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The Material City

Potential for Urban Development in Mapping Material Processes, Erosion and Obsolescence in Helsinki

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Abstract

Urban development hinges on the availability of free space. The planned growth of Helsinki as reflected in the General plan of 2016 relies on identifying areas for infill in the urban fabric. In built-up areas there is a tendency to let the processes of urban change take place instead of top-down planning. This change is therefore not managed, but piecemeal, resulting in a patchwork of 'stamp' plans directed by narrow private economic considerations.

The life -span of buildings varies according to their material composition – also the type of a building and its spatial configuration affect its vitality. These attributes and conditions play a part in how long a building can endure before confronting the need for radical changes, and can be aggregated from open-source data and modeled using historical referents as benchmarks. This information forms a layer of probabilities in the city, revealing dormant locations facing imminent change.

By mapping the information of the material conditions on the topography of the city, we can identify potentials for development. Identifying these latent sites in the city and engaging proprietors and landowners would give new tools for the City to affect the change and renewal associated with turnover of the building stock.

Keywords: Urban metabolism, Helsinki, Urban design, planning

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Introduction

To create a framework explaining urban change, especially in the context of Helsinki, that can also function as a basis for actionable knowledge for public and private actors, we need to identify all the different disciplines and regimes that have to be accounted for. Concerning urban transformations, we need to separate city planning and development into wide ranging and long term operations and more local and specific processes; then complicate and refine the definition of a building in the city and challenge the analytical models of 'Urban Metabolism' as satisfactory for understanding the changing city.

This paper aims at outlining the multidisciplinary nature of the challenge and propose methods to arrive at points of convergence, in the form of a mapping combining cadastral, material (building historic) and land use information – and placing these in the context of the city as a sociocultural environment. First, planning and development in Helsinki is described and defined, especially concerning planning-led and developer-led processes (section 1.), then the concept of Urban Metabolism is discussed, especially in regard to understanding the urban fabric (built fabric) of a city in detail (section 2.),

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against this backdrop, the definition of a building is described, as a material configuration and a set of relationships, changing in time (section 3.). Finally, the conclusions of these 'essays' (section 4.) sums up the possibility for a mapping of the city, using the definition of a building introduced in section 3., aiming at actionable knowledge that can guide the processes described in section 1. The paper ranges widely across disciplinary boundaries, in the hope of finding locations of common interest and openings between different ways of assessing and planning urban change.

Planning Operations and Processes – Urban Change and Helsinki Today

The growth and change of the urban fabric of Helsinki happens through a number of ways, here described as *operations* and *processes*. *Operations* being planning decisions and the production of documents and resolutions by the city planning officials or by proxy (i.e. by the public planning authorities or by an outside consultant, like a developer or an architect) resulting in legally binding zoning plans – in line with the aims expressed through politically approved outlines, like the current general plan for Helsinki, approved by elected officials.[2,3] These operations are mainly led and initiated by the City, based on its monopoly on zoning and extensive land ownership.

A set of *processes*, maybe best described as 'organic'[4] partake in the formation of the city in a more case specific manner: opportunities are presented by the changing environment (economic, material, cultural), identified and seized upon by diverse actors and stakeholders. Usually reflecting wider trends, but always focused on singular projects and potentials. These processes are often driven by developers, looking for profitable opportunities – and as often in league with the City, looking for the balance for a private project that coincides with the public interest.

Operations – the General plan and planning as a blunt instrument

The goals of the City in the case of Helsinki are spelled out in the general plan, drafted by the appropriate agencies roughly once in a decade.[5] In the latest plan, one of the strategic goals is to make the city affordable through the building of housing and increase its competitive edge by focusing on an 'urban city environment' (Helsingin kaupunkisuunnitteluvirasto 2016). The tactical means of planning that are deployed for reaching this goal are threefold: zoning new housing in completely 'new areas' freed from earlier uses (harbors, airports), as well as planning built neighborhoods along 'urban boulevards', and proposing substantial infill densification (Helsingin kaupunkisuunnitteluvirasto 2016, 36-42), mainly along rail connections and around traffic nodes. Large, contiguous 'free' areas in the general plan are relatively unproblematic from the viewpoint of zoning guidelines and implementation, once the political foundations have been laid for the developments (as in the case of the Helsinki-Malmi Airport area). The urban boulevards present a set of political and technical challenges, the plans relying partially on architectural solutions and technical innovation[6], but the most considerable challenge of the plan may be the amount of infill densification (a third of the new housing units proposed). It will probably run quickly against the general opposition to infill (Farris 2001; McConnell and Wiley 2010; Vallance, Perkins and Moore 2005) as well as the decision making process concerning the Finnish housing company (Puustinen

