Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

Convenor: **Richard Lorch**, Editor of Building Research & Information
Chair: **Professor Flora Samuel**, University of Reading (FS)
Speakers: **Professor Rohinton Emmanuel**, Glasgow Caledonian University (RE)
Professor Michael Hebbert, UCL (MH)
Professor Sue Grimmond, University of Reading (SG)
Professor Phil Steadman, UCL (PS)
Respondees: **Julia Thrift**, TCPA (JT)
Euan Mills, Future Cities Catapult (EM)

Introductions:

Richard Lorch

Welcome and introduction to the content in the special issue of Building Research & Information[1]. The special issue was the first publication to bring together the interdependent effects between urban form, density and microclimate. A strong evidence base from the research community is emerging on how these are connected and interact. However, not all the papers in the issue were academic. For example one recent paper from Hong Kong on defining the environmental performance of neighbourhoods has directly affected planning regulations to improve the alignment of medium and tall buildings with prevailing winds for outdoor comfort. Some countries in SE Asia are providing leadership in managing microclimates (configuration of built form, wind generation, pollution dispersal, shading, planting, thermal comfort) in their planning policy and actions. These provide useful lessons to learn and adapt to the context and climates of European cities. The purpose of this evening's presentations and discussions are to focus on how we can apply the emerging body of knowledge to planning and design.

[1] **Urban Form, Density and Microclimate**, guest edited by Rohinton Emmanuel and Koen Steemers. https://www.tandfonline.com/toc/rbri20/46/8

Flora Samuel, Chair**:**

The debate would address a series of questions:

1. How must planning & design change?
2. Who is empowered? Who is responsible?
3. How can current barriers be overcome?
4. What knowledge & skills are needed?
5. Professional institutions – education curricula, CPD and practice?
6. Mainstreaming - an appropriate public narrative?

Presentations:

Rohinton Emmanuel, Co-guest editor of BRI special issue – Overview

The Special Issue had tried to address the relationship between sustainability and compact form. It is conventional wisdom that they closely interact, but what are the unintended consequences?

There are interactions between urban form, ventilation and shading:

- Shading and urban form: Futcher et al's paper is based on an analysis of buildings in Moorgate, London and asks what are the energy consequences of mutual shading between buildings and concludes that increasing solar shade can be beneficial.
- But in a comparison of buildings by height (Godoy-Shimizu et al) there is a substantial increase in the use of energy as they grow taller with a 137% increase in energy intensity comparing buildings with less than 5 storeys to those with over 21.
- Density & cooling load: It appears that 'technomass' (anthropogenic matter per unit surface area) is a good indicator of cooling demand.
- Outdoor comfort & geometry: Openness to sky is affected by site coverage but how the site is covered (vertical or horizontal) is key to outdoor comfort.
- Density, wind flow and air pollution: tall buildings disrupt natural ventilation and can make modelling meaningless.

Lessons:

- It is important to control street geometry in relation to the function of buildings
- High densities can lead to problems with pollution.
- Tall buildings may free up open space, but simpler, lower forms can result in greater plan density.
- Low energy retrofits are possible for tall buildings

Michael Hebbert, Emeritus Professor of Town Planning, UCL and Manchester

A quick detour into history:

1. How not to do it: The example of Hilbersheimer, who specified that all dwellings should be L-shaped for optimal solar radiation and all neighbourhoods should be purged of all non-residential uses and organised to suit the prevailing winds. This dictated the form of cities but was fatuous and grossly misunderstood the multidimensional nature of public policy.

   Public policy must always:

   - Be administratively credible
   - Be relevant to the variety of legal regimes and political systems
   - Match resources and competences
   - Address more than one issue
   - Be adequate to all times and seasons

   It showed a cheerful disregard of what planning really is

2. Learning from the sciences of urban form and climatology. There is long history (Hippodamus, Vitruvius, Alberti, Palladio, Howard, Pettenkofer etc.), but a slow gestation. Modern climate science began in 1937 with Albert Kratzer's Das Stadtklima, followed by postwar developments, including the work of Gerald Mills, and the later development of planning tools such as the Klimaatlas (2008) and techniques codified by the German Institute.

