

# A Quantum City, or How to Master the Generic<sup>1</sup>

Here, is where people live. Yet *here*, is not exactly definable in geometric terms. In order to locate us, one must consider *n-dimensions*, out of which none is correct or false. In fact, all of them coexist simultaneously in a non-Euclidian condition, where (when) *here* is not a point in space, but rather a point and all its possible trajectories, reachable within a few digitations. Our city is no longer locked in *one space and time*, but can be *engendered*, and connected, at any time, in any place. Unmistakably, such an expansion of our capabilities was some centuries ago a privilege of emperors, popes and kings. Just imagine, today, any of us has more access to information than Augustus back in Roman times, or the president of the United States of America twenty years ago. Considering this as an enlargement of urban experience towards more abstract and operational dimensions, what does it entail in the way one can engender and understand the city? What to do if, potentially, one could do *anything*?

## DECOUPLING FROM THE GROUND

The last century saw the emergence of a myriad of city models in urban theory, as the product of transversal relations woven with industrial technological developments, sometimes in a far too literal fashion. The fascination that came with standardisation, linearity and discretisation of industrial processes, brought about the modernist dream of a mechanist city. It was embodied in theoretical constructs such as Archigram's Walking City (1964) and Lynch's City as a Machine, and exposed extensively in 'The Good City Form' (1981), as a set of mechanical parts interacting in a network in disjunction from any place. As for a machine itself, in this light, the city becomes a discrete and deterministic object, where clearly defined parts can be linearly scalable in relation to flow demands, and processes can be predicted in accurate quantification.

During the 1970's, the emergence of New Cybernetics, as the study of self-organizing and complex systems beyond the issues of the first cybernetics and their sciences of control, leads to new heuristic and holistic metaphors of the city, where notions of wholeness, feedback loops, dynamic equilibrium and self-organisation become part of the agenda. Research fields such as general systems theory, and particularly hierarchy theory, integrate the urban discussion under

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the promise of simplification and hierarchy, as bare conditions for the decryption of complexity.

Hierarchy theory uses a relatively small set of principles to keep track of the complex structure and behaviour of systems with multiple levels. (...) The behaviour of structurally complicated systems is behaviourally elaborate and so complicated, whereas the behaviour of deep hierarchically complex systems is simple.<sup>2</sup>

The Oxford English Dictionary defines “complexity” as *the state or quality of being intricate*, and ‘complex’ as *consisting of many different and connected parts*, and more extensively, *as not easy to analyse or understand*. Stripping it down to blunter terms, complexity characterises what cannot simply be understood or decomposed into smaller parts. From this perspective, general systems theory and complexity per se—and even further, urban complexity— seem to stand in rather antipodal positions.

In like manner, towards the end of his life, Lynch rejects both models of the City as Machine and more aggressively, the City as Organism, as direct implementation of general systems theory. He points out not only the simplicity of the metaphor, but also the antithetical relation between the concepts of hierarchy and self-sufficiency; and the incompetence of notions such as equilibrium, scalability and optimisation when applied to complex organisations such as cities.

Cities are not organisms, any more than they are machines, and perhaps even less so. They do not grow or change themselves, or reproduce or repair themselves (...) It is more difficult, and more important, to see the fundamental ineptness of the metaphor and how it leads unthinkingly to cut out slums to prevent their “infectious” spread, to search for an optimum size, to block continuous growth, to separate uses, to struggle to maintain green belts, to suppress competing centres, to prevent “shapeless sprawl,” and so on (Lynch 1981, 95).

However, more than thirty years later and despite of the exponential development of information technologies having led towards more decentralised, and hybrid (non-discrete) urban conditions; some of the current urban debates, seem to point out in the same direction. The idea of establishing a science of cities where, assimilated to an organism, the city is reduced to a set of linear generic laws of scalability and spatial constants, has been emerging in the last years. Heavily relying on simple geometrical systems such as fractals, Michael Batty asserts that urban patterns manifest

(...) their self-similarity or spatial invariance across different scales, which in turn implies that the similar sorts of processes are operating across scales (Batty 2011, 4).

