Literature Review

The ranking of dynamic cities through a proliferation model and demography of building types.

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June 2009
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Abstract*: Dynamic growing cities are currently ranked by human population alone- those with over ten million people being called 'Mega-cities', resulting in the attention of academic, government and industry commentators. Apart from ignoring emerging 'Mega-cities', as well as the relative growth in population between cities, the ranking takes no notice of the growth in 'building population' that is created and left as a remnant, of the growing population. Since 'building matter' (as a product of the building population) is a common denominator in the assessment of energy used by the built environment, a ranking system that measures the growth in building matter would inform the grading of our cities by environmental impact. The proposed method involves the creation of a 'matter making profile' for cities based on both 'population growth' and 'building population growth' recognizing that although related, each have their own actors and demographies, and therefore independent propensity to grow. Underlying the method is a 'proliferation model' which describes and measures 'matter making propensities and traits' of different building types based on an organic metaphor. The literature abounds with those who would (from many disciplines) seek to explain the dynamism of the changing face of our built environments, cities and Mega-cities through the frames of urban morphology, building typology, organic metaphors, physics based models, oncological frames, fractal analysis, satellite modeling and even Darwinian views, all of which inform the topic . Missing however is a simple measure of our cities by their building populations, with buildings viewed in demographic terms as a species, each with their own actors and propensity for 'making matter', the sum of which is a primary legacy of our civilisation.*

Key words: proliferation of cities, ranking of cities, mega-cities, growth modeling, urban morphology

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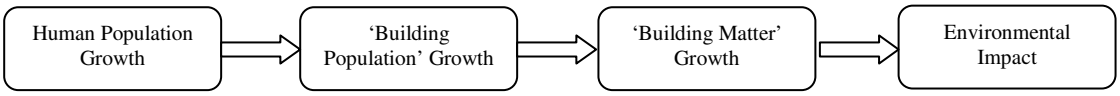
Introduction

The city consists of people and the accommodation of their needs in the form of built structures, which in aggregate are described in such terms as cityscapes, urban agglomerates, urban environments or the built environment.

The built structures are in the form of familiar building types - houses, apartments, offices, hotels, shops, hospitals, factories and so on. The community of these 'building types', form the 'building population' of a city. Each building type is normally described or categorized with its own characteristics and properties, the most obvious being height, floor plan, footprint, area and shape. Each are predominantly physical traits which are measurable at one point in time, similar to the static demographic measures of the human population e.g. age, race and gender.

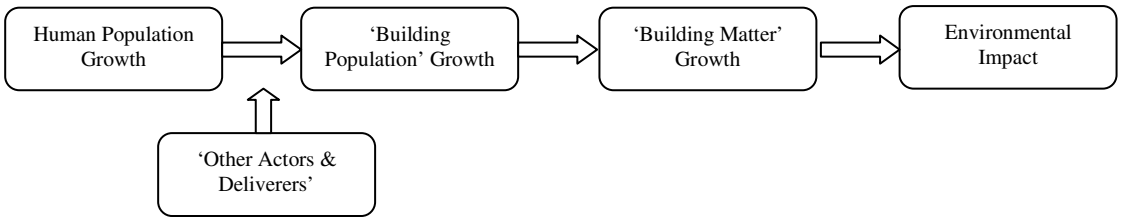


The static nature of these measures however, provides a 'snapshot demography' of building types, and not a dynamic view of their changing face, nor the propensity for building types to proliferate at different rates, independent of the human population growth rate. Time lapse would reveal that like plants in nature, each building type has an individual growth profile, as well as a pattern of growth in aggregate. Combining these two traits reveals that each species has a different 'proliferation model' and propensity to create the common denominator of all building activity- 'built matter'.

When viewed like this, the 'building population' of a city, comprising all the different 'species' of building, and like a garden or forest with their various species of tree, has a 'dynamic profile ' of its own which, along with the other 'static characteristics' form a 'dynamic demography', indicating the changing face of building types and therefore the building population.

It is easy to assume by simple observation, that the growth in this building population and the human population are proportionate and dependent- the more humans, the more buildings are demanded in a linear responsive manner. Both populations however do not always grow in line, or even at the same time.

The creation of new building types in a city may have no immediate relevance to actual current population growth, due to other actors who 'deliver' building types ahead of and in anticipation of the underlying population and growth. The property development mechanism which is the medium of one of these actors is notorious for its inability to match supply and demand, resulting in the proliferation of large and empty buildings that lie fallow for years. When this phenomena occurs, a city can be filled with empty buildings within the space of a few years. The new buildings it would seem have their own propensity to spawn and proliferate based on their own actors and principles.



Accommodation of corporate and industrial requirements are remotely related to human population growth, and more to anticipated growth in the need for corporate or industrial accommodation, spurred by simple macro indicators such as vacancy rates and economic sentiment. Accommodation of hotel requirements also have more to do with the increase in the transient population of visitors to a particular city or region. These non-residential building types, it would seem operate on a different set of laws and principles.

In the residential area, accommodation of human population growth is more directly related to growth in residential building population, however is also the subject of 'delivery' actors who supply based on prediction of demand or need.

Human populations in different cultures and cities also grow dissimilar building types for the same purpose. Mumbai's slums and shanties accommodate people in structures that involve far less ' built matter' per population, than alternative more advanced forms of built structures providing accommodation and shelter.

It is the understanding of inequities of the relationship between human population growth and building population growth, that is the foundation of the model proposed in this thesis.

To rank or view a dynamic city by its human population alone would ignore not only the population's propensity to proliferate, but the separate but related propensity for proliferation of its building population . Each in effect are related, but has a life of its own.

The method proposed provides a means of creating a ranking of dynamic cities by measuring, and classifying not only human population, but 'building population' using a demographic model based on the 'proliferation profile' of different building types. The key factor in determination of this model is the identification of a city's propensity to create 'built matter' over time.

Underlying the 'proliferation profile' is a 'proliferation model' for each building type based on an organic metaphor, that likens building proliferation to that of prolific plants in nature (bamboo[1]) which grow in clusters that are linked by a common shoot .

Topic Genesis & Development
The topic started with an organic proliferation model for tall buildings, with the title 'Bamboo Buildings- The proliferation of tall buildings in the cityscape'. The review focused initially on other 'proliferation models' resulting in the discovery of a large and diverse community who were interested in proliferation of cities, and who viewed it from different perspectives. There are many roads to the centre of town it would seem.

The topic evolved in the light of these commentators from the disciplines of geography, town planning, urban design, physics, architecture, oncology, satellite modeling and anthropology. This allowed for the reinforcement and expansion of the 'bamboo model' itself, to explain further actors and drivers, as well as a link to another organic metaphor which allowed for the separation of view of 'organic drivers' and 'organic remnants'. This separation added light to the idea of the action between humans and the built remnant they leave behind. The latter being far easier to measure than the former!

The Rise of The City

The year 2007 marked the first year in human history when urban dwellers exceed rural dwellers by number. By 2030 it is expected that two thirds of the world population will live in cities (Taubenbock 2009) (United-Nations The 2007 Revision New York).

