REPORT

Will Cities Eventually Collapse?

Alvin Chua

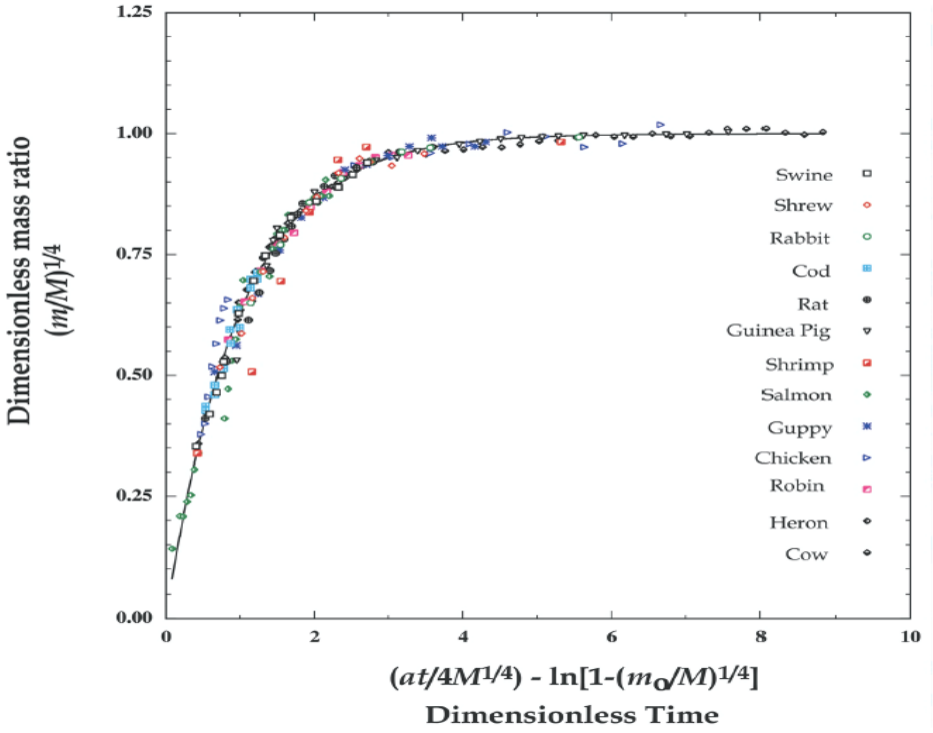
Source: Pawel Nolbert, unsplash

> [Social relationships] do not change with city size. Even though your interactions are increasing rapidly the bigger the city size, the people that you are staying connected to is the same.
>
> — Prof Geoffrey West, Santa Fe Institute

With over half of the world urbanised today, and more to come in the future, the fate of the planet lies in finding a sustainable way to grow cities. The current belief in exponential, open-ended growth can only go on if cities innovate faster than when resources run out, said Prof Geoffrey West of the Santa Fe Institute.

Speaking at a CLC lecture in March 2018, the author of *Scale: The Universal Law of Growth, Innovation, Sustainability and the Pace of Life in Organisms, Cities, Economies and Companies* explained how cities worked in a metabolic fashion.

Prof West's research built on Kleiber's Law, which states that "for the vast majority of animals and plants, the metabolic rate scales to ¾ of the animal's mass. This is also known as negative quarter-power scaling." To put it simply,