Or even further, other scaling approaches, regardless of any cultural contextualisation, still hold the ambition of explaining urban complexity within a set of universal scaling properties of a city in relation to its population size, which are claimed to expose accurately any urban phenomena such as

(...) the socioeconomic outputs of cities, from economic production to innovation but also crime as proportional to the number of social interactions (Bettencourt 2013, 7).

## A. DISENGAGEMENT

Perhaps by now, you may wonder, whether this will be yet another story about how well we can *control* the so-called urban complexity. The excessive mediation and semantic saturation of the term have turned out into a bland melody everybody sings to without listening. Indeed, we will tell you about complexity, but we promise we will aim to project you in an orthogonal direction, because like you, we are also bored. Bored by simplification, crisis scenarios, fabricated nostalgia; bored by the same generic urban product that can be found everywhere. We promise a disengaged journey through this city, or rather, through this *cityness*; our city is a mood, a genre, a brand, some indefinable haze you can sense, smell, feel, and perhaps get a grasp of, but never confine or define. We want to make a visit without stating verdicts or even before attempting to *understand*. Instead, technology shall be the lens we want to show you the city through, not as a machine empowered with astonishing calculation capacities, the master principle of industrialisation and modernism, but as an empowering externalisation of human intellect.

Just look out there, and you will find the beautiful cities, nurturers of creativity, attractors of talent, gatherers of diversity. How does one preserve vividness while facing the ubiquitous wave of globalisation? Grasp the pervasiveness of the city, without trapping it into the stiffness of boundaries? Deal with a primacy of exception, where every singularity can be seen as a case, and not as a knotty deviation from the rule? How is information technology showing us a way to abstraction from the generic infrastructural background?

## THE GENERIC

Is the contemporary city like the contemporary airport – “all the same”? (Koolhaas 1998, 1238).

With this non-ingenious enquiry, Rem Koolhaas starts his journey through a city deprived of memory and identity, which he accurately designates as *generic*. Any attempt towards instantiation becomes irrelevant, neither Alpha Ville, Metropolis nor Springfield epitomises it. Rather an encapsulation than an embodiment, this city, the Generic City, is none of them but condenses them all together, simultaneously. The promise of the Generic City overlaps its own threat. Liberation from overdetermination equates damnation to dullness.

In this way, after a century of industrialisation and faith in scientific management, the very conditions for the deployment of the Generic City are set. Strategies for improving economic efficiency and labour productivity—such as analysis, synthesis and fragmentation of tasks—are transposed onto urban space, engendering bifold consequences. On one side, the development of infrastructural and systematic setups at territorial scales opens up the way for the development new ways of living, daringly challenging intuitive notions of time and space—for instance, the spread of the telegraph and electricity, allowed rapid urban development, both in physical and operational terms. On the other hand, the same logic of optimisation defines clearly segregated monofunctional areas, dependent purely on infrastructure armatures for connectivity and ultimately engendering a city minus contingency, diversity or meaning. *A city without qualities*.

From a pöietic perspective, such a celebration of the power of tools manifestly develops into the improvement of parametric setups, providing ideal conditions for automatism and consequently disavowal of mastership. The Generic is

defined by the instantiation of an analogic general form where only instances of one same kind can be articulated.

(...) [The] ‘one-of-a kind particularity’ attributed to instances of such abstract objects is neither example nor prototype, but that there is a “suchness” to the “thisness” of their instantiations nevertheless, and that despite the engendering of its hylomorphic identity (its form and content) through mere tentativeness (purely indexical, without decision of how to interlink the dots into a figure), these instances are conditioned (...) (Bühlmann 2013, 14).

The enhancement of such form-finding parametric setups promises a *fertility* conditioned by the rigidity of its own governance.

#### **A. 100% URBANISM**

The Generic is imperialism revisited and consented. Every society on the fast track to success aspires to the same abstraction of the West. All the same discussions, speeding highways, simulated romanticism, gigantic shopping malls, naked plaster walls.

