*Editorial*

B Urban Analytics and City Science

# The Coronavirus crisis: What will the post-pandemic city look like?

EPB: Urban Analytics and City Science
2020, Vol. 47(4) 547–552

DOI: 10.1177/2399808320926912
journals.sagepub.com/home/epb
SAGE

Many times in these editorials over the last 30 years have I speculated on how we might think about cities in terms of their dynamics. The central constructs in such thinking involve ways in which cities can be disrupted by new technologies, and how a myriad of networks define the way energy, materials, people and information come together to generate levels of complexity, unimaginable before the industrial revolution. This science suggests how resilient cities are in the face of unanticipated, often chaotic events, due to the fact that cities are constructed and evolve from the bottom up. A favourite model is based on the notion that if a city is conceived of as a network, then we should be able to figure out the set of cascading consequences that rapidly diffuse from some break in transmission. This relates to how we might get a handle on such repercussions if we are able to observe these networks in much more detail than we have been able to in the past. It was Edward Lorenz (1993) who in 1972, first articulated this notion of unanticipated effects or chaos in the weather, in his question 'Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?' or more critically for cities, in the words a popular 1960s song how ' ... the lights went out in Massachusetts'. Or more to the point, how these seemingly random events in distant places like a wild life market in the Chinese city of Wuhan, suddenly throw the world into a global lockdown as an unknown virus begins to spread more rapidly than we could ever envisage.

Nothing, nothing whatsoever, could have prepared us for what has happened since the beginning of this year. I know that some researchers and public health professionals who have been modelling pandemics have argued that they were always aware of the risks but that no one has ever taken them seriously enough. Even Bill Gates (2015) has been preaching the dangers of a pandemic for years as reflected in his TED talk. But for over 100 years since the so-called Spanish flu at the end of the First World War, we have not really taken to heart the idea that everyone and everywhere might be infected by a disease that we were unable to control. I remember as a young boy growing up in Liverpool in the 1950s being somewhat afraid of various viruses such as polio and smallpox but they were fast being eradicated, disappearing by the end of the 20th century. The obviousness of what has now happened however is sobering, indeed humbling. We were able to control SARS, Ebola too and other respiratory diseases in the recent past, but the sheer virulence of the Coronavirus has taken us by surprise. The fact that we are all connected so closely to everyone else due to global travel and global supply chains has spread the disease much faster than we were able to grasp. This has revealed that our perceptions of the way the world is globally connected

lag far behind the actual reality, while the density of this connectivity appears to have grown exponentially since the Millennium.

Over the last 20 or so years, there has been some limited progress in figuring out what happens when a large network composed of tens of thousands of nodes and even more links goes down, that is, experiences some break in connectivity or transmission. We know that networks usually have a distinct structure and social and communications networks are usually composed of different clusters of nodes that reflect our competitive nature and our need to agglomerate. Such networks have gatekeepers who control key links between the clusters – weak ties – while the size of the clusters themselves are arranged according to various power laws where very often networks have giant components. Moreover, many networks are extremely resilient to attacks on their nodes or their links. There are many social and economic networks that are very difficult to bring down even if key nodes and segments are removed. In some respects, this is both the great strength as well as the great weakness of many human networks. In some networks, there is so much redundancy that it is almost impossible to bring them down, meaning stopping transmission of information between their parts, and this a great strength if what is being communicated is essential for the life blood of the system. This is easy to see if a key highway goes down through an accident. There are usually many alternative routes. But if what is being communicated is undesirable like a disease, a bad idea, or an illicit and potentially harmful drug, a network with great redundancy is not what one wants. To intervene positively to either build new links that would enable better communication or to remove links and hubs that could kill the undesirable communication at one fell swoop, then the connectivity or the density of hubs and links is all important. In the case of the Coronavirus, to stop the virus spreading one has to target the clusters where the super-spreaders of one type are located or the weak ties where another type of super-spreader exists. This can only be done by very detailed contact tracing that is expensive and will always miss some cases. Stamping out the virus in this way is difficult for it amounts to squeezing it out of the system, in its entirety. A vaccine to reduce its effects or to make the host immune is the only way.