[2] The planning system of Finland, and the dynamics between planning-led and development-led approaches is described concisely in Eero Valtonen et al. (2017).
[3] The latest plan approved by the City Council (Kaupunginvaltuuston kokous) 26.10.2016.
[4] Here understood as events that affect the turnover of the building stock in a city, but that are not centrally planned – events happening through the interaction between the material reality of buildings and their users and owners.
[5] Large scale General plans have been drafted during a duration of over a century: from Bertel Jungs plan of 1911, through plans in 1918, 1923 (not ratified), 1932, 1960, 1970, 1976, 1992, 2002, and finally to the plan of 2016.
[6] See http://www.yleiskaava.fi/tag/kaupunkibulevardi/ for an overview of some of the discussions and studies.

and Viitanen 2015, 475). The challenges are generally acknowledged in the plan, but as a remedy only a 'general regional overview' is proposed (Helsingin kaupunkisuunnitteluvirasto 2016, 41).

The general plan is an example of a top-down approach, a blunt instrument, constitutionally challenged in dealing with situations like infill densification in detail, where the realities of implementation are more complex than in situations of zoning 'free' land for new uses. The challenges and processes of integrative urban redevelopment, from the viewpoint of the planning organization and its processes, have been opened up in the work of Hirvonen-Kantola (2013), but here the main challenge to be highlighted is the friction between the public interest and the atomized private interests. The public authority can not use its planning resources efficiently for possibly very quarrelsome processes, where the number of apartments or amount of floor area or economic opportunity that can be added to a neighborhood is with a high probability not worth the effort and attention of the planning apparatus of the City.

Also the need for economic feasibility and quick development can force the hand of the City and different models for the City to delegate or 'outsource' the planning of more specific and demanding projects have been tried, most notably in the large scale developments of Central Pasila and Kalasatama in recent years and the Eiranranta area, where the decisions have arguably not resulted in solutions of greater environmental, contextual or architectural quality, than if planned by the public authority. The models used have secured implementation, but at the price of being examples of subsidized speculation and willing, as well as accidental, ceding of planning powers for sites and projects affecting the whole city region (on Eiranranta see Hyötyläinen and Haila 2016, on Central Pasila and Kalasatama see Lindgren 2017).

The 'broad strokes' planning tools available to the City makes it hard to achieve many of the goals set forth in the general plan, save stating a number of wishes concerning the future.

Processes – Myopic and Purposeful

In addition to ... planned urban change ... there is another level of change, a 'churn', that affects the city like a constant current

In addition to the above *operations* – planned urban change, centrally by the public authority or jointly with private actors – there is another level of change, a 'churn', that affects the city like a constant current. There is a turnover of the built structures in a city, sometimes languid and sometimes quick. The renewal and change of the building stock happens most spectacularly in the cases of war or other sudden catastrophes, but the daily transformation of the city is an usually slow and almost imperceptible cycle of upkeep, updating, extending, altering and rebuilding of single buildings or blocks in the city, one by one.

These transformations can be called *processes* – they are not the result of city plans or strategies, even though they can be affected by them[7], but they are planned as specific answers to specific material situations, usually by or with the immediate stakeholders. Processes of change can be triggered by a myriad of reasons – the performance of a façade material being deemed insufficient, fear of failure in the systems for water circulation and waste removal because of corrosion of the metals or plastics used in the components, a wish for more space – for sale or for the enlarging of existing spaces, a vision of a more profitable use for the building plot, or a more suitable one considering the present needs of its owners or controllers, etc. When dealing with smaller alterations, the immediate owners – for example the housing company – take the initiative and manage the process, in instances of larger projects, an investor or owner teams up with a developer for planning and implementation. In the Finnish context, the public authority acts as a gatekeeper and overseer, and in some cases comments on the process, but mostly stays out of the

[7] For example through subsidies for renovation leading to better accessibility, the public authorities easing up regulations for specific kinds of developments – like transforming attic spaces into apartments in Helsinki.

fundamental planning decisions.[8] The processes on this level of urban change can not be controlled or steered by the public authority, save for a slight weighing of the scales when private actors deliberate on their possibilities.