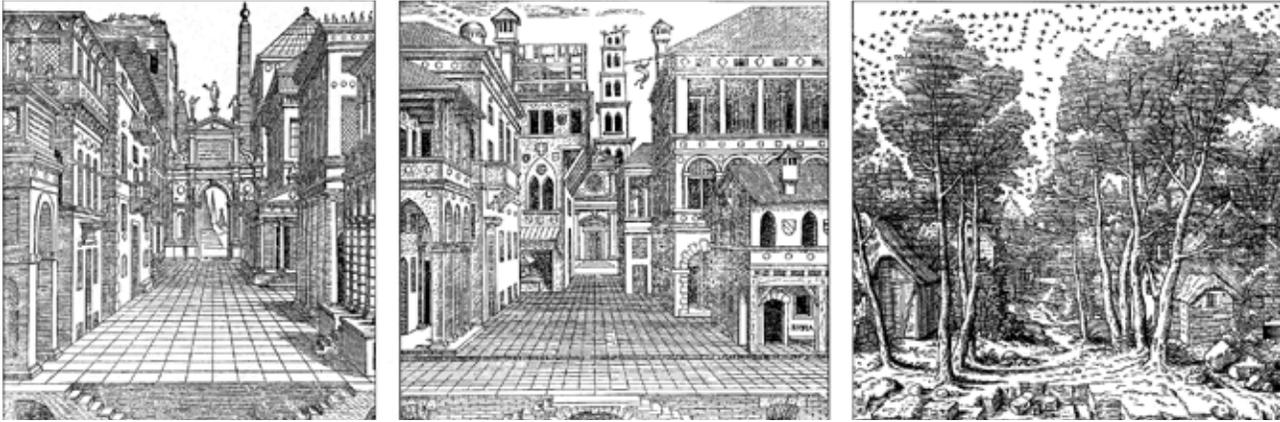
The “Western” has become, a self-administered process that we do not have the right to deny—in the name of various sentimentalities—to those “others” who have long since made it their own. At most, we are like dead parents deploring the mess our children have made of their inheritance (Koolhaas 1996, 1013).

In the light of this generic common ground, discussions about the future *100% urban society*, dictated by rationales pushed to extremes, fall into sheer bureaucracy. The definitions of megacities, megalopolis, urban areas, agglomerations, turn into *Potemkin Villages* or *Kafkaian Metropolis* in a statistics race for global rankings, rather portraying an inability and lack of interest to grasp the city as a veritable complex phenomena.<sup>3</sup> All the numbers, all the theories, all the models, quickly reach their own limits. Curse of dimensionality, linearity or discretisation, are unable to keep up with the pervasiveness and indistinctness of the new hybrid urbanity, radicalizing the romantic divide between city and countryside.<sup>4</sup> This is how solutions to all the big discussions tend towards the 100% designed, 100% conditioned, 100% optimised, and just because of this, not towards *a city*.

#### **B. THE SETUPS**

In *The Five Books of Architecture* (1537) the Italian mannerist architect Sebastian Serlio designs a range of theatre sets based on analogies between urban hierarchies and classical dramaturgical genres: the Tragic, the Comic and the Satiric. Each set depicts not only an urban system, but also a range of ideologies and ambitions about the city. While the Tragic appears to promote the hieratic, controlled and honourable, the Comic sprouts with some sense of self-organisation and diversity, and the Satiric sinks into a romantic idealisation of the wild (Figure 1).

Serlio’s analogies seem to be as pertinent today. Interest and preoccupation over subjects such as global crisis, scarcities in resources and population growth, have ended up in the construction of narrations around the two extremities of Serlio’s triptych. The Tragic and the Satiric are the armature of the accessible generic ground, the ultimate instance of the *every world*. Images of improbable slums, unending traffic jams, colossal mountains of garbage, or inexorable natural catastrophes appear staged on a tragic scenario, where contrition for acts of dirt, pleasure or abundance seems the only way out. On the other side, the satiric seduces by inversion, seemingly by diverse incarnations of the Post-modern, romanticised images



of locality, colourful palettes of food, jam-packed bazaars. In this setup, the picturesque and the vernacular are artificially kept alive, like a comatose to whom only the clean, the beautiful and the correct are the last remains left of whatever it meant to have an identity.

