wang (2012), “consumption exemplifies the ongoing dialogue between economy and culture” (2012). The United Nations Environment Programme (UNEP) mentions consumption patterns in Chapter 4, “Agenda 21 - Changing Consumption Patterns” (UNEP, 2015). It does not give a clear definition on what consumption patterns are, however, it mentions several key areas that are connected to the idea. First, consumption patterns fulfil specific consumer needs. These can range from covering basic, physiological needs to self-actualisation. Second, consumption patterns are related to the demand for natural resources and require a certain input of natural resources for their provision. Third, most consumption patterns cause environmental pollution and produce waste materials. Fourth, consumption patterns show an unequal distribution among countries; in developed countries, consumption patterns show a higher use of natural resources compared to developing countries. In acknowledgment of the connected problematics, UNEP recognises the need for action towards a general shift to sustainable consumption patterns. Using the UNEP framework as a foundation, this paper defines a consumption pattern as a single or series of repetitive behaviours performed by individuals; making use of similar physical resources or similar services to satisfy a personal need that is formed by their belief systems or culture. Including culture as a driver for individual and collective consumption patterns, emphasizes the ever-changing nature of the interaction between the different cultures and hence, existing consumption patterns. People of different cultures, with different lifestyles, could demand certain goods thus changing local marketplaces as they adjust to meet these new demands (2012). Intangible cultures are a driver for individual decision making, and individual consumption patterns, which when conglomerated, affect the city’s urban metabolism. Consumption patterns of both dominant and minority cultures, then, create a change that can be seen on a larger scale.

For the purpose of this paper, we describe culture as a collective common lifestyle, taking into account individual's' contribution to dominant culture systems through their consumption choices and tastes. There are two sides to culture that both individuals and collectives participate in: the intangible, which encompasses belief systems, practices, and knowledge; and the tangible, which encompasses physical objects that the group has created. The tastes in either of these aspects help form ‘Diderot unities’ (McCracken, 1990) or groups in “which members are assumed to consume an assortment of objects and symbols that express their identity (Holt, 1997).” As such, tastes, taking the form of consumption, not only create symbolic boundaries of groups (Lamont & Fournier, 1992), but are also expressions of them.

These types of boundaries are found in the urban cultural landscape, where The density and diverse population allows for the emergence of varied lifestyles where individuals can express themselves according to their tastes and values. These lifestyles, in turn, interact with and influence each other and their shared environment through their different consumption behaviors. The studies surrounding cultural landscape analyzes how the intangible aspects of culture shape and are shaped by the tangible, specifically, the physical environment (and vice-versa). The field of study is too broad to go into detail, but what is important to understand is that intra- and inter-human relationships interact with their physical environment, creating lasting effects on the latter. This is an important connection to make, as *how* this interaction plays out is where consumption patterns that are ingrained in cultural norms become significant in terms of a city’s ongoing urban metabolism. The urban cultural landscape is both the process and the product of the cultural identities interacting with each other and the city itself (Calcatinge, 2012, p. 115). The existing interactions between the members of different ‘diderot unities’ influence lifestyle choices on an

individual level; which can be multiplied on a larger scale, reflecting changes in dominant cultural practices.

One example of such a shift in cultural practices is the historic societal transition from agrarian to service and industry based economies (Krausmann, Fischer-Kowalski, Schandl, & Eisenmenger, 2008). The industrial socio-metabolic regime that rose in the 19th and 20th century led to the growth of urban/industrial centers. This socio-metabolic regime can be defined by industrialization, a spark in population growth and a surge in energy use per capita (Krausmann et al., 2008). As the industrialization settled, the working population transitioned from labor intensive jobs to service sector activities, allowing for patterns of mass production and consumption to emerge and become more defined. This transition was based on various technological advances that allowed populations in urban areas to access and consume resources from far away (Krausmann et al., 2008), thus accelerating the migration from rural to urban, making the city one of the most important settings for analyzing societies worldwide. This shift towards urbanization is also indicative of how inner and outside forces (such as technological changes), are influential in consumer tastes and in the development of cultural landscapes. Today's cityscapes can then be read as tangible manifestations that are laden with contemporary cultural values, which have developed over time in line with overall economic growth, globalization and the rise of capitalism.

In an industrialist, market driven society, although many lifestyles can coexist in an urban center, usually there is one or two prevailing lifestyles that become dominant and shape the urban landscape. Determining the dominant lifestyle that shapes the landscape is an important question that falls outside the scope of this paper, but looking back in history one can see how dominant groups have shaped urban landscapes and left a lasting impression on the city's metabolic state. One example of this is the bacteriological city model that rose as an answer to the chaos of the 19th century industrial city to create social cohesion and protect the political and economic functions of the city (Gandy, 2004). Elite European cities were the first to have modern sewage systems, their leadership set new moral codes, ideologies and modes of social discipline that spread to urban-industrial areas worldwide. In this example water is not just a material element to be measured for efficiency and contained, it also evolutionized cities, created new capital flows, and became part of the socio-political structure of urban space (Gandy, 2004).