Over the next thirty years world population is expected to increase from 6.1billion (in 2004) to 8.1 billion, (Molina 2004) and almost all population growth in the next 30 years will be concentrated in urban areas. (Taubenbock 2009)

In 1950 Tokyo and London were the only megacities (cities with a population of more than 10 million inhabitants). The number has increased to 22 today, (Molina 2004).

The average population of the 100 largest cities was 200,000 in 1800 and increased to 7.7million in 2002. Only two of the largest 10 cities in the world are in the developed world (Molina 2004).

The ranking of Megacities by population is 'assumed' across a number of groups including the 'Megacity Foundation' which draws on a collaborative approach by industry and academia. Despite the diversity of thought, theory and models viewed, none suggested (nor questioned) the ranking assumption.

[1] Refer appendix for original metaphor based on the proliferation of bamboo.

Diverse Schools of Thought

The dynamic emergence of cities and their impact on human and natural environments, is the subject of commentary from diverse disciplines - geographers, architects, environmentalists, anthropologists and town planners, not to mention those from the perspective of more unexpected frames such as oncology (Hern 2008). Common to each is the concern for what appears to be a compounding phenomenon, and the desire to understand the drivers, forces, patterns and laws of its behavior.

Throughout the 20th century the study of cities has fallen naturally under two separate key disciplines, in the form of 'built environment commentators (architects, town planners and urban designers) and geographers. Both disciplines share a common interest in cities and their development.

The two disciplines it would appear have not enjoyed a high degree of cross-collaboration nor congruence within their own disciplines, and although both focus on the physical forms of urban areas, each is missing part of the other's view(Whitehand 2001). Architects concentrating on typomorphologies and spatial analysis (sometimes in isolation) and geographers adopting the Conzenian tradition (which forms a foundation for both geographic as well as urban morphological study) are not familiar with spatial analysis (Whitehand 2001).

Within the commentators of the built environment, the British school has also only recently collaborated with the European (Italy and France), the two recognizing both the work of geographer M.R.G Conzen as a foundation for the emergence of 'urban morphology', and the further recognition of architect Saverio Muratori's 'building typology' as a basis for the definition of urban form (Moudon 1997; Cataldi 2002) (Whitehand 2001).

Revealed are not only the foundation theorists, from phenomenological views such as urban morphology (Conzen) and building typology (Muratori) , but also those who would seek recognition of the 'drivers of growth' of the city, including the 'politics of growth'(Molotch 1976). By other commentator's views, the roots of these various ideas are founded in the philosophical notions of time, space and place, and the categorisation of mental, spatial and social views of the city sourced from philosophers Foucault and Lefebvre (Mugavin 1999).

Relevant Studies and Models

Those who study the proliferation of our cities are not always categorically related to geography or architecture. The city and its impacts are far reaching, and effect a large number of disciplines. The following draws on the studies which inform not only 'dynamic building demography', but the 'proliferation model' proposed as a foundation for this topic.

Self Organised Criticality

Drawing on the works of Per Bak, and the 'science of complexity', which suggests that complex processes operate on simple rules, 'Self Organised Criticality'. This is explained by the metaphor of the 'sand pile', used by Bak to show how structures in nature move toward a critical dimension, and then shed excess matter to preserve their critical dimension (or shape) at what is termed a 'critical threshold'(Bak 1996).

Through his study of frontier town Buffalo using property tax data dating to 1773, (Batty 1998) views the urban changes in the town as it emerges from frontier to agricultural and then 'car city', from the

point of view of 'critical threshold', drawing on Bak's model by describing Buffalo's maintenance of 'its critical threshold' over the period. Bringing an understanding of the physical state of 'space growth' and 'space filling' using a scientific model based on a naturalists metaphor, is supportive of the use of an organic growth metaphor in the proposed study. It does not however necessarily coincide with the same growth traits of the proposed organic model (growth like bamboo) which relate more to expansive growth, without obvious consideration of 'space filling'.

In his study of Berlin over a period of 35 years from 1910 to 1945, Schweitzer found that "the growth of large urban aggregates (megacities) is analogous to the development of self-organised structures in physics". This suggested that megacities evolve towards a "hierarchichal form of spatial organization". Validating this in the Berlin analysis , he then simulated the likely pattern of growth in Daegu (Korea) up to 2010. The limitations of extrapolating from one city's data set is understood or implicit (Schweitzer 1998).

The study also found in the patterns of growth, a form of spatial organisation which " provides estimates of the size of sub-clusters that compose the urgan aggregate, and which emerge with a 'rank-size cluster distribution' that can be described by a 'Pareto coefficient'". The study offers that the coefficient may "provide a useful complement to structural measures of urbanisation such as the fractal dimension" (see fractal studies below).

A proliferation model nonetheless, it forms one of the many views discovered of the 'phenomena of the growth' using graphical aerial analysis. Cities are reduced to 'ink blot' patterns, and the movement and change in shape of the ink blot over a period of years is then analysed, by comparison to Pareto and fractal dimensions.

Like many of the models viewed, the convenience of aerial mapping and the 'after the event' view of the pattern of urban growth, does not provide a detailed understanding of the drivers and actors, that influence the 'change in ink blots', and instead appears to reduce them to mathematical ideas.

Like Batty, Schweitzer and Steinbrink attempt to descibe large amorphous city scapes through the use of a geometrical model which informs the patterns of change in the built fabric correlated to historical change

Fractal studies of urban land patterns and growth models

The fractal dimension is based on a geometric model of 'space filling' and 'space expansion', using simple shapes, which in aggregate explain large and complex amorphous masses like cities (viewed from the air).

Frankhauser provides a simple representation of this model using a pattern of squares called the 'Sierpinski Carpet', which emulates the way cities grow in blocks along roads. The model, which visually shows the way space both fills and expands along constrained geometric corridors, brings a clearer understanding the complexity of the city and the action of its individual physical elements (Frankhauser 2004).

Frankhauser's work is embodied in an extensive study of 15 European metropolitan areas across France, Germany, Belgium, Switzerland and Italy. Providing a rich comparison of the 'fractal model' across many different cities, showed the consistency of the model. The model itself is reminiscent also of

crystal and snowflake patterns, which are consistent with an organic or natural analogy, which contradicts the organic (bamboo) metaphor proposed, but supports the idea of an analogy to natural processes, viewed in a scientific (in this case geometric) manner.

Hern likens the "fractal dimension of Urban Morphology" to malignant neoplasms or cancers. The city shows three comparative traits- invasion of its host (the rural environment), de-differentiation (the spread of similar patterns), metastasis (distant colonization) and uncontrolled compound growth (in population). Using aerial views of London, Berlin , North Carolina and Baltimore-Washington over several decades, the changing patterns were analysed and compared, to similar patterns from advanced cancer cells (Hern 2008).