In between, the Comic appears already as a nostalgic representation of the mercantile city, with its irregular street alignments and independent actors, promptly replaced by the magnanimous city plans of the Renaissance. In awareness of the danger of nostalgia—mourning a city that has been lost—and uninterested in romantic formal representations of such a stance, we believe the Comic can offer an enriching lens to look at the city through. Namely, Bergson’s view on the Comic, broadly exposed on his collection of essays ‘Laughter’ (1900) appears illuminating:

A situation is invariably comic when it belongs simultaneously to two altogether independent series of events and is capable of being interpreted in two entirely different meanings at the same time (Bergson 1900).

Hence, the Comic reinvents itself through the unexpected encounter of elements of radically different natures. Every new configuration provokes semantic shifts, thus gaps between meanings, engendering an underlying tension where the Comic emerges. In this light, once liberated from the idealisation of the Satiric and the standardisation of the Tragic, a world of contingency, that needs to be addressed with individual as well as collective intent and mastership, opens up.

### C. THE RICHNESS

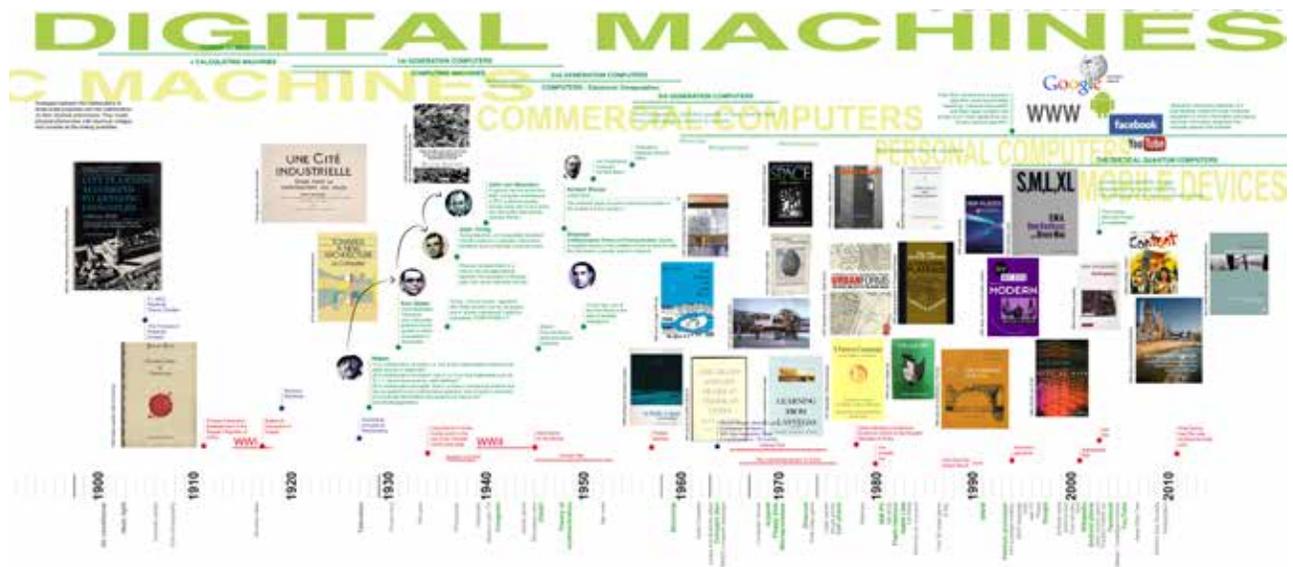
The Generic have also provided the framework for an entire structure of developments, such as a doubled life span, and an increasingly global population, out of which today half is already urban and 8 out of 10 inhabitants are literate.<sup>5</sup> While people born at the beginning of the 1950s could expect living in average 46.6 years, today, those born between 2005 and 2010 may reach at least an age of 67.6, almost a second life.<sup>6</sup> In addition, with better health, improved quality of life and increased life expectancy, the world population has rapidly grown while its growth rate has dropped down.