All the examples we have of adding or removing links and hubs from a network are miniscule compared to the networks involved in the current pandemic. To stop transmission beyond the household or dwelling unit demands a total lockdown which means that everybody needs to stay at home – to self-isolate in the current jargon. This would kill the transmission of the virus to anyone outside the household but it would be akin to simply dismantling the entire network. This is not physically possible for the population must still consume the most basic necessities so what has been adopted is a lockdown for all but the category of key or essential workers. In the UK, there are about 32 million persons in employment and about 5 millions of these are defined to be essential workers. This gives some idea of the scale of the lockdown. Very roughly, we might say that this implies that about 80% of the social and economic networks of the country are currently locked down, and non-functional. It is a unique and entirely unanticipated situation and there is very little idea of what will happen next as there are severe demands for this situation to be eased so that the economy can be rebooted back to its pre-crisis levels. There are no examples in the literature of any cases where networks have been targeted in this way even in theoretical terms and thus we have little or no experience of knowing how such a network might recover.

Recover of course it will but if the lockdown were completely released tomorrow, the economy would not come back in one fell swoop. Far from it for it would take some time to reboot various industries and services. There would be differential effects related to supply chains and once one examines this in the wider global context where different nations and

cities are recovering at different rates, none of this is bound to be smooth. But parts of the economy will not come back in any case. It cannot restore itself to its former glory for some businesses will have gone broke, unemployment is bound to rise. About half of all employment is currently being unpinned at a lower level financially by government, and it is most unlikely that these workers will have saved enough to recover their former life styles, at least for a while. Recent predictions suggest that this virus will lead to the greatest economic recession since the Great Frost of 1709 – which is so long ago that it is not possible to make comparisons (Schofield, 2020). One might as well say since the Black Death, it is so unrealistic a comparison.

The biggest change however is likely to come from changes in the way we move around. Until a vaccine is found – if it is found although there is a very strong chance that something to alleviate the symptoms will be – then people will be very wary of keeping close to one another. Social distancing which implies that if we do not know that anyone within 2 metres of ourselves has the virus, we will always keep more than 2 metres from them. Many movements on public transport in cities greater than about 50,000 population have crowding at peak hours where this rule is likely to be adopted socially in a time when it will be no longer be mandatory or strongly advisable as it currently is in the UK. This is likely to lead to changes in our modes of transport. In fact for two weeks before the current lock down in the UK which occurred on March 23, I walked to work instead of using the 'Tube' and 2 weeks earlier when I returned to the UK from the US to Terminal 2 at Heathrow on February 16, it struck me that we should have been exercising much more caution especially as a plane from Beijing had just disgorged its passengers and half those in baggage claim were wearing masks. Social distancing may well be here to stay especially if the disease becomes endemic and we are unable to eliminate it which is quite possible as in the case of various strains of influenza.

Shifts in mode when people avoid public transport and resort to walking or cycling or to travelling in their own cars are likely to be a fairly immediate consequence of the pandemic and this will probably have a major effect on the amount of travel undertaken. Many more people having adapted to working from home, may well continue to do so, at least for part of the week. In fact before the pandemic during the last calendar year (2019), the UK Office for National Statistics (ONS, 2020) reported that 5% of workers worked from home all the time, 27% worked from home at some point in the year and 8% worked close to their homes in the same complex of buildings. This suggests that up to 40% could work from home if the conditions were right and if there was continued pressure to social distance. If this were the case, then the impact on transport would be dramatic.