Although limited to a 'graphical analysis' of patterns also, the use of a cancer as a metaphor is relevant noting "metaphors summarise complex realities in ways that make them understandable" . The categorization of the four different growth traits is highly relevant to the organic model proposed, for the 'bamboo metaphor' proposed also shows the four similar traits of host invasion, remote colonization, de-differentiation and uncontrolled growth.

Object Oriented Studies and Classification Methods

The German Aerospace Centre uses 'multitemporal remote sensing' satellite observation, to obtain highly detailed images of our cities and then uses "object oriented classification methodologies for automatic detection of urbanized areas". Taubenbock & Roth use this technology together with a method used which allows the detection of "temporal and spatial urban sprawl, densification processes, and urban development at city level". Studying images of Moscow and Turkey over three decades, they used this process to 'clarify' and 'filter' the key features of each city, and their changes with associated comparisons (Taubenbock 2009)

In their other study, Taubenbock & Roth use the same technology to develop 'thematic land cover classifications', 'develop region growing rules' (colonization) and map 'homogenous zones of urban morphology'. (Taubenbock 2006)

Although satellite technology is probably the only means of 'real time' survey of our cities, the satellite resolution, although impressive did not appear to allow for individual observation of building types' and was more helpful for overall 'city growth phenomena' observation, and general changes in cityscape.

The images that were provided of the changes in the two cities in the first study noted, and the comparison of their urban sprawl and restrictions due to topography, informed the understanding of factors that constrain the growth of cities, but was not central to the study proposed.

Herold uses similar satellite technologies and 'object orientation' to classify urban areas into land use categories. 'Spatial metrics and texture measures' are used to describe land cover objects. Spatial metrics were apparently more effective in these categorizations. The relevance and limitations for this study are similar to Taubenbock (Herold 2003).

The school of object orientated analysis has arisen it would appear, from the benefit and limitations of satellite based analysis. The studies help with real time description in photographic and graphical terms of the earth's urban situation. However due to the resolution of imagery on a macro scale, the need for matching real structures with apparent 'object oriented descriptors', provides a sense that one is trying to

read 'ink blots', and interpret the elements that go to make up the overall image. This school of thought however helps greatly in providing a global view of the physical spread of cities, and the patterns they form over time.

(Zhang 2004) takes a more detailed view by using GIS-based land use data to "quantify the spatial pattern of urbanization in Shanghai metropolitan area". Focusing on 'edge density', 'patch density', 'patch shape' and, 'patch size' he determines how these aspects change with increasing urbanization. A useful study to show the more detailed effects of proliferation, however in a similar vain to the 'object orientation' approach, the study describes the phenomenon in terms of the physical remnants only.

Urban Morphologies

The earliest observers of the phenomena of the city as an amorphous complex mass, arose in the late 1800's with the works of Schluter in 1899, where he defined the 'ground plan of towns' and 'aspects of settlement geography' (Whitehand 2001). The more recognized founder of town planning principles M.R.G Conzen, arose in the 1930's and started the Conzenian school of thought, which formed the foundation for the discipline of 'urban morphology', or the study of the changing face of our cities.

Conzen [2] in his study of a mediaeval township, introduced the idea of 'morphological elements' that explained the division of the city and its components, linked to individual action through the introduction of the 'morphological region', 'the fringe belt' and 'the burgage cycle'. These ideas were consistent with the ideas of space filling and space expansion, through outer regions which is consistent with the organic model under study.

Saverio Muratori, spurred by the rise of rationalism in architecture and city building during the mid twentieth century, drew upon the rich philosophies of architecture and history and placed them in context with urban design (Cataldi 2002).

Muratoru and Conzen are hailed as the founders of urban morphology. With Conzen's roots as a geographer with deep interests in town planning, and Muratori's emphasis on history and architecture, a new discipline emerged to form a foundation of a movement in urban thought. This movement is supported strongly today across Europe, by the creation of the "Urban Morphology Research Group" (Whitehand 2001), (Kropf 2001) (Moudon 1997).

The urban morphological view provides a view of individual action and its aggregate, by viewing the city as phenomena and remnant but more emphatic on the latter. This view is informative and places the study perspective clearly in the area of the 'drivers of individual action' that would add to the view of the urban morphologists.

Individual Elements: Dynamics Of Interaction

In contrast to the 'as built' or phenomenological represented above, the idea of individual action of the 'parts', that make up the whole aggregation, are brought to life by the drivers of human action, corporate growth and political power, by various commentators.

[2] Whitehand refers to Conzen's foundation work in M.R.G. Conzen, 1960, "Alnwick, Northumberland: a study in town-plan analysis", Institute of of Britich Geographers Publication, No 27 (George Phiip,London). In Macquarie University Stack.

Providing a foundation based on the idea of 'land based elites' who act with 'power over land' , Molotch's political and almost tribal view of the drivers behind the changing face of the city, provides a connecting view of urban morphology and building typologies.

Central to the drivers in Molotch's view, are the notion of growth and power embodied in a city viewed as a 'growth machine'. The drivers mentioned are at the heart of the proliferation model proposed, which views proliferation in terms of factors such as 'available habitat' and 'seasonal conditions for germination'. Growth and the dynamics of the property delivery mechanism are intrinsic to Molotch's view of the world (Molotch 1976).

Van Den Burg studies the city in terms of 'growth clusters' that form around commercial interests, such as telecommunications, health, tourist, media and audiovisual sectors. Explaining the clusters' emergence through 'fruitful cooperation between economic actors who form innovative networks', the study explains the drivers which lead to 'cluster based proliferations' of building centres' that informs the study by providing an increased focus on 'centres of influence', that are a source of growth (Van Den Burg 2001).

Molina commentates on the driving forces behind the formation and growth of megacities, and their consequences. Impacts on climate change are evaluated. This commentator provides background research that supports the importance of proliferation studies. Similar commentators abound like Molina, but do not provide direct emphasis on proliferation modelling (Molina 2004).

Gibson shows the imbalance in the demand and supply mechanism between the supply response of property development, and the demand trigger of corporate real estate. Based on the writer's experience, the inefficiencies in the development mechanism can lead to oversupply due to inadequate understanding of demand triggers in the market place. This has relevance to the dynamics of the proliferation process (Gibson 2001).

Organic Metaphors

The human population of the city in organic terms, can be seen as the 'soft inner organism' (of the city), whilst the built environment is the 'exoskeleton', shell or remnant that is created as a result of their needs . This 'organic' view pervades the literature, the most notable foundation being Dawkin's 'extended phenotype', which proposes that creatures of nature, like birds and beavers, create nests and damns, as part of their genetic make-up or code. Cities, are by this analysis a product of the 'genetic code' of their associated species- mankind (Kropf [3]).

Kropf comments on the extensive history of organic metaphors, but notes the tendency to 'conceptualise the development of architectural styles in terms of a life cycle', where early, high and late styles, relate to growth maturity and decay(Kropf 2001). [4]

[3] Kropf expands on Dawkin's phenotype in his article (Kropf 2001). Further reading required Dawkins 1982, The Extended Phenotype, (Oxford University Press, Oxford).