Every third person has access to knowledge via Internet, and mobile phone subscriptions have reached 6 billion, doping us with the potentiality of being engendered in any place, any time.

(...) mobile phone penetration is growing exponentially, from 2 per cent in 2000, to 28 per cent in 2009, to an expected 70 per cent in 2013. (...) Today’s mobile device is the new personal computer. (Diamandis *et al.* 2012).

Figure 1: The City as theatre, Serlio’s stage sets each modelled on classical theory as articulated by Aristotle in his Poetics.





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leap—out of space and out of time. Already in 1968, the architecture and design critic Rayner Banham develops in his essay 'The Great Gizmo' a *mythology of the wilderness*, where sheer gadgetry is the main protagonist in the transformation and ordering of the territory, independently of any centralised infrastructural setup.

True sons of Archimedes, the Americans have gone one better than the old granddaddy of mechanics. To move the earth he required a lever long enough and somewhere to rest it—a gizmo and an infrastructure—but the great American gizmo can get by without any infrastructure. [Further on, he emphasises the probability of such a leap by exposing this situation as an extraordinarily liberating prospect.] Many of the developing countries, (...) find themselves being bullied into sinking aid funds in massive infrastructure of a kind the US got along without for several generations, whereas small sophisticated devices that can work without much capital investment under them might produce better immediate results and leave the ground free for even more sophisticated developments in these countries later on' (Banham 1968).

Information technology is cheap, clean and fast. It does not come from *some-where* but from *anywhere*. Its universality promises a *cultivation of culture*, rather than sheer performance at expense of imperialistic subjugation. This is where technology becomes an empowering externalisation of human intellect.

#### A. BODIES-TO-THINK-IN

Instigated unconsciously and unplanned, far more than a built environment made out of stones, we cannot explain how cities started or whether they will stop. With certainty, we can see them as the quintessence of cultural articulations and as manifestations of collective *bodies-to-think-in*. There is not an absolute city—form of life—that can provide a reference plane of stability, but rather a continuous cohabitation of *bodies*. Let us explore their genealogy, not linearly but rather as consecutive encapsulations of levels of abstraction, namely reflected on their relation to the *description of patterns* (Figure 2).

While previous *bodies* dedicated to the more static matters of counting, describing shape and measuring, in the 17th century a fascination about patterns of

Figure 3: Evolution of computation, technology and industrialisation throughout the XX century, in relation to urban theory discourse.

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## ENDNOTES

1. “A Quantum City” is part of an on going research project developed by a collective of architects, computer scientists and philosophers at the Chair of Computer Aided Architectural Design (CAAD) of the ETH Zürich in collaboration with Singapore’s Future Cities Laboratory. A forthcoming book on this research is to be published in 2014. For further information on “A Quantum City”, please refer to: Hovestadt, Ludger, and Vera Bühlmann. *Sheaves: When Things Are Whatever Can Be the Case*. Vienna: Ambra, 2013, and more extensively on “A Quantum City” energy scenario: Hovestadt, Ludger, and Vera Bühlmann. *Genius Planet, From Scarcity To Abundance: A Radical Rethink For Our Energy Future* (forthcoming).
2. [www.iss.org/hierarchy.htm](http://www.iss.org/hierarchy.htm).

motion and change appears. Newton and Leibniz independently invent calculus. Infinitesimal numbers endorse thermodynamics and the description of movement, setting the conditions for industrialisation and the development of cities as systems to be balanced. With the development of industry and mass production, generic descriptions appear as an abstraction from specific ones.

From the 20th century on, complex numbers, quantum physics and information technology develop.

The classic picture of material particles occupying a surrounding space disappears. In its place there is a quantum field, a fundamental continuous medium present everywhere in space. Particles are just local densities—concentrations of energy—in the quantum field (Devlin 2001, 331).