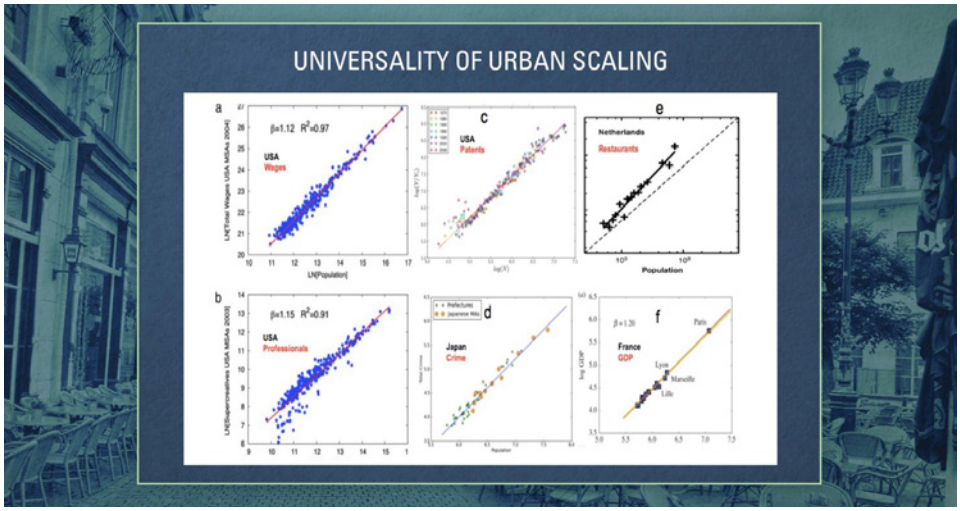
The universal growth curve that shows the metabolic rate scales to ¾ of the animal's mass.
Source: Geoffrey West, Santa Fe Institute

if you plot mass versus metabolism on a logarithmic scale, the result is a perfectly linear relationship. As life gets bigger, metabolism slows down. This means that all living things have roughly the same number of heartbeats in their lifetimes—smaller animals just use them faster.

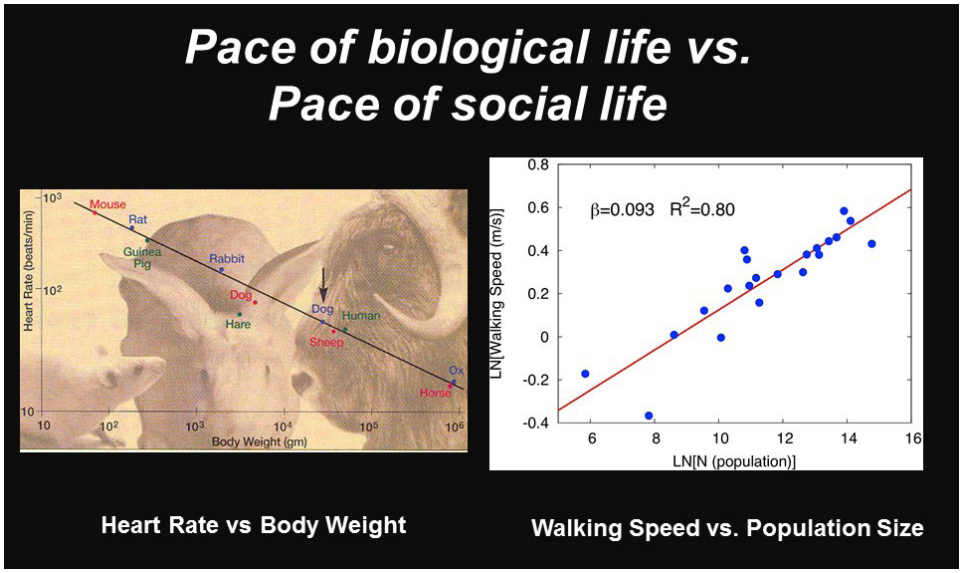
Just as cells of animals and plants take in energy to sustain, replace, repair and reproduce, cities also depend on energy, and Prof West's data found that city infrastructure can be scaled the same way. Despite having very different histories, geographies and cultures, the energy consumption and transportation growth in cities metabolised in the same way as an organism.

"Why is [it] that trees, birds, bacteria and humans all scale in the same way? The idea underlying this is that we're all sustained by networks, and it is the mathematics and physics of networks that give rise to these scaling laws," he said.