The role of *processes* in the change of the city is undeniable, as is the mismatch between the more general planning tools of the City and the challenge of controlling the very situated building-by-building transformation of the urban fabric. Surveying the city as flows of material and energy can provide us with a viewpoint, through the concept of Urban Metabolism, that may open an access to the triggering material actualities behind the processes.

Urban Metabolism as a Way to Understand the City and its Planning

The term 'Urban Metabolism' is used as a term describing the flows, repositories and transformations of energy and matter in an urban region. Metabolism, as a word ties the term to the metabolic processes of organisms and the relationships found in ecosystems. Kennedy et al. (2011) have divided the use of the term in two different 'schools', the other focusing on energy equivalents, the other on material flows. Here we will outline the ways in which urban metabolism has been used in understanding cities as material accumulations and how it has informed planning. Furthermore, we will argue that a number of the features of the city have been overlooked by the most prominent applications of urban metabolism in planning, and that these oversights reveal rich potentials for understanding the processes that shape a city, and harness this understanding when designing effective planning operations.

Describing the City

For considering the city as a material entity (as opposed to a network of connections, or a diagram of social relations or production, or any other abstract model) the relevant strain of studies around Urban Metabolism rely on uses of material flow analysis (MFA) developed especially in the 90s, by Baccini and Bruner (1991). Understanding the city as accumulated stocks (in buildings and infrastructure) in addition to flows is imperative, as construction materials are the second largest flow into urban areas, and the largest waste deposit.

The focus on flows in most studies - inputs and outputs - even while acknowledging the importance of the building stock and its composition (Kennedy et al. 2007) is often operating on the scale of a region or a whole city, and treating material accumulation either as general quantities or specific trace elements, mainly because of the nature of the available data. This turns the urban fabric, as well as the individual buildings and structures that it encompasses into a black box, an more or less unknown processor of material and energy.

Studies focusing more exclusively on the material stock accumulated in cities open up the processor and start to give us insights that can be used for planning as well as for assessing existing environments. For example Brunner and Rechberger (2002) call attention to the large material stocks built up in cities, and the risks inherent in hazardous materials as well as possibilities for 'city mining' and recycling. In their recent review of several studies on construction materials flows and stock with a focus on non-metallic minerals Augiseau and Barles (2017) highlight the different methods used in studies and their implications on the data. Their analysis of methods reveal the variation in the quality and coverage of data, often because a number of assumptions are

[8] This happens through the decisions on building (as well as alteration and operation) permits by the City of Helsinki, and by the requests of statements concerning cityscape and the value of the built environment in conjunction with this process. When a change in zoning is sought for, the City Council debates and decides on the proposition - when they are not considered 'minor' (for example only a raise of 20% of maximum floor area) and are approved by the 'council for the urban environment' (Kaupunkiympäristölautakunta).

made to simplify the model – from a homogeneity of material composition to similar lifetime assessments within groups of buildings. With their comparisons of studies Augiseau and Barles are able to infer methods (or more correctly combinations of them) that can be used in order to reach more accurate models of building stocks as well as their behavior in time.

Applications in Urban Planning and Design

Kennedy et al. (2011) have articulated the different applications of an urban metabolism approach to urban design (in addition to applications concerning sustainability reporting, urban greenhouse gas accounting and mathematical modelling for policy analysis). The application examples range from a reconstruction project where the plan (and more generally urban activities) can be assessed in terms of urban metabolism (Oswald and Baccini 2003), to examples of reviewing the ecological sensitivity of different urban plans (Quinn 2007), and ways of analyzing material and energy loops in neighborhood scale designs.

These applications retain the focus on material as substances – to be counted and measured – and thus are removed from the spatial reality of urban environments as well as the material reality of buildings. But methods for accounting for an artifact as formally and materially complex as a city - building by building – have been developed and they seem highly useful for understanding urban structures on a deeper level, see for example ‘Urban metabolism and the surface of the city’ (Deilmann 2009), where by using detailed geo-data and typological models (Urban Structural Types) the micro-scale of urban change can be revealed. Also the material reality ‘on the ground’ can be approximated by connecting the typologies to databases of construction materials and products – the added resolution to the picture is crucial, because it helps us differentiate an area or development into its actual ‘building blocks’ - instead of looking at the area as a black box with inputs and outputs.

Still, the even though we can present the city or the neighborhood on a scale that tells us about building type, material composition and the use and abuse of energy, we need to switch viewpoints once again for understanding the peculiar nature of a single building, in its materiality and environment.

