Urban System Design

DESCRIPTION

Urban system design is a new discipline. Situated between naturally and slowly growing cities, between geometrically predefined cities, and between arbitrary growth, it is a challenging, responsible and proactive design activity.

Its foundations should be threefold: the first pillar is the ability to understand, to abstract and to model the urban system. The second pillar is the careful simulation of design ideas, which based on data and information can be placed in and interact with the urban system model. The third step is the projection of various possibilities and the creation of design scenarios that can be discussed with the stakeholders and decision-makers. The design of the final artefact then results in executable plans and multidimensional models, based on which the city can be built or re-built.

Urban systems are large and complex, yet most of them work because of the adaptive capabilities of humans. From the original idea through planning, competitions, commissioning, construction to management, it takes years or decades. This reduces the probability that a single idea will be followed through the entire process and will significantly influence the final result. Nevertheless exceptions are possible and stay in the mind of the public. Examples are Brasilia in Brazil, Chandigarh in India, or Shenzhen in China.

Chandigarh, designed by the Swiss architect Le Corbusier in the 1950s, was a social experiment in system design. Le Corbusier was a foreigner to India and the city has developed in a very different direction since then.
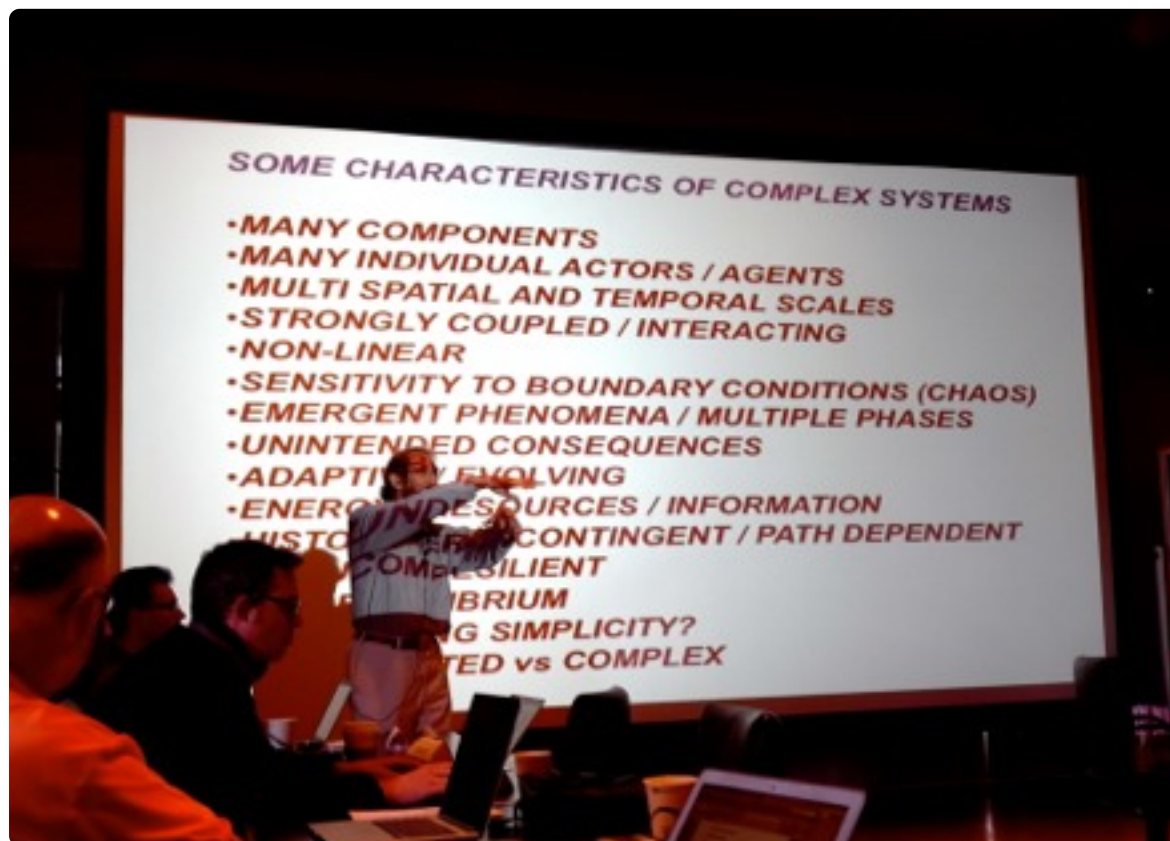
Brasilia, inaugurated in 1960, is directly connected to the work and memory of Oscar Niemeyer, and to the Brazilian president of that time, Kubitschek. It could be described as one of the first system design attempts, as it tried to integrate the human, architectural, political, planning, and infrastructure needs of a future city. Oscar Niemeyer was a native of Brazil, but still the city developed differently to what he originally intended.