[4] Kropf references Malfroy who provides a detailed summary of organicist metaphors in his article "On the question of organicist metaphors", Journal of Urban Morphology,1998 vol 1, P47-50. Mis-referenced still searching for this article.

Central Themes & Foundations

The various approaches are based on different views of the same thing – an amorphous city comprising individual elements, and the drivers that act between these two aspects.

The morphologists and those who adopt fractal, object oriented and self criticality frames, are all similar in that they seek to explain the drivers, forces and laws by examining the phenomena of the changing pattern in the physical fabric of the city. They are in a way like the readers of tea leaves (without limiting the importance of their work), watching the scatter of leaves in the bottom of cup, making out the patterns, seeking significance and reading meaning.

The view is in a sense 'modern archaeological', through studying cities within the last three hundred years based on available data using GIS, tax data and satellite imagery. This approach seeks meaning in the separate parts, and their interaction and causation of the aggregate, but by view of what has already happened historically.

The other school of thought is more 'metaphysical', (not in the spiritual sense) but accepts the existing physical fabric, drawing on the data from the morphologists, and explaining in a micro sense the drivers and laws that cause the parts, not the whole. In their considerations the aggregate of these actions is the cause of the patterns in the tea leaves.

The use of organic metaphor to bring light to this latter view is seen as 'simplistic' but , like Per Bak's sand pile helps explain complex ideas in clear terms. ((Kropf 2001), Malfroy)

Behind the two views of the proliferation of the city, is a divide in the philosophical foundations of thought related to how one views space, time and place. Daniel Mugavin brings light to the idea that morphology must surpass the bounds of 'material' thinking, and include 'mental' and 'social' views of the phenomenon. In this analysis he draws on the philosophical views of Michel Foucault and Henri Lefebvre .

Foucault's works focused on the 'nearness of both time and place', later extending his view to historical and political perspectives, using 'the prison' as an example of the use of power and space. Space and place accumulates history as time elapses, giving enduring meaning to place. (Mugavin 1999)

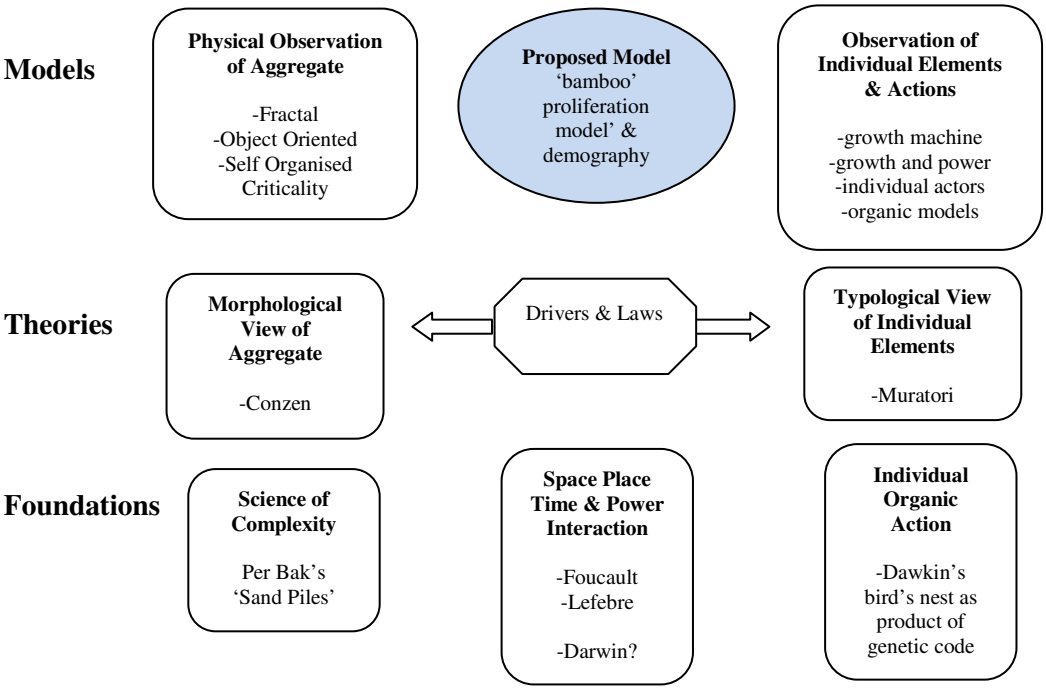
Lefebre placed importance in the idea of social space "unrelated to Cartesian references" and more to 'mental state and view of space'. (Mugavin 1999)

These views aligned somewhat to the different themes viewed, with urban morphologists' focus on space and place, whilst the individual action models included political and social factors. This does not mean to suggest lack of emphasis on this by the former, but lesser relative emphasis.

Finally, a more evolutionary view of urban morphology and building typology is explored by Kropf who analyses both, through the 'ontogenetic' change (or developmental view) and 'phylogenetic' change, (evolutionary view) drawing on Darwinian ideas. By this account, lacking in the current wisdom is the understanding of an evolution of the morphological view. This particular 'evolutionary' aspect, has helped with the limitation of the proposed organic model, which works on the basis of a developmental view of a dynamic phenomena- the proliferation of our cities, and not an evolutionary view.

The aggregate of the views noted to this point have been represented in the literature model shown below, where the various ideas are placed in three layers; foundations, theories and models, showing the founding of the various disciplines in the early philosophers. It is interesting to note that Per Bak, Charles Darwin, Lefebre, Foucault and Dawkins hold a place in the foundation of the themes noted. Drill far enough down it would seem and you end up with philosophy!

Map of Themes



Positioning of The Model in The Literature

The study involves the 'ranking of dynamic cities through a proliferation model and demography of building types'.

The review has shown that there is no apparent alternative ranking system for dynamic cities ,which strangely, is a shared assumption by commentators across all disciplines and schools of thought. The review however nly sourced literary articles, and did not drill into the more generalist literature and community knowledge across interest groups. The latter seemed to share a common theme of concern for the environment, which would be advanced by the creation of a more relevant ranking system.

The idea of studying proliferation is common to many of the approaches studied, with diverse (and historical) commentators and researchers seeking the same understanding of the one problem-proliferation of our cities. Although it would appear that the road has been covered already, the above

map shows the potential gaps in the connecting the two schools of thought by a common model which links the 'drivers and laws' to the other two schools of thought i.e. 'aggregate' and 'individual elements ' views shown.

The proposed organic growth model (bamboo) has been revealed to be simplistic, but well grounded and supported by other simple metaphors– sand piles and birds nests!

The idea of an organic metaphor also had strong similarities to other biological models such as Hern's malignancy model, and the fractal and self criticality models of Batty and Frankhauser, since they also sought natural phenomena in the form of the Per Bak's sand pile, as a foundation for their geometric and mathematical approaches.

The bamboo model and the aspects of 'uncontrolled growth', remote colony and amorphous nature resonated across several disciplines including Conzen's morphological zones, Hern's malignancy model and the fractal studies of Batty and Frankhauser.