What is a Building?

A building is a collection of material facts, that relate to its performance as a biological environment, its status concerning regulatory directives and its position entangled with cultural and economic realities. This twofold condition: a material composition in flux, and a set of contingent biological, cultural, legal, etc. relations – describes a building as a situated artefact, tied to its material reality and surrounding society. Below we elaborate on this definition, and the ways it can be used to interpret the built environment.

The Building Defined as Material and Space

A building is by definition a thing built, made of a number of materials, in certain proportions, combined in specific ways. This encompasses the fundamental structure of the building as well as its more ephemeral layers. All described by Stewart Brand (1995) as (paraphrasing and refining an argument by Francis Duffy): site, structure, skin, services, space plan and stuff. This breakdown is used by Brand as a way of separating the different durations or paces of the components of a building – it is also a categorization that often coincides with building conventions – the way buildings are put together, according to a division of responsibilities amongst designers and contactors – that extends to some measure to the materials and techniques used: poured in-situ concrete, copper encased in plastic, plate glass, insulating gasses, textiles and metal fittings all have their position vis-à-vis each other and the process of building. A building is not the raw sum of its material parts or embodied energy – it is a dynamic constellation that needs to be accounted for in its richness to be properly understood. For example, there is a qualitative difference between two buildings with the same amounts of concrete, insulation materials, timber, glass

and metals built according to different designs, by different construction crews and under different conditions. It is the difference between a dovetail joint and setting logs on top of each other – the same amounts of material can perform in a radically different way just because of their configuration.

This carries over also to the spatial and technical aspects of a building – the proportions of volumes of space, the way they are connected with each other and the exterior, not just what the building service conduits are made of, but also where they have been placed – encased in concrete, behind a molding or running in the open (this is a point heavily stressed by Brand). These are attributes that tell us about what the building consists of and also more importantly how it performs and what it can become.

The Building Defined as Relations

The building defined as the interdependent compilation of site, structure, skin, services, space plan and stuff – and their material composition has several relationships with its environment – that determine its meaning and value. Amongst other, the buildings biological, regulatory, cultural and economic surroundings are constitutional for its building-ness. They transform ‘a pile’ of material into a building, fit for habitation, work and production; to be sold as a commodity; that is able to tell about the values and relations of the people who built or commissioned it. These relationships are not ‘something extra’ – or added on, but essential for the building to exist.

As an illustration, it is a rare event that a building becomes a ruin because its material makeup alone. This is absolutely possible, and in most cases inevitable as a future prospect, but ‘ruination’ because crippling discord between the material reality of the building and its biological, regulatory, cultural and/or economic context comes usually first – making a need for change or dereliction imperative. This is the reason why surveys of material conditions are problematic without extensive regard for issues outside the strictly measurable brick and mortar. As conditions change, the building changes with them – we can see that most radically in the industrial ‘simple’ spaces with good bones turned into loft apartments, whether in SoHo or Helsinki, or in the more subtle ways that the deep building frames of the apartment blocks in Etu Töölö in Helsinki, built in the 10s and 20s, have answered the changing conditions around them: first the dimensions made possible arrangements for servant spaces, with double corridors and hallways, that then turned into problematic windowless square meters as the needs of society changed, but again made it easier to split large apartments into smaller units, according to the demands of the post-war years. Other kinds of transformations of buildings, where the actual material makeup doesn’t change – but its relation to its environment does – are numerous, from certain building materials being labelled toxic or dangerous (asbestos, lead, and so on) to new regulations being made concerning accessibility, energy conservation or fire-safety – rendering the same building suddenly in a different light.

The Building in the City

The building seen as a whole – its material reality as well as its relational qualities – does not easily translate into a measurable known quantity, to be used in modeling an urban area. But also, not every building can be treated as the subject of a building historic survey. However, methods and data for models that appreciate the qualitative aspects of the urban fabric are available – the challenges in creating surveys and models in ways that don’t miss the buildings for the city lie in the paring down of the data. Some of these methods are reviewed by Augiseau and Barles (2017, 158-159) and in the case of Helsinki we have surveys of buildings making it easier to make generalizations about their material composition and configuration (see Mäkiö et al. 1990, Mäkiö et al. 1994, Kaivonen 1994, Neuvonen et al. 2002, Neuvonen et al. 2015).