In the case of cities, these networks include transport systems, water pipes and electrical grids. By analysing data sets of urban infrastructures as plotted against city size, Prof West found that doubling the size of a city required less than double the growth in infrastructure such as the number of petrol stations or water supply lines—a result of economies of scale. What was even more interesting to Prof West was that as cities grew, socio-economic activities and outcomes such as wealth creation, creativity and wages increased exponentially.



Urban scaling occurs in multiple dimensions, including wages, patents, restaurants, creativity level (professionals), crime and GDP. Source: Geoffrey West, Santa Fe Institute



Prof Geoff West shows data that reflects how animals and cities scale in a similar way, at a constant metabolic rate. Source: Geoffrey West, Santa Fe Institute

The collective gains generated by creativity and innovation are probably why cities keep growing in scale, said Prof West. However, he noted that even as cities grew, data shows that people still roughly stay interconnected with a small group of people regardless the city size. Urban planners and designers need to ensure they create environments and buildings that remain "village-like" or more social issues will arise.

"This is extremely important in understanding and creating the kind of life we want in cities. As we increase the incredible connectivity, there is this need to remain village-like, small and interactive. If we design environments, buildings, blocks of flats [without] taking that in account, we are destined to create more social issues."

Another issue with this theorem of super-exponential growth is that there will come a point when resources will run out, be it in five, 10 or 100 years from now. The only way to avoid stagnation and collapse is for cycles of paradigm shifts. Examples from the past include the discovery of bronze, coal and, more recently, the invention of Information Technology.

Prof Geoffrey West talks about the need for a new paradigm shift in how societies operate to prevent resources from running out.
Source: Centre for Liveable Cities

URA's Chief Planner Hwang Yu-ning and Prof Geoffrey West share insights about how cities scale.
Source: Centre for Liveable Cities

However, as such technological growth cycles become shorter and shorter, the population's social-cultural mindset is struggling to keep up. "You're going to have to be innovating...not just every 15 or 20 years, but every five years, then every year." The impossibility of keeping pace with such an acceleration is why he believes the next paradigm shift cannot be about technology, which has defined the modern era. Instead, we need to rethink how society operates to overcome its next inevitable collapse.

Prof West called for the academic community and practitioners to get together to think seriously about the question of sustainability, from the scale of the local to the planet.

"We need to devise a grand unified theory of sustainability," said Prof West. And it should have much more urgency than what the United States had with the Manhattan Project to build the atomic bomb or the Apollo Program to send a man to the moon."

About the Speakers

SPEAKER

Prof Geoffrey West

Distinguished Professor; Former President, Santa Fe Institute; Associate Fellow, Green-Templeton College, Oxford University; Visiting Professor, Nanyang Technological University

Prof Geoffrey West is one of the leading scientists working on a scientific model of cities – networks and laws of scalability. Prof West is a theoretical physicist, and has been a lecturer in many popular and distinguished scientist series worldwide, including the World Economic Forum. His recent awards include Time magazine's 2006 list of 100 and the APS Szilard Award (2013).

MODERATOR

Hwang Yu-Ning

Acting Deputy CEO;
Chief Planner,
Urban Redevelopment Authority

Having served in the Urban Redevelopment Authority (URA), Ministry of National Development and Strategy Group in the Prime Minister's Office, Hwang's experiences include long term strategic planning, local urban design, master planning, policy development and coordination across government. Hwang currenly guides URA's land use planning to enhance liveability, economic development and future physical capacity.

About CLC

The Centre for Liveable Cities was set up in 2008 by the Ministry of National Development and the Ministry of the Environment and Water Resources, based on a strategic blueprint developed by Singapore's Inter-Ministerial Committee on Sustainable Development. Guided by its mission to distil, create and share knowledge on liveable and sustainable cities, the Centre's work spans four main areas - Research, Capability Development, Knowledge Platforms and Advisory. The CLC Lecture Series is a platform for urban experts to share their knowledge with other practitioners. For more information, please visit us at http://www.clc.gov.sg

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