Shenzhen is the newest of the three examples and there was no grand architectural urban system design scheme at the beginning. This makes it interesting, because in the city of today, more than 15 million people grew organically.

Systems

A **system** defines a set of objects acting together as part of a whole. In the urban context, a system contains buildings, infrastructure, landscape, water and other elements as its parts. Taken together, and adding their individual behaviour and multiple interactions, they form a complex system. Complex systems theory is an important field of science. Its findings are applied to many areas, including urbanisation.

The Santa Fe Institute

The Santa Fe Institute in New Mexico, USA, is a leading think tank on complex systems and increasingly deals with urban conglomerates as complex systems. It attracts researchers from around the world who explore different aspects of complex systems. Recently, the success of social media and large search engine companies seem to challenge some of the views that were established in the last two decades.
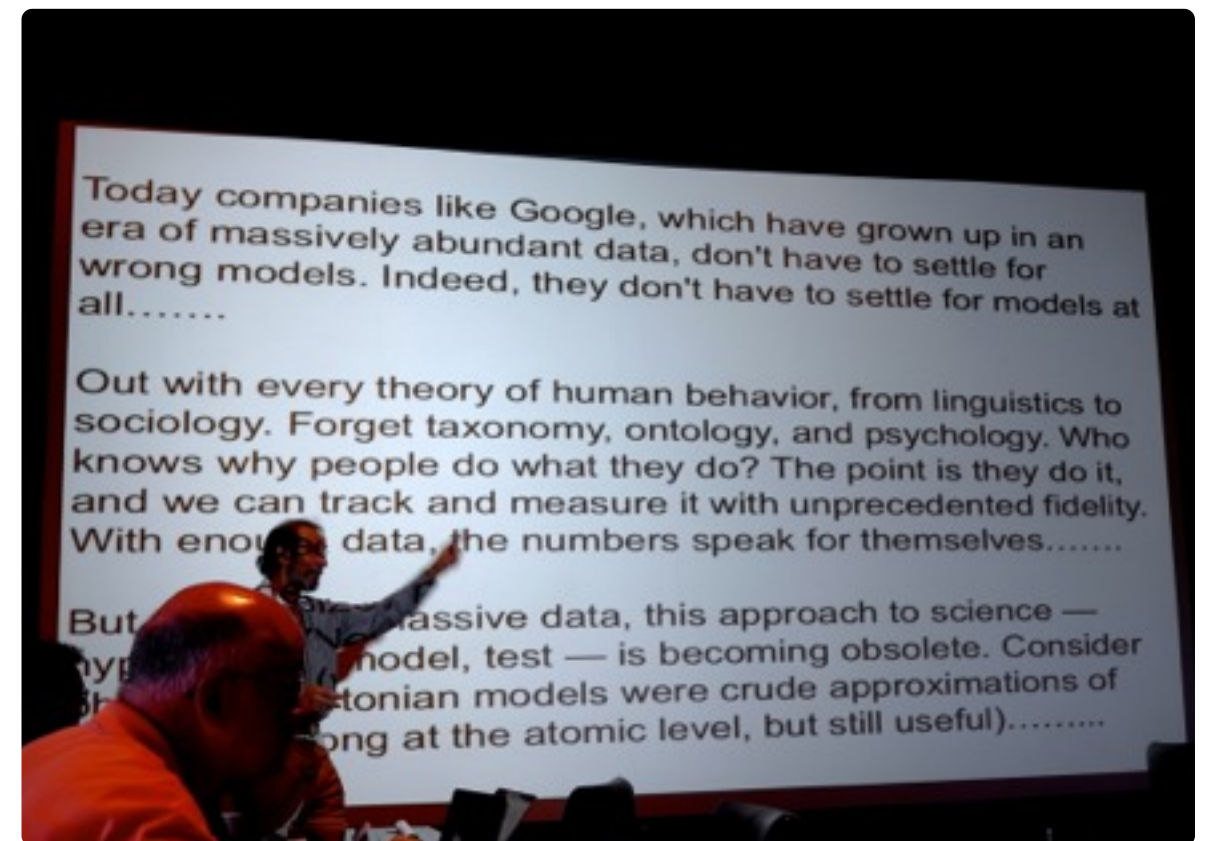
Gallery 10.1 Complex Systems

Schmitt, G. 2013. *Geoffrey West is a leading Complex Systems theorist. A physicist, he increasingly focuses on complex urban systems.* [Photograph]. Santa Fe Institute.

Gallery 10.2 The Santa Fe Institute

Schmitt, G. 2013. *An alternative view on systems by web companies? Geoffrey West at the Santa Fe Institute on September 20, 2013.* [Photograph].