Intriguing to the writer however is the idea of Dawkin's 'extended phenotype', which suggests in nature that animals create nests and structure from a part of their genetic code. The review has revealed resonance between this idea and the proposed model, and is the source of further consideration for development of the organic 'bamboo' model by the notion that our cities are 'manifested', based on predetermined codes within our genes or behavior.

The idea that 'cities may be in our wiring' informs the study further and the proposed model, and will form a further basis for development of the model with a deeper understanding of the human drivers that lead to the creation of our cities. Such drivers it would seem have been pondered by many and complex patterns explained simply by organic (bamboo), natural (sand piles) and biological (nests) metaphors.

The last aspect of the study title i.e. 'demography' has been supported by the presence of what are basically 'static indicators' of building types such as area, height, age and footprint. The more dynamic measures of 'propensity for growth', 'available habitat' and 'seasonal conditions for proliferation' implicit in the study model, are not currently measured nor perhaps understood in such terms.

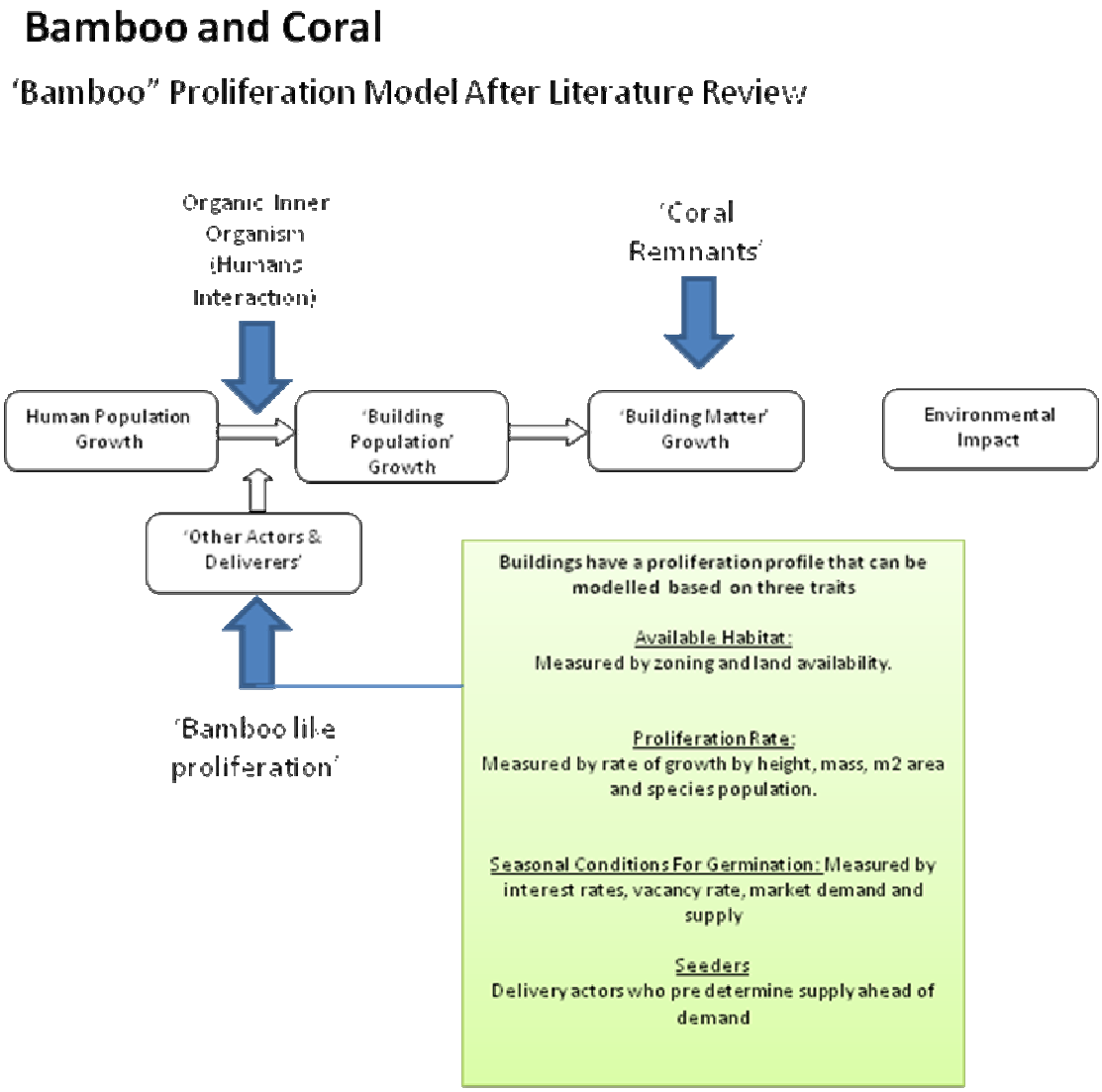
The model informs the demography of building types, and can help form the basis for a new classification of buildings types (and groups), as a demography.

Development of The Model

Starting with a simple organic view of how office buildings seem to proliferate cities 'in season', the model was seen to represent a clear view of a phenomena that is only seen under time lapse. In addition the idea of the bamboo model correlated to a dynamic view of the drivers and laws that seed such a proliferation. Implicit but missing overtly from the original model, was the recognition of the variable array of actors who 'seed' such proliferation. (This was bought to light by Molotch's 'land based elites', that rang true with the writer's years of building and development experience.

Bamboo and Coral

Clarity was also brought to the idea that there were two forces at work, the inner organism (human interaction) and the outer shell (built remnants) which was like the action of growth in coral reefs. Scientists it would appear measure reefs by the remnant growth, not the organism. The two however are linked by nature. Cities leave 'coral' remnants long after the 'originator organism' has passed with time.