4. CONSUMPTION PATTERNS AGGREGATION INTO LIFESTYLES

Consumption is an important feature of individual life and used by people to reaffirm their socioeconomic status in their community (Warde, 1994). A thorough understanding of consumption patterns and their impacts thus should take into account the wider life circumstances of people. Lifestyles are one way of describing the life circumstances of people. Some cities are particularly known to represent a specific lifestyle image. Berlin, for instance, is described as a 'hipster' city (Edelstein, 2013). Amsterdam, on the other side, was named the first 'Sharing City' of Europe in February 2015 (Shagana, 2015). Both examples give rise to the question of whether and how dwellers in these cities are transforming their lifestyles towards a new urban 'way of life' (Wirth, 1938). Lifestyles have generally been researched using the two prominent concepts personality/values approach (e.g. VALS in Kahle, Beatty, & Homer, 1986) and object signification research (e.g. Miller, 2001). These approaches can be applied to group individuals into different lifestyles that aggregate a variety of social factors (Holt, 1997, p. 327), such as sustainers, belongers or emulators (Kahle et al., 1986). However, both the VALS approach and object signification approach face numerous limitations for studying lifestyles and consumption patterns in increasingly complex contexts such as is evident from modern urban life.

Poststructuralist lifestyle analysis (PLA) (Holt, 1997) has consequently been proposed as an attempt to account for the complex dynamics of urban life. PLA acknowledges that lifestyles can change over time and across societies due to social, political, cultural, economic and technological changes that are explored and reflected by individuals through consumption patterns (Holt, 1997, p. 342). Moreover, people often experiment with new lifestyles as they emerge, but even if new ones do not emerge, existing lifestyles are constantly evolving as their meanings are constructed by relational differences with a constantly changing set of alternative lifestyles. From a lifestyles perspective, consumption is not only a means to satisfy needs but conceived as a field of social life that is organised by the expression of tastes (Holt, 1997, p. 343). As a group, people who share similar social conditions acquire similar tastes that organise their consumer actions; lifestyles socially pattern these formations. From an individual perspective, lifestyles are expressed as patterns in how one consumes across multiple categories through time (Holt, 1997, p. 344). Although individuals can individualise their consumption and construct innovative ways of consuming, they always express themselves within the existing frameworks of tastes in which they have been socialised.

In this paper we use PLA to define lifestyles as an aggregation of similar individual consumption patterns. We conceptualise that people adopt similar consumption patterns to reach three main objectives in a particular social context. Those are expression of tastes, reproduction of tastes, and transformation of tastes.

5. LIFESTYLE INTERACTION AND URBAN CULTURAL LANDSCAPE

In this section we propose a conceptual framework (Figure 2) that combines the aforementioned theoretical elements from Section 2, 3 and 4. The multi-level lifestyle framework describes changes to the aggregated level of the urban metabolism of a city over time. Lifestyles are expressed as consumption patterns and shaped by the development of market supply (provision of goods and services to be consumed) and demand (expression of tastes through consumption of goods and services). We distinguish three lifestyle types according to their potential to transform the aggregated level. The expressive lifestyle is considered the dominant lifestyle of a city that has shaped the aggregated level in the past. The transformative lifestyle is corresponding to a newly emerging pattern, initially produced by individuals in a social niche, with the potential to shape the aggregated level in the future. Similarly reproducing lifestyles are expressed in social niches. However, in contrast to the transformative lifestyles, those consumption patterns are not collectively shared by a significant number of individuals and therefore considered to reproduce themselves at a constant pattern. A break-even point of cultural transformation is reached at the point in time when the previously expressive lifestyle is going to be replaced by the emergent transformative lifestyle. At this stage, the latter is facilitated by other (outside) mechanisms reflected at all levels of city organisation (e.g. recognition by city authorities, uptake of shift in consumer tastes by the market economy) to ultimately establish the new dominant cultural representation of the city. The interaction between expressive, transformative and reproducing lifestyle produces the urban cultural landscape.

consumption patterns have started off as a niche lifestyle to spread among people of different cultures, and initially different consumption patterns, to ultimately affect the city's urban metabolism at the larger scale.

7. CONCLUSION

With this paper we intended to provide a cultural perspective on the urban metabolism concept. We introduced a multi-level framework that distinguishes four different levels of an urban metabolism. Subsequently, particular attention has been given to the special features of the aggregated level. In our model, this level acts as the interface between the micro-level of individual agents and the meso-level of the city. We conceptualised this level using the notion of the urban cultural landscape that is transformed and shaped by lifestyles that form the aggregation of similar individual consumption patterns.

We hope to contribute to a better understand of the urban dynamics and for a better description of the underlying reasons for measurable changes in metabolic stocks and flows that had been used prominently in previous urban metabolism studies.

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