Urban systems design

Systems design describes the process to define the structure, the model, the components and the necessary data for a system to perform in a desired way. In analogy, urban systems design is the process to define the underlying structure, the desired model, the necessary components and the data and information for an urban system to function in a sustainable way. In an abstract way, it is an extension of architectural design. Rather than buildings interacting with the urban system, the urban system will interact with the territorial system.

Specifications

High-level specifications for an urban system could be sustainability, value creation, happiness of the population, affordability for all income classes, positive environmental impact, and contribution to the functioning of the territorial system surrounding the urban system. The process of defining the specifications is the most challenging and important.

Processes

In a top-down process, a process owner, for example a city mayor or a city planner, assembles a transdisciplinary team of experts to address the specifications. In a bottom-up process, a community or a group of stakeholders organises itself to address the same set of specifications after formulating, ranking, expanding and discussing them carefully.

Results

The results of the process to fulfil the specifications is normally a master plan or a master rule plan. With increasing computational capabilities, crowdsourcing and design oriented social media, the design results will be visible immediately and lead to an interactive process of improving the design and performance.

Implementation

The implementation of the design results will last for years and will continue until an equilibrium is reached, or until the urban system ceases to exist. Traces of the original design can be found today in cities that are more than 2000 years old, and this strength of the original design is a phenomenon that will persist. The **memes** of the urban system design appear like the analogy to genes in biology.

Data collection and feedback

As soon as the first buildings and infrastructures are completed, data collection must start. Data and their prudent monitoring and use are crucial for the functioning of all systems. The extensive application of data in the urban design process is a new phenomenon that was not possible just a few years ago. The data and information feedback loop helps urban systems designers to adjust their designs based on the observed performance and on the degree of fulfilment of the original specifications. This opportunity is specific to the urban systems design of the 21st-century.

Why urban systems may fail

Acemoglu and Robinson convincingly argue in their book "Why Nations Fail" that the most prominent reason for the failure of nations is the extractive nature of national government, in stark contrast to the inclusive nature which fosters growth and makes nations sustainable. The authors mention numerous cities and city states to which this observation also applies.

They argue that it is not geography, or culture, or ignorance which decides if a nation will be successful or will fail. In contrast, they support the view that it is the simple difference between being extractive or inclusive. They give powerful examples under the title "How Venice Became A Museum" and described how Venice, after the decline of the Roman Empire became most likely the richest and most powerful city in the world during the Middle Ages, with several times the size of London at its time.

The description of the rise and fall of Venice, which the authors connect directly with the switch from an inclusive type of economic and political development towards an extractive type of development, was caused by the always inherent wish of the leadership and the elite to concentrate power in their own hands, rather than letting it go to new persons that constantly enrich the economic development. The authors claim that Venice today is a museum and only lives on tourists that come to visit the results of the time when inclusive governmental structures defined the city.

In view of the discussion of the three examples of Chandigarh, Brasilia and Chenzhen, inclusiveness and extraction also play an important role. Chandigarh, after many years of British extractive policies, was founded based on a top-down decision where the next capital should be built. A similar development could be claimed for Brasilia. Also here, the extractive nature of this part of South America is well argued by the authors of "Why Cities Fail". In fact, the relative economic underperformance of Brazil as compared to North American countries could be one result, stemming from the extractive policies of the previous governments.

In this light, the rapid development of Chenzhen comes as no surprise, because it could be seen as an island of inclusive policies, enabled by an economic development zone. The rapid growth of the city within the last 30 years, which by far surpasses the growth of Chandigarh or Brasilia in more extractive contexts, could be a powerful point to support this theory. In all three cases, it seems indeed a fact that neither culture, nor climate, geography or governance led to the development of the cities as they are today. The example of Shenzhen shows, as does the example of the neighbouring Hong Kong, that inclusive institutions and local governance are dominant factors in the development of cities. They will also eventually decide on their long-term success or failure, and on their long-term sustainability and resilience.

Urban - Rural Systems

Urban systems cannot exist in isolation. They are always connected to their hinterland, or to rural systems. In fact, the combination of urban and rural systems will be one of the main features of future development. Stijn Kuipers describes this trajectory in his article "metropolitan rurality – new alliances for a legible landscape" (**Kuipers 2013**). He proposes a new ordering system for the territorial landscape, consisting of (1) a natural buffer zone with 95% nature and 5% recreative infrastructure, (2) lively ribbons with forests, farm and residential yards, horticulture and agriculture, (3) multifunctional forest with some development and recreative infrastructure, (4) dwelling slow zone with fields and dwellings, and (5) industrial production landscapes with farmyards, agriculture and some recreative infrastructure. In summary, he suggests a feasible way to apply urban economies in traditional landscapes through metropolitan rurality.