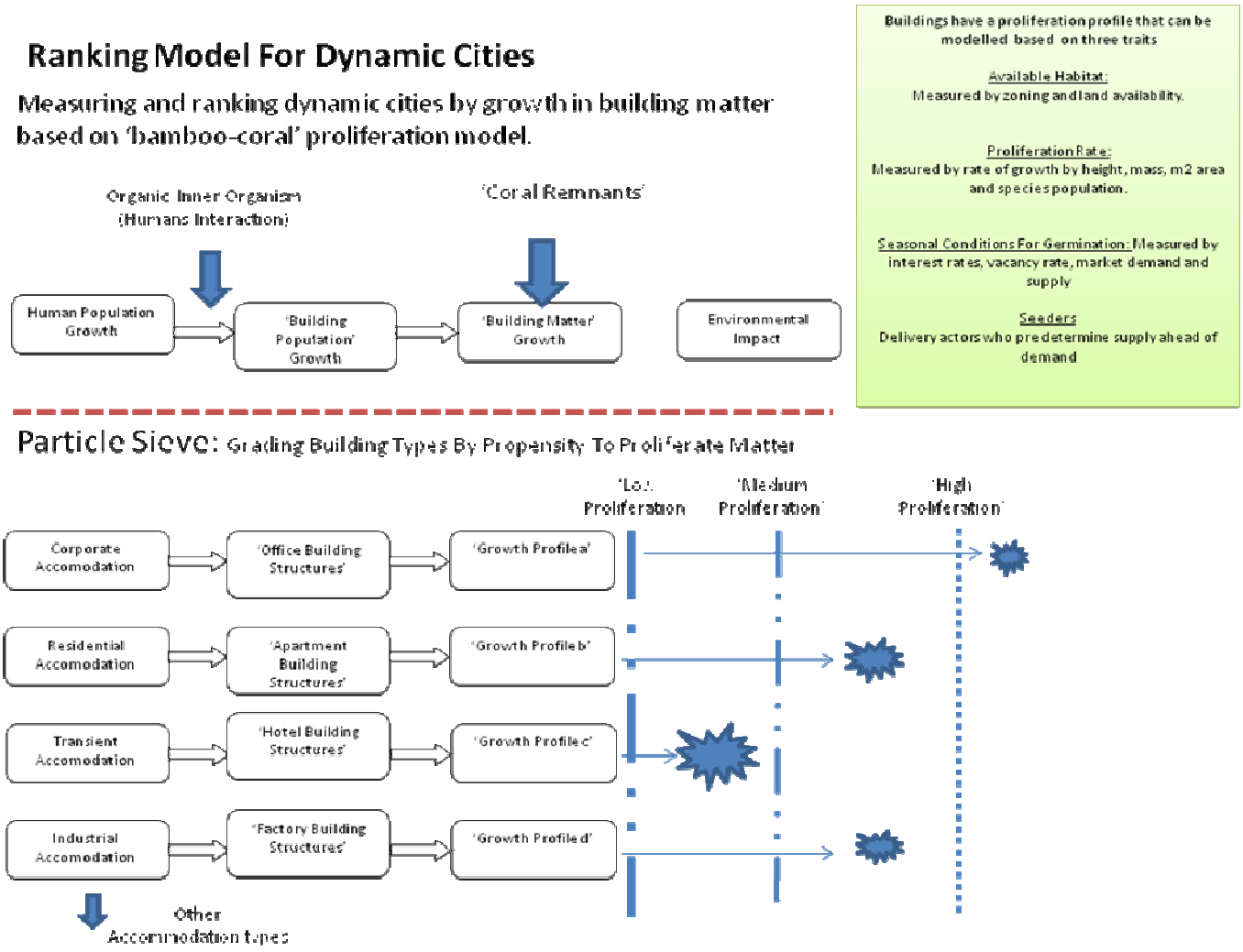
The bamboo model (see above chart) was improved to include a 'fourth element' in the form of 'seeders' who embodied the 'actors' and 'deliverers' who created the built shells.

The Ranking Model

This clarified the model with the notion of separation of the action of the inner organism which still using the bamboo metaphor. The four traits noted in the model could be used as a basis for adding a growth profile to individual 'accommodation types' – corporate , residential, transient, (tourists) and industrial amongst others. The separation of each building type in a city could then be ranked, using a

'particle sieve' view where like the pebbles in a river, the faster (high growth) particles were separated from the slower (low growth) – boulders and pebbles.

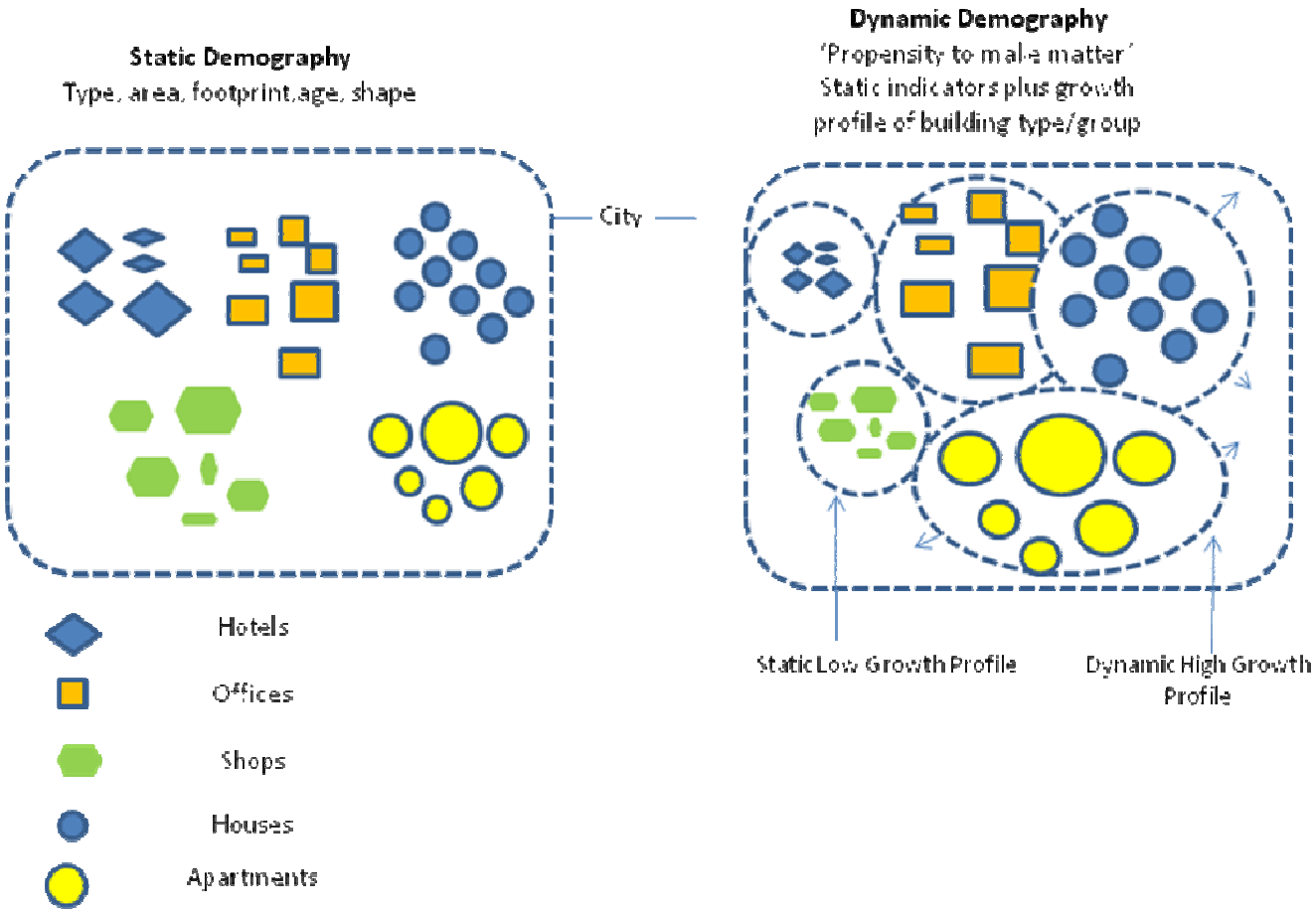
The model below brings this to light showing the separation of each building type by proliferation measures which correlates to particle size in a sieve grading.