   Hilbersheimer looked for simple rules but the more we look the more complex it is. Winds vent, flush out pollution and change energy requirements, but they are also unpredictable. Street width rules can be a good tool for making use of street canyons but there are constant contradictions for both mitigation and adaption of extreme weather conditions.

3. Take home lessons for planners from the Special Issue – despite the confusion:
   - The principle of the compact city has been reaffirmed
   - Steadman's empirical demonstration of tall buildings' energy demand provides a healthy corrective to the fashionable myth of 'green skyscrapers' [N.B. it's easy to plant trees all over tower blocks in cyberspace, almost impossible in real life)
   - The knowledge base has been refreshed, but points up the need for climatic knowledge and an updating of the Klimaatlas.

   Tools need sharpening in the current crisis. The 20th century's tools are no longer adequate. There has been mutual incomprehension, but just increasing 'greenspace' is probably not the answer.

Sue Grimmond, Professor, Department of Meteorology, University of Reading

Meteorological data in the form of the meteorological year was essential for running building energy models, but although most countries have data based on typical climatic zones they covered incredibly large areas and varieties of climate. The Met Office was working on how to divide zones up. Was it possible to use observations based on GIS techniques to model with? Many places, such as NY City, are working towards a 4m grid.

It's possible to create a typical model and run it for really long time scales and model meteorological years into future. Also beginning to model wind fields, although need to take into account tall buildings.

Feed back between urban form and function can feed back into climate models and improve them. Currently working with Public Health in NYC on heat stress as well as with the GLA and London Climate Change Partnership on translating their ambition into an atmospheric model for future planning.

Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

Philip Steadman: Emeritus Professor of Urban and Built Form Studies at the Bartlett School, UCL and Research Fellow at the UCL Energy Institute

Energy and the density and height of buildings:

- Energy intensity in residential buildings decreases as density increases, but above 6 storeys this reverses.
- Using 3D stock models, e.g. Camden, and all results derive from actual energy use.
- Study shows that there is a large fall in gas usage as dwelling density increases, straightforward explanation is that this due to a shift from houses to flats with fewer exposed walls/roofs, but there is also an economic effect as there are less profligate people.
- There is an extremely steep rise in energy use in office buildings with height. Going from 6 storeys to 20 storeys and above, electricity intensity increases by two and half times, and carbon emissions are doubled. The reasons seem to be to do with lower temperatures, stronger winds and greater solar gains at higher levels.
- This provides a strong argument for compact, low-rise cities as carbon emissions double between 6 and 20 storeys. The reasons are still being debated as well as the effects on energy demand in high buildings from levels of exposure etc.
- High densities can be achieved in low-rise buildings

Responses

Julia Thrift: Projects and Operations Director, TCPA

Much of this academic research was new to her, although was also aware of the growth in research into green infrastructure (see Green infrastructure Resource Library).

But what does this mean to planners? The answer may be: not much - unfortunately. They were under too much pressure to learn, reflect or act on new ideas.

TCPA currently doing review under Nick Raynsford[2] covering issues from how planners are trained to options for the future.

Planning in England is in a terrible state with planning currently being seen by many as something that gets in the way of things happening.

There is much good material here, but planners are under too much stress at the moment to pay attention to the wealth of new information.

Euan Mills, Urban Futures Team Lead, Future Cities Catapult

London is currently living at $^{1}/_{3}^{rd}$ of the density it was in the 1930s

Previously worked in the Planning Department of the GLA and some new areas of London, e.g. south of Canary Wharf, are being built at the highest density in the world.

There is a need for data feeds and feedback loops so we can learn from every single new building and every impact assessment.

Because planning system takes 5 years to deliver projects, planning policy inevitably takes so long that by time of implementation it is out of date. In the time it takes to agree policies huge changes can happen.

2 www.tcpa.org.uk/raynsford-review

Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

Architects, planners, communities all struggle with the planning system and we are not using modern technology to help them. We are trying to solve 21st century problems using 19th century institutions. The system is broken!

It is important to see, value and find ways to assess data – it is the new oil. Planners are still physically counting buildings and using pdfs that are not machine-readable.

The FCC is trying to come up with alternatives, creating live, real-time feedback loops with interlinked policy and implementation. The use of digital systems can free planners up to plan.

Gehry is better at BIM. Wind impact assessments should not be in the form of a report but exist as a database.