We may well see a rise in demand for car travel, reversing the slow decline which has been happening in many countries since the late 20th century. If we see a significant increase in car usage, this could well sound the death knell for the compact city idea. During the Second World War, the idea that we should 'decentralise' our activities away from big cities took on a new urgency. Throughout the 19th century, the drive towards urban planning was based around the notion that we should return to the countryside to avoid the evils of the big city, indeed the garden cities movement and the idea of new towns reflected these concerns. And this was long before we acquired the ability to travel individually using the automobile. Indeed the history of the city in the 20th century is one of letting the city 'breath' through a decentralisation of congested activities from housing to industry to services in edge cities, low-density urban sprawl and new communities far from the central city. Combined with working from home and severe social distancing, these old ideas look increasingly attractive. During the Second World War in the UK, the strategy that emerged was based on decentralisation from the urban heartlands. The various reports which were produced for

government by Barlow, Scott and Uthwatt suggested that the industrial population should be dispersed, that to avoid a repeat of the bombing, we should live in smaller places, with industry widely decentralised and with an implication that towns should be more self-sufficient. The core of urban development in Britain in those far-off days was in fact referred to rather darkly as 'the coffin' due to the shape of the predominant industrial development in Britain in the area embracing London, the Midlands, the North West and West Yorkshire. It was this area that was largely regarded as the region of the country from which one should redistribute the population. At a more local scale, this policy came to be implemented particularly in the British new towns. Years where a degree of self-containment with respect to employment and population would minimise travel, notwithstanding it was entirely counter to the way in which our towns and cities had developed since the start of the industrial revolution.

Needless to say this policy of self-containment was impossible to implement, deeply flawed in that cities grew ever more rapidly around their edges and commuting distances became ever longer. By the late 20th century however, policies to compact the city rather than establish new towns around its edge began to be implemented such as development on brown field sites, and this was accompanied by various policies to constrain the car and reduce pollution largely through taxation and road pricing. The emergence of smart growth through policies associated with transit-oriented development came onto the agenda and before the pandemic began, the notion of a greener, more compact way of urban living was beginning to establish itself as our love affair with the car began to dwindle. The fact that as our cities grew and began to compact, the price of housing and everything else within grew ever faster and more than proportionately to our individual wealth and this a major dilemma. The pandemic will probably end all this as we strive to keep our distance from one another in many different ways, certainly in the immediate future. Much will depend on how the pandemic plays out.

Perhaps a bigger casualty of this crisis will be air travel and tourism. We have in the last two months taken to Skype, Zoom, Teams and such-like web-based conferencing systems and progress in making this experience as painless as possible has been rapid. I for one will think twice now about travelling long distances to give a talk where you barely see the place you visit and spend long hours in crowded airports waiting for planes that seem to be continually disrupted and overbooked and living in hotel rooms that are too cramped. Much of this can now be done online. Tourism too will suffer and change accordingly, not least because people will not wish to put themselves at risk but as much because we are likely in the short and medium term to be a good deal poorer, needing to rebuild our own economies. In fact, the parts of the local economy that will find it hardest to return to pre-pandemic times will be restaurants, pubs and large entertainment venues where we gather for much longer periods of time and where we are likely to be more exposed than in airports, trains stations, or at work where we have some control over our self-distancing.

It is globalisation in general that is likely to change most dramatically because so much of our world is now built around supply chains that satisfy demand that cannot be met locally. Before the pandemic, there was already a strong movement globally in many nations where the concern was with bringing production back onshore. The best example is in our health systems. In Britain, we have a good, equitable and efficient national health system. During this crisis, it has not been starved of expertise in terms of health care workers but it has been starved of the right equipment because much of it is made offshore. This will have to change just as the health care system is itself likely to become ever more significant in thinking about how we organise contemporary society. If there was ever an argument for bringing

production back onshore even though it might be much more expensive in terms of labour to do so, it is related to our public health.

That there will be a new normal, I have no doubt. What this normal will look like, in terms of cities and everything else, is still in the realms of speculation. Much is being written about this near future, but events are unfolding at amazing speed. Bringing the economy back is a critical issue in such a way that damage is minimised but once again we are in uncharted territory. In our domain, we should be able to say something about how when you lockdown an economy in the way we have done, it should come back. We need to predict the sequence of bringing jobs back to traditional ways of working and what casualties there will be with respect to the order in which they are brought back. And all this has to be factored into the virus suppression, to keeping the 'curve flat' so-to-speak and avoiding more damaging waves of infection that continue to threaten life. We may well see walkable cities emerge, we may well see much more work from home, a decline in redundant international travel, a move to produce more locally and cities built around health care. But we may see much more sprawl as people seek to get away from big cities to small towns, we may see a growth in car travel and a decline in public transport, we may see countervailing trends reinforcing each other such as working from home at much farther distances away from cities, we may see more social isolation, and different kinds of social epidemic related to changes in our health and longevity.