Dynamic Demography

The resultant separation would add to each building type, a 'time-space dynamic' which was in addition to the static traits of height, footprint, area, age and shape. Together these building types would form a new demography for the city, which would result in a quantitative and inductive description of the city's 'propensity to make building matter' . This is represented graphically in the chart below.

Dynamic Demography of Building Types



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Appendix

Notes & Limitations

The model proposed has been strengthened and made more real by the review, however the enormity of creating a new demography of buildings is limited by the available data of existing buildings.

The resourcing and operationalisation of the idea behind the study, is more aligned to government and cross-national initiatives than a dissertation. The idea is however worthy of pursuing due to a level of its own originality, (in the sense of a new ranking based on matter making) and the place it enjoys amongst the other models.

The review has meant the proposed model will be developed through the revealing of the following aspects:

-The higher understanding of the triggers of proliferation, through the historical and aggregate views of many cities that the literature revealed.

-The difference in proliferation profiles across different countries, and constraints of topological factors,

-The power of 'the simple study' of one town or city as an starting point. Three case studies in sample areas of dynamic cities is envisaged. (Conzen's study of a mediaeval township caused a new discipline)

- Recognition of the property development mechanism, and its part as deliverer of 'proliferation states '

- The idea that the 'point of conception' for proliferation is the 'agreement to lease/occupy' in commercial property transactions. In more 'speculative development action' this has less constraint on growth.

-The factors leading to the 'point of conception' are embedded within the organic model proposed, and strengthen the model.

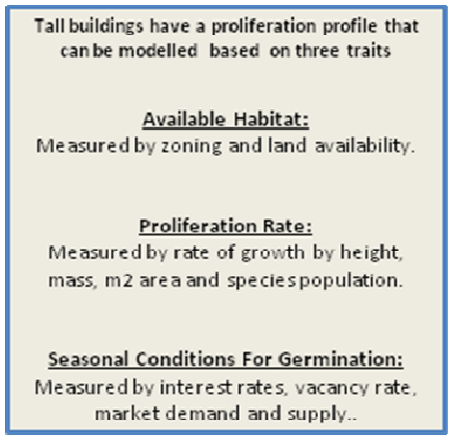
-The deeper understanding of separate growth profiles for individual building types – office, residential, hotel and industrial by the identification of relevant delivery actors.

Original Proliferation Model (as noted at the start of the literature review)

Modern growing cities appear to abound with tall buildings (offices, apartments and hotels) which proliferate (in 'tall building season') at what appears to be a frightening rate, with enormous visual and environmental impact.

If the cityscape prior to tall buildings was to be likened to a natural habitat with a species of trees, a savanna perhaps, then tall buildings appear to be the 'tall bamboo cluster' invading a landscape that was traditionally marked by low grasses, bushes, scrubs and the spasmodic tree.

Can tall buildings be viewed this way however - as an 'organic species' that have their own proliferation profile based on a 'proliferation rate', 'seasonal characteristics' and the 'available habitat'. Can their proliferation be modeled in this manner to help inform the planning of our future cities?

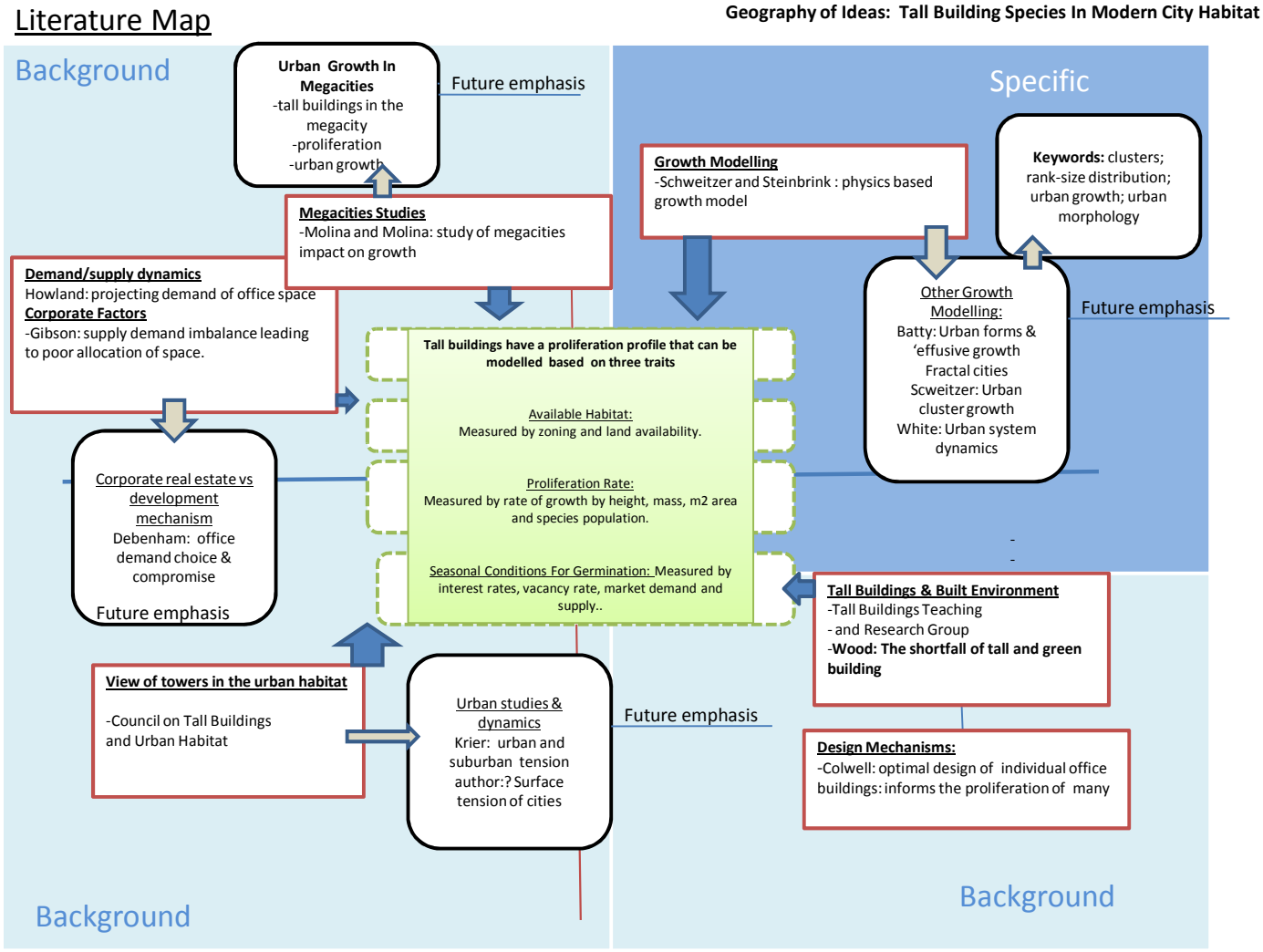


Central Model: Proliferation of Tall Buildings
The model relies on an organic view of 'tall building proliferation' and is based on the measuring and modelling of key characteristics that determine proliferation (see model adjacent)