We need a transparent, data rich, inclusive and agile environment that can respond to change.

Discussion:

FS How much must planning change?

We need to think about water. The Sponge City concept is so important and the way water can provide evaporative cooling.

A. Water is really critical. Need to combine all these aspects from the start.

B. Are the various different ways of modelling the environment talking to each other?

SG The models we use are talking to each other but they are very simple and do not have adequate detail for individual buildings.

EM A London company, Improbable (improbable.io), and worth billions, has got hugely complex modelling capacity that they're using in areas such as transport systems and realising social media.

C. Does the planning system want to change? All the players inside the system are very comfortable with its complexity, its lack of data, poor consultation etc. They are currently happy to present data without proper titles and with a lack of accuracy.

D. Planners have no resource even when there are more buildings in the system. They are increasingly reliant on design review to challenge more towers and tall buildings. Developers do not understand the importance of orientation and that is easy in comparison to assessing wind. They simply get consultants to cheat the system through manipulating wind tunnel studies.

E. If even the design team struggles to understand the system, how do we expand knowledge and skills so that others can respond effectively? This leads back to the lack of education and qualifications and effective CPD.

F. Consultants know all of this, but they are employed by people to get consent. They give clients etc. the answers they want to hear; they blind planners and committees with fat volumes; they do assessments that have no pass or fail criteria; and they move straight onto the number of units to be delivered. We haven't managed to convince clients that there is a different sort of value that we can contribute.

G. There are no studies of microclimate impact provided at planning for the environment within the footprint of developments. It is extraordinary this is not done.

RE We are beginning to do studies. There is a problem of interdependency with adjacent buildings.

EM. This is not the case in my experience. Planners ask for wind impact assessments in courtyards etc.

F. But even when studies are done there still are problems, cf the Walkie-Talkie etc.

H. Almost being unfair to planners, developers and designers when everything is so complex. You can't micromodel everything. Can we not pre-set what is acceptable, as in most places in the world? The UK has a very free planning system. Why not define what is normal and try to simplify the complexity?

Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

PS What is the role of simple rules of thumb? Maybe the models are for academics and rules of thumb are for practitioners? Energy models are very unreliable and this is why UCL uses real data. Results from energy models need to be taken carefully.

F. Consultants just need to deliver the right EPC!

PS. Without real evidence we just don't learn. Maybe rules of thumb are the best way.

MH. There is a need to tighten the regulatory framework for plot ratios and height control, but the Mayor's policy is going the other way – unlike NYC. Pencil blocks in NYC have prompted a review of height controls. This is not just a British problem – cities are cities.

The *Klimaatlas* idea is very strong – we need to get translated into regional models.

J. The relation between energy models and reality is key. Smart meters may provide the opportunity to test with live data.

JT POE is absolutely essential and doesn't happen enough. There is work done with Public Health England (PHE) doing baseline surveys with the intention of doing follow-up surveys to see if projects are successful. But in planning there is never any attempt to see if strategies work. We just plough on – some POE for buildings but not for planning.

E. Chief planners in Copenhagen are using 'outdoors time' as a measure of success for city planning. It covers all sorts of issues including air quality, the comfort of places, seating etc. It is a really good way to get a handle on success.

FS There is the Social Value Toolkit that has been developed with The New Economics Foundation.

K. In The London Plan the boroughs have got to do their own work including on density frameworks. There is no citywide approach. In one year the Plan will go live and at that point the developers will be ready but the planners won't be.

There are not enough 'musts' in the London Plan. There are lots of 'shoulds' and lots of advice. If we don't get the policies right we can't start critiquing the implementation. An SPG will be coming out – the Edge should be influencing it!

FS Should the Edge be developing a combined response?

K. It could all go wrong – so it is important that things are said. There is an impasse with the boroughs. So it is important for the Edge to respond.

L. The Edge gave a co-ordinated response to the London Plan consultation and is happy to do more. We need to look at guidance.

M. On the energy performance of buildings there is a 'performance gap' due to contractual issues. Need to go back to first principles. However no knowledge ever gets fed back to practitioners and the same issues keep recurring.

EM It is now cheap to measure energy in real time. It is important to build in sensors to buildings.