Later on, with the development of programming languages, the ‘generic object’ appears. Deprived of any specificity while yielding many specifications, the later produces —instead of engendering— populations of instances of one kind and yet unique. Within the promise of archetypes and master-models, upon which other objects can be emulated and reproduced, the ‘generic object’ becomes then the corner stone of parametricism (Figure 2).

Today, the emergence of networked communication technologies has extended our interaction with the city towards an invisible and complex network of relations. For the first time in history, we are not only aware of the complexity surrounding us but also likely to grasp incomparably much of it through a real-time flow of data. Hence, we are no longer constrained to see the city as a finite set of generalisations, but as a data platform able to preserve *any potential relations*. Grasping the city becomes a *backwards gymnastics exercise*, where the articulation of processes primes over crystallised outcomes.

## B. FROM COMPUTATION TO DATA LITERACY

Drawing, writing, coding, not only conceptualise levels of literacy, *from ideography to textuality to digitality*, but also establish relations to technology. Whereas Industrial revolution produced tools to provide extensions of the body, media revolutions generated networks to provide for a widening of the space of intellection. Computational power has been the compelling force of globalisation and market economy, however

(...) If you don’t get the idea of abstraction and look at computers just as fast machines, computers are frightening, because they are getting superfast (...) the beauty of computers is that they are not machines. They are abstract machines (Hovestadt *et al.* 2014).

Their abstract logistics form a continuity of transformability through mediation. These *any-machines*, not only treat the world symbolically, but today they develop into a kind of infrastructure above the infrastructure, or a further level of abstraction, which requires *data literacy*.

The centralised system, initially traced by infrastructures, has turned into increasingly decentralised networks of applications. In 2007, Apple launched the first smartphone into the market, causing an exponential boom in mobile computing. From *one computer-many people*, to *one person-one computer*, today we reach a radical inversion with *one person-many devices*, deepened further within their integration into the body and the future development of the Internet of Things; transforming urban space and practices into indexes of *real virtuality* (Figure 3).

## THE PRE-SPECIFIC<sup>7</sup>

In 1964, Marshall McLuhan coins the cybernetic slogan “The medium is the message” in his book *Understanding Media*, positioning the medium as a tool that *shapes and controls the scale and form of human association and action* (McLuhan 1964, 11). From the point of view of such a positioning, focusing on the content that is being mediated appears as an obscuring element to the understanding of the medium’s character. Five years later the Apollo 11 shoots the first photograph of the earth from outer space. The picture shows our planet as an isolated sphere, in a strong gesture of geometric idealisation, where a clear distance is established between the earth and us, its contemplative observers. The connection is far from anodyne. Both the reification of the world and McLuhan’s slogan flatten down every possible interpretation to a single medium of convergence.

Forty years later Google finds a way of dealing with a planet composed by a trillion of indexes, or *messages*. In this cloud distinctions between subject and object are blurred in a reciprocal way. Like in any city there’s a potential richness that cannot be understood nor analysed. We don’t solely look at things but things look back at us, they surround us. We are narrators, playful storytellers that never talk *about* something but always *around* it, in a baroque gesture that filigrees around a centred void. Let us call this probability space *pre-specific*: it can be ossified, fossilised, territorialised, deterritorialised but it can never be given nor lost (Figure 4).

### A. THE EVOCATION

Computation, when considered algebraically,<sup>8</sup> provides an operational *body-to-think-in*, opening up perspectives in the conceptualisation of a new notion of *cityness*. Pre-specific approaches such as Markov probabilistic network theory (Markov 1906), Self Organizing Maps and data-driven nonlinear relation approximation (Kohonen 1982), can show us the potential of the unstructured abundance of information and continuous urban data streams in enriching the understanding of global urbanity.