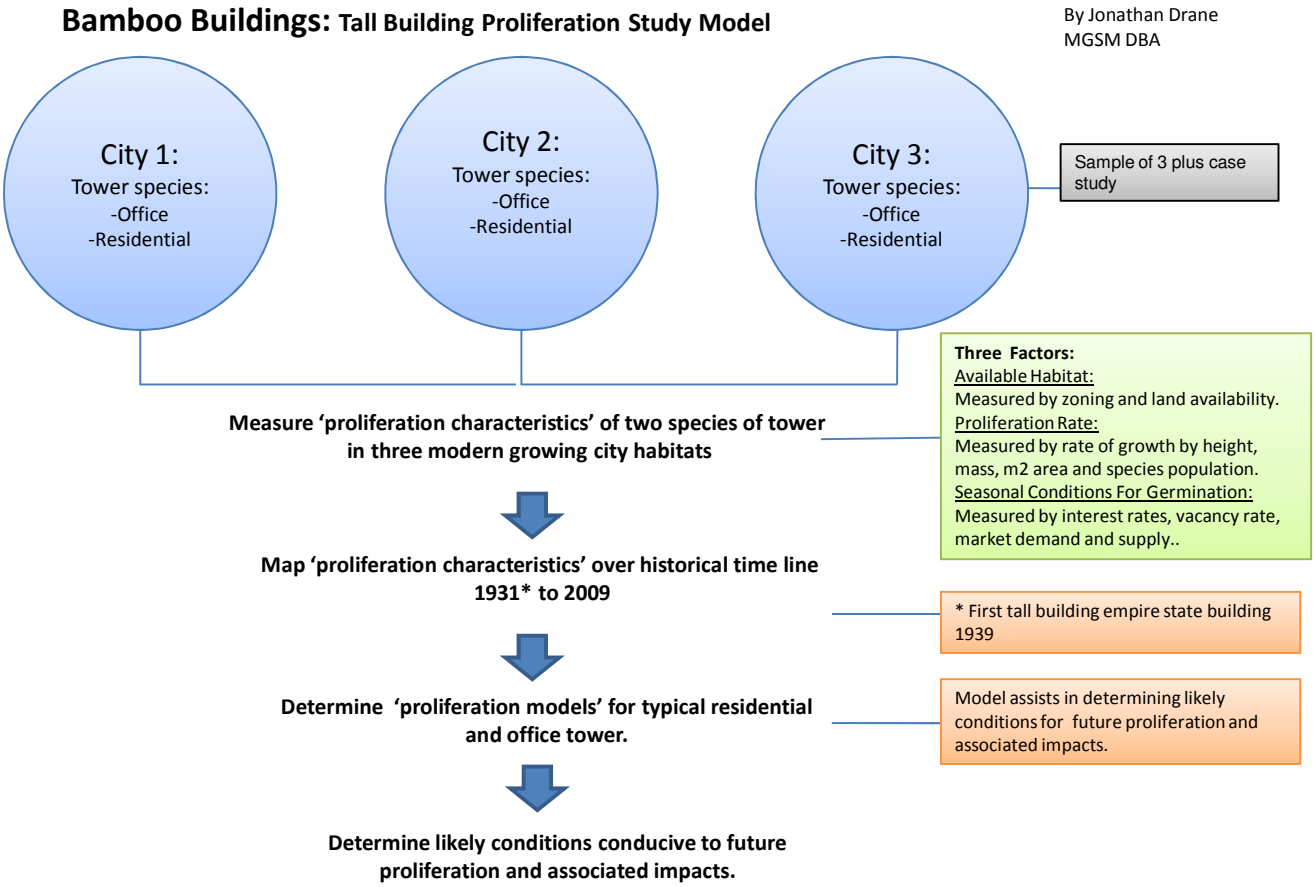
After classifying a building population by its dynamic demography, building types are then graded to separate those with lower from higher 'matter profiles'. The resultant separation into low growth, high growth and prolific categories allows for the measuring of a city's propensity to proliferate and therefore its ranking as a high growth city- a 'turbo city' .

Original Literature Map (at the beginning of the review)

A map was formed based on Berger's "*semantic map of critical approaches in cultural studies*", and Hart's definition: '*mapping ideas is about setting out, on paper, the geography of research and thinking that has been done on the topic*'.. Hart, 2005



The literature map above shows the existing discovery in the rectangular boxes. The future discovery areas are outlined in the rounded boxes. The 'background' shading shows topics which, based on current review are not related to modeling of proliferation, but more related to the understanding of proliferation.The 'specific' darker shading shows topics that are related to modeling of proliferation, which directly inform the topic and how to advance a model by the writer.


Bamboo Buildings: Tall Building Proliferation Study Model
By Jonathan Drane
MGSM DBA
City 1:
Tower species:
-Office
-Residential
City 2:
Tower species:
-Office
-Residential
City 3:
Tower species:
-Office
-Residential
Sample of 3 plus case study
Measure 'proliferation characteristics' of two species of tower in three modern growing city habitats
Three Factors:
Available Habitat:
Measured by zoning and land availability.
Proliferation Rate:
Measured by rate of growth by height, mass, m2 area and species population.
Seasonal Conditions For Germination:
Measured by interest rates, vacancy rate, market demand and supply..
Map 'proliferation characteristics' over historical time line 1931* to 2009
* First tall building empire state building 1939
Determine 'proliferation models' for typical residential and office tower.
Model assists in determining likely conditions for future proliferation and associated impacts.
Determine likely conditions conducive to future proliferation and associated impacts.

For Further Reading

Wood through The Council of Tall Buildings and Urban Habitat, offers a perspective related to the enhancement of the 'green building' design of towers to support a better urban environment given the level of proliferation. Wood uses the metaphor of city as a habitat similar to the writer's view. This however is not supported by corresponding proliferation models or analysis. Most is commentary.

Colwell & Ebrahim [4] comment on the key parameters for the optimal design of an office building, taking into account characteristics such as footprint, height and rental rates. The model forms an individual tower model for optimization, which could inform a proliferation model for all towers.

-Frank Schweitzer and Jens Steinbrink, *Estimation of megacity growth*, Applied Geography, Vol18, No 1, pp.69-81, 1998.
-Wood A. *The Shortfall of Tall: The Rise of an Environmental Consciousness in Tall Building*, Council of Tall Buildings and Urban Habitat 7th World Congress.
[4]Peter F. Colwell and M. Shahid Ebrahim, *A Note on the Optimal Design of an Office Building*, Journal of Real Estate Research, Vol14,No 1/2, 1997
-Larkin 1995 ref Kropf c5: Organic thought in urban geography
-Wolman 1965 (ref hern c9) : Metabolic requirements defined as materials to sustain a city's inhabitants.
-Malfroy expands on the notion of organic metaphors (ref Kropf) cant find this paper it is in Urban Morphology 1998, vol 1 p 47 to 50