Conclusions and Complications

The material reality of the city is considered only in cases of immediate crisis – as in cases of deteriorating structures like collapsing bridges and roof structures or as an inconvenience to be overcome after a design has been settled upon – as in cases of remodeling without considering the strengths and weaknesses of the existing building. Arguably, answering to the material conditions of the buit environments plays a significant part in efforts aimed at vitalizing mono-structure neighborhoods i.e. suburbs built at once (part of the Neighborhood Project in Helsinki) – but it is also valid as an universal way of seeing the city and its potentials – an invitation to planned action by public and private interests also in more built up and heterogeneous urban areas.

Below a proposition for systematic mapping of the city – in a way that takes up the challenge of urban metabolism by defining the city as its material flows, transformations and accumulations, while taking account of the complex nature of a building – in a way that makes the map a useful tool for identifying locations for the planned operations of the city and opportunities for private actors.

The Image of the City

As a starting point for a mapping of the city that can be of immediate value for the urban designer or planner in identifying possibilities as well as assessing impact (applications listed by Kennedy et al. 2011), we need to use micro-scale modelling (Deilmann 2009) as a default 'resolution'. A micro-scale model can incorporate data for assessing the possibility of urban resource harvesting (Agudelo-Vera et al. 2012) through typologies and formal information, and act as an index on the different materials accumulated in the anthroposphere (especially in the construction stock) (Brunner and Rechberger 2002) for the management of hazardous waste as well as possibilities for 'city-mining'. For a full picture of the material city, we need to still augment the proposal by Deilmann (2009) for linking a model with databases of construction materials and products – for the information to be operational, we need to know the breakdown of the accumulated materials in a building as well as the way they have been configured (Brand 1995, Augiseau and Barles 2017). The dimension of time has to be reflected in the model – different configurations of different materials weather and corrode in different ways – and here the building has to be seen as a whole – a façade structure may get damaged beyond repair during a few years in a house without an appropriate sheltering roof design, while another with the exactly same material composition lasts for several decades with only minimal upkeep. A material model like this has still to be subjected to a review of the regulatory, economic and cultural context – the same material facts look different when the context changes. The interdisciplinary nature of this challenge is self-evident.

The Fecund Corruption of the Built Environment

The poetically powerful entry by OMA for La Dèfense in Paris (1991) proposed a somewhat arbitrary 'duration' for all the buildings in the competition area – presenting a plan that evolved in increments, 'liberating' the site for new development:

"… if we laundered the site in five-year increments simply by erasing all buildings over the age of 25, vast areas would be gradually liberated… We could gradually scrape whole areas of texture off the map and in 25 years the entire area would be available." (Koolhaas and Mau 1995)

The plan with the spirit of Le Corbusier hovering in the background made exceptions out of locations and buildings of significance (a cultural relationship) but otherwise can be seen as an extreme version of employing a map of the 'material city'. Here below a few proposal for applying the more nuanced mapping proposed in the earlier sections.

Positive and negative maps

A map of the material city that is used only to highlight the positions of probable weakness – the points where the urban fabric or single buildings are close to

ruin – can be called a negative map. The city as an organism slowly shedding dead cells that are then renewed or replaced. As in the example above, this way of seeing the opening of opportunities through material degradation has a certain clarity and simple charm to it. But as a way of seeing the city, even just the 'material city', it tells only half of the story. An assessment of the material qualities of the city, that highlights the possibilities provided for by its material configurations is equally compelling – a positive map. These two can combine a view of the 'facts on the ground' with the potentials for the future. We need to see simultaneously how a buildings 'inner layers' are eroding towards a total overhaul, while the structure is strong enough to carry a number of new floors. A map of negatives and positives.

The arcades project

A mapping of the urban fabric can present possibilities even in dense built up areas, as when the spatial and structural qualities of adjacent properties, that have to be renovated or altered within a close time span, make the creation of new interventions possible. For example, arcades crossing plot boundaries and opening up hitherto inaccessible locations. Here the need for material renewal can present itself as an opportunity for the City to enrich the uses and spatial qualities of central city blocks in a dialogue with the owners and operators of the buildings and spaces.

Serendipity

For private actors, a mapping of the city that makes it possible to localize the strengths and weaknesses of the built environment has several applications – from private citizens to assess their city and neighborhoods to property developers being able to systematically look for chances and openings. The processes of transformation described in the first section form the constant change of the urban fabric but it relies on first individuals identifying the need or room for change – a mapping of the material city is a way of seeing our environment as a number of potential futures and opportunities to be seized.

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