The Pre-specific is not a negation, but a cultivation of the Generic. Not procedural, parametric or object-oriented,<sup>9</sup> its symbols are *functionally operative for articulating what is generically determined* (Hovestadt and Bühlmann 2011). A preservation of all instances (or possibilities) takes place on a purely relational level, where the *identity* of an object is defined in its relations to a constellation. Consequently, every singular case is a potential class, for which no previous set up of an archetype is necessary. The process is iterative, and has the ability to *learn*. As a result, the Pre-specific approach has the ability to compute particular models, each optimally *bespoke* to a certain situation and capable of integrating as much as possible from the data constellation and the experience acquired by (unlimited) iteration (Figure 5).

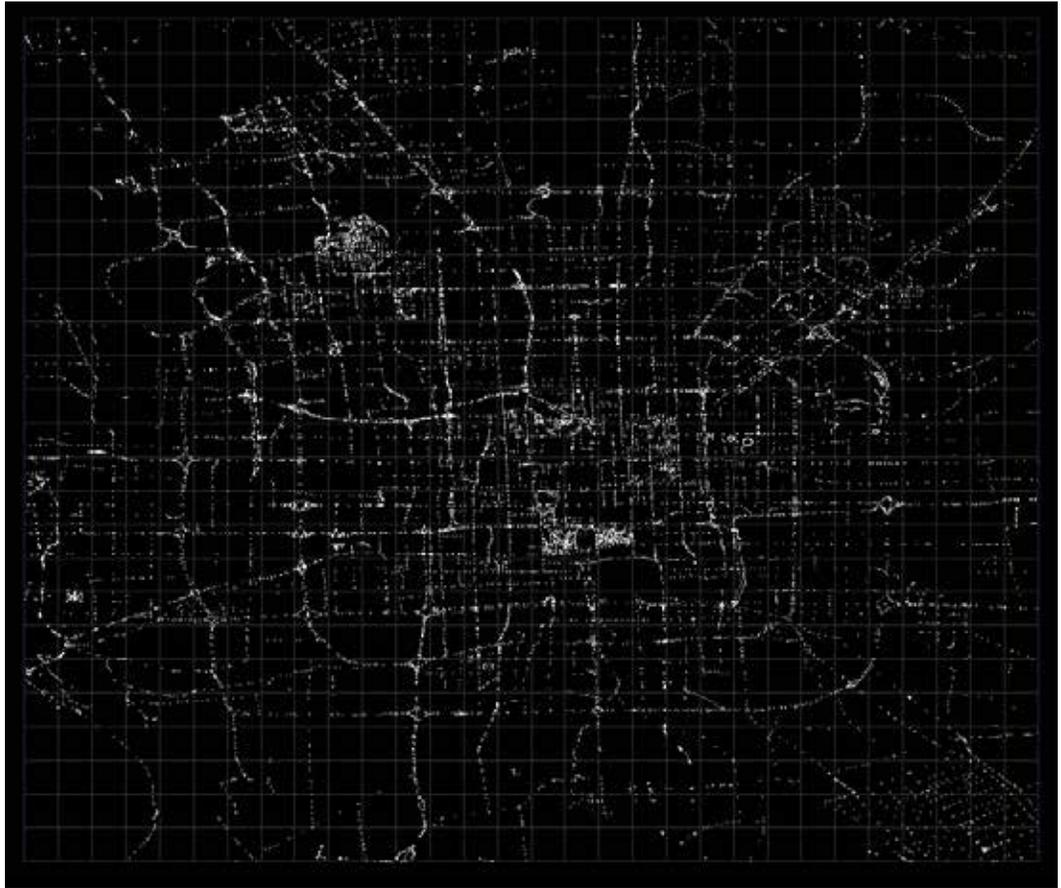
### B. CITYNESS

It is important to evoke a fundamental difference between *civitas* and *urbs* within the new notion of city opened up by the availability of continuous data streams. *Civitas*, the etymological origin of the term city, is the collective will of a community or contract of a community to coexist in one location.<sup>10</sup> *Urbs*, a term replaced by *urbanisation* in 1867 with the widespread Cerda’s neologism,<sup>11</sup> depicts *a city of stones* where territories are exclusively defined by the power of infrastructures. The preponderance of the latter in the 20th century discourse about the city, has unfolded achievement into commodities, production into space and growth into settlements, visible in ‘tabula rasa’ planning and diverse forms of urban sprawl



Figure 4: Apollo Planet and Google Planet: one object and trillions of indexes.