F. … and need to back up with regulation

M. … but some of the most energy-guzzling buildings are labelled 'Smart'.

N. Re. retrofit. The vast majority of buildings are already in existence and we can expect weather extremes from climate change. How do we treat existing infrastructure and buildings?

Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

JT Planning system responding very inadequately and there is not strong enough guidance from political and sectoral leaders. There is no national spatial strategy to provide an overall framework and no regional planning. 333 local authorities are making their own plans, using very different sets of climate data. Politicians are ignoring this for understandable reasons. There has to be a much stronger response because local authorities cannot possibly cope with the challenges ahead.

P. There is pressure for more radical stakeholder engagement. Do we embrace or contain?

EM Embrace – we can model everything. If Cambridge Analytica can control US elections we can make better decisions on the built environment. We are soon going to move onto relatively objective modelling using real data.

RE The feedback loop will be closed as data improves. AI will begin to understand the data and provide analysis.

Q. I've been trying to close the feedback loop in the built environment for over 40 years. Be very careful about big data as its very difficult for it to understand context. There is a culture of design for compliance and not performance. Smart buildings use high energy. They are all dressed up with nowhere to go. Can we afford that dependency, especially in tower blocks? They are a very fragile system.

People want simple answers, but not simple mindedness. They can be much more expensive.

On water: the US Army is predicting a median sea level rise of 6m by 2100 and that is probably a conservative estimate. Why are we building a sewer under The Thames? It won't be any use.

G. On data and planning: The waste facility on Caledonian Road (N7) was built in a residential area and stinks. It didn't require data to know that, yet with the best policies such developments still happen. Planning issues are more political than technical.

JT. Democracy is messy – but is an essential part of planning.

MH Political leadership is possible as Michael Bloomberg demonstrated as City Mayor of New York. His Green Codes task force looked at the spectrum of regulations affecting built form, public health and fire safety. Among many other regulatory improvements they advised making stairs visible in buildings to encourage people to use them.

R. Politics and academia need to come together to learn from and implement the ideas coming out of PS's work. Peter Foggo noted in the 1980s that the plot ration of 1 Finsbury Avenue was the same as the NatWest Tower.

It is important that research comes out with simple facts and it is essential that politicians fund access to research and data.

PS All the building stock data that UCL uses is public. The London Building Stock Model that it has developed (based on 3DStock) will run out to the M25 and its purpose is to provide tools for the GLA and the boroughs to use to help improve the performance of all the existing building stock.

It is easy to sink in masses of data and to despair. You need to have an idea in mind of what you are going to discover. I am suspicious of AI's ability to find meaningful patterns in the data.

The Data and Analytics Facility for National Infrastructure (DAFNI) at Harwell is developing a data model for infrastructure

F. TFL's opening up of its data for others to use and to create apps around has been a great benefit and is a good example of good data use. Open access is more effective than us in this room trying to work it all out.

S. Comfort in the built environment is a key concern. Advert for the Network for Comfort and Energy Use in Buildings' (NCEUB) next conference in Dubai, April 2019 (comfortattheextremes.com)

T. I have an academic background but am now working in a Local Authority planning team. They have very different approaches and there is no collaboration. The transposition of knowledge to planners and designers is much too late and needs to be much more responsive. A system of exchanging personnel might improve links between academia and practice.

Edge Debate 86 - Urban Form, Density & Microclimate:
How must planning & design change?

13th November 2018 – Glasgow Caledonian University, London Campus

Summary:

FS Everything about the current system of academic research works against improving such links

PS It is important to have real evidence. Models have a role but they need to be tested against reality. Academics do talk a lot to practitioners, but communication could be better.

SG The use of common tools is important and then working together with them. It brings understanding of what is important. Data is important but we need to look at it across a wide scale, a whole city or a region. We have got to be working across sectors.

MH Scientific collaboration with government in urban environmental management may take several forms, from external consultancy and commissioned university projects to in-house teams such as the longstanding meteorological unit within Stuttgart municipality.

EM There is a need to have a National Policy on building feedback.

JS Communication is essential. Often academics' public image is for dense outputs that planners are not going to read. There is a need to get the information out there and equally planners need to pay attention.

RE Climate change means we need to inform performance decisions by closing the feedback loop. The data already exists but we need to be both careful and smart with it.

Robin Nicholson, the Edge – Thank you