That the future is unknown there can be little doubt but the fact that it is in our hands to invent it is something that we need to take to heart (Batty, 2018). In the spirit of the theories and tools that we profess to research in the pages of this journal, we need to consider the myriad of networks that compose the contemporary city and work out how these will change as the pandemic is managed. Many nodes and links in these networks will change. Consider what we have said about transport. Major changes could take place in the modes of transport we use with many public transports declining rapidly, many people working from home and many supply chains being refashioned. Some networks may well disappear while new ones will take their place. How the pandemic maps onto these networks is of obvious significance but the ramifications of changes in our social behaviour will be deep and wide and the new normal that emerges will be very different from that of the immediate past. These changes will impact on every corner of our world. Suppressing the virus in one country or one city will not lead to its return to the old normal as it sits within a global network where every place will have its own behavioural response.

There are dangers too in moving to a more decentralised, isolated kind of world where crowding has disappeared and everybody lives at much lower densities. In conclusion, I am reminded of E. M. Forster's (1909) wonderful story written many years ago about what happens when such a world of isolation breaks down. In his story 'The Machine Stops', Forster paints a picture of a world that is underground, where everyone is connected by an 'internet' of sorts, where production and consumption are a strange mix of local and global, where most never venture outside and where most do not really know how such a world sustains itself. It is not quite the world that we have entered in lockdown but there are many similarities. Forster's new world was one in which an old world had been built around '. . . bringing people to things, instead of for bringing things to people', strangely prescient in these unusual times of ours. His story recounts how the world of social isolation that had become a new normal was breaking apart due the fact that the society had lost its '. . . sense of space'. He continues by quoting one his principal characters saying 'We say "space is annihilated," but we have annihilated not space, but the sense thereof. We have lost a part of ourselves'. There are many features of this world that remind us of the lockdown and the story is really all about how the machine that sustains such a world is stopping. One cannot

help thinking about our own internet in this context, and how, in the present crisis, it continues to operate. To an extent, we have avoided thinking very hard however about the sustainability of our physical networks and supply chains, particularly those providing basic needs which have become increasingly global too. Forster ends his story with the machine breaking but he does not speculate further on what kind of world will return. I will end my story too by simply asking the reader to absorb Forster's essay and his message – it is online in many places. His speculations are better than any I can reflect upon here and thus provide a sense of what might occur and what we might do as the immediate future begins to unfold.

**Michael Batty**
CASA, University College London, UK

## Declaration of conflicting interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author received no financial support for the research, authorship, and/or publication of this article.

## References

Batty M (2018) *Inventing Future Cities*. Cambridge, MA: The MIT Press.

Forster EM (1909) The machine stops. *Oxford and Cambridge Review*, November 1. Available at: www.ele.uri.edu/faculty/vetter/Other-stuff/The-Machine-Stops.pdf (accessed 29 April 2020).

Gates B (2015) The next outbreak? We're not ready. *YouTube*. Available at: www.youtube.com/watch?v=6Af6b_wyiwI (accessed 29 April 2020).

Lorenz E (1995) *The Essence of Chaos*. Seattle, WA: The University of Washington Press.

ONS (2020) *Coronavirus and Homeworking in the UK Labour Market: 2019*. London: Office of National Statistics.

Schofield C (2020) What happened in 1709? Why the UK economy slumped into a recession even more severe than the coronavirus forecast. *I-News*. Available at: https://inews.co.uk/inews-lifestyle/money/1709-what-happened-uk-economy-recession-slump-coronavirus-lockdown-forecast-2539553 (accessed 29 April 2020).