3. The expression Potemkin villages was originally used to describe a fake village, built in order to deceive others into thinking that some situation is better than it really is. According to the story, Grigory Potemkin erected fake settlements along the banks of the Dnieper River in order to fool Empress Catherine II during her visit to Crimea in 1787. (en.wikipedia.org/wiki/Potemkin\_village).
4. Term coined by Richard E. Bellman when considering problems in dynamic optimisation, the curse of dimensionality refers to various phenomena that arise when analysing and organising data in high-dimensional spaces (often with hundreds or thousands of dimensions) that do not occur in low-dimensional settings such as the three-dimensional physical space of everyday experience. (en.wikipedia.org/wiki/Curse\_of\_dimensionality).
5. data.worldbank.org
6. data.worldbank.org
7. The term *Pre-specific* was first coined by Vera Bühlmann in order to refer to information-based design. See Bühlmann, Vera, and Martin Wiedmer. *Pre-specifics: Some Comparatistic Investigations on Research in Design and Art*. Zurich; New York, NY: JRP Ringier ; D.A.P./Distributed Art Publishers, 2008.
8. Algebra (from Arabic al-jabr meaning “reunion of broken parts”) arose from the idea that one can perform operations of arithmetic with non-numerical mathematical objects. These objects are variables representing either numbers that are not yet known (unknowns) or unspecified numbers (indeterminates or parameters). This allows one to state and prove properties that are true no matter which specific numbers are involved. (en.wikipedia.org/wiki/Algebra)



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Figure 5: Urban traffic dynamics in coexistence with urban data streams (Vahid Moosavi, Ludger Hovestadt 2013). Collection of GPS data from taxi journeys in Beijing. A map of the city can be traced with no other previous knowledge of it.

—the common generic urban ground—reducing the city to a pastiche devoid of real identity, mastership or *cityness*.

A Quantum City does not have an explicit form, because it embodies something beyond what it apparently represents. Its level is operational, not representative. This is the power of information. We can symbolise things that are not there and describe the city as a set of collective narrations that talk *around* the city but not *about* it. We can grasp concepts beyond the quantifiable and qualifiable, such as *cityness*, *brooklyness* or *zürichness*. A Quantum City is a narration, a concept of universality that integrates any individuality.

9. *Object-oriented programming allows to devise entire 'libraries' of 'abstract objects' that depend on no statically specified order and classification system. Yet such 'abstract objects' are not really 'objects', they incorporate entire 'objectivities' – they allow for 'one-of-a-kind particulars' to 'concretise' singularly, and optimally be fitted according to the requirements of a task.* Bühlmann, Vera (2013). *Articulating a Thing Entirely in its Own Terms, Or: What Can We Understand by the Notion of Engendering in: EigenArchitecture*. 2014.
10. In the history of Rome, the Latin term *civitas* (plural *civitates*), according to Cicero in the time of the late Roman Republic, was the social body of the *cives*, or citizens, united by law. It is the law that binds them together, giving them responsibilities (*munera*) on the one hand and rights of citizenship on the other. The agreement (*concilium*) has a life of its own, creating a *res publica* or “public entity” (synonymous with *civitas*), into which individuals are born or accepted, and from which they die or are ejected. The *civitas* is not just the collective body of all the citizens, it is the contract binding them all together, because of which each is a *civis*. Smith, William (1875). *A Dictionary of Greek and Roman Antiquities*. London: John Murray. pp. 291–293. ([penelope.uchicago.edu/Thayer/E/Roman/Texts/secondary/SMIGRA\\*/Civitas.html](http://penelope.uchicago.edu/Thayer/E/Roman/Texts/secondary/SMIGRA*/Civitas.html))
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