

## **The Conundrum of ‘Form Follows Function’**

---

Throughout much of the last century, planning was dominated by the idea that the physical environment determined the quality of life for urban and rural populations. By reorganising the form of cities with respect to their geometry and the relative location of their different functions, people’s lives would be dramatically improved. Although this view began to weaken as the century wore on, it still remained the predominant way in which contemporary societies articulated their concern for increasing the sustainability and quality of life in cities and regions. This focus on physicalism continues to this day and progress in linking spatial configuration to the social functioning of cities continues to underpin the planning process with most societies adopting various kinds of land use plans as one of the main instruments for increasing urban sustainability.

A deep seated rationale for this focus is the widely held view that “form follows function”, articulated at the end of the 19<sup>th</sup> century by the American architect Louis Sullivan (1896). This notion of form being determined by function became the mantra of the modern movement in architecture as well the basis for somewhat wider concerns about the way contemporary society should be organised. The argument originated from industrialisation, particularly in building, where new forms of manufactured structure dictated much simpler forms than those that had dominated architecture hitherto. From this movement, the notion that “the form” of a building should reflect “its function” was embodied in its structure, thus implying forms that were bereft of the sort of ornamentation that characterised different styles of architecture from earlier ages such as the Classical and the Gothic. Beauty, it was argued, came from simplicity and in the case of buildings, this new movement that came to be called ‘modernism’ in general, and ‘modern architecture’ in particular emerged as a consequence of the industrial age.

Although Sullivan (1896) is credited with the cliché, in fact he actually said in his short article that “... form *ever* follows function, and this is the law. Where function does not change, form does not change.” This determinism quickly became ‘the law’ of the modern movement as articulated by luminaries such as Frank Lloyd Wright (1954) who said: “‘Form follows function’ is mere dogma until you realize the higher truth that form and function are one.” To an extent like all movements, its essence can be traced back further in the 19<sup>th</sup> century to the French architect Viollet-le-Duc who “...maintained that while a rationally designed structure may not necessarily be beautiful, no building can be beautiful that does not have a rationally designed structure.” (from Wikipedia, 2022). These sentiments quickly came to be embodied in 20<sup>th</sup> century urban planning where it was argued the land use plan represented the essential way in which cities could be improved by manipulating their layout in ways that would optimise their economic efficiency and social equity. Quite how this was to be accomplished was rarely explained while the professions that were responsible for generating such futures were presumed to act on the basis of their intuitions and insights about what such better futures might mean.

In fact although some of the most impressive architecture of the 20<sup>th</sup> century follows the principle of ‘form follows function’ fairly religiously, even the purest of modern architecture departs from this dictum. Le Corbusier whose buildings are regarded as being the ultimate

embodiment of this principle, are graced with some form of ornamentation if only in the way the form is sculpted to reflect its underlying structure and the local environment in which it is developed. His first plan for Paris – the Plan Voisin – although reflecting the kinds of open space and densities that do embody such principles, is based on locating 18 identical skyscrapers on a grid system bearing little relation to the underlying context for it was to be imposed on the existing plan of central Paris in top down fashion (Lubin, 2013). In short, it is almost impossible to avoid using one’s own intuitions based on our perceptions about cities are structured in developing any plan, and this reflects the long-standing and obvious consequence that form and function are rarely developed together when it comes to cities. If an architect has complete control over the design of a building, then it is just possible that “form and function are one” as Frank Lloyd Wright (1954) said but in the case of anything more extensive involving more than one designer or developer and associated with more than one population or activity, form can never be entirely reflected in function. There will always be many forms and many functions. And once the passage of time begins, the wider context is volatile, beyond our control, intrinsically unpredictable, and thus form inevitably begins to diverge from function.

If we examine cities and their geometric configuration at the macro scale where we can identify distinct changes in location and density, then form and function might be perceived to be close. The forces that determine the size and shape of cities can be identified as those pertaining to the centralisation and decentralisation of activities and populations (Batty, 2008). These forces are determined by various functional relationships pertaining to the relative advantages of locating centrally or in peripheral locations (Wurster, 1963). At this level, we assume that form and function are completely interdependent and that as function changes so does form. Since the beginnings of the industrial revolution, cities have continually decentralised from their points of origin – their cores – due both to urban growth which is mainly peripheral and changes in transport and building technologies which allowed people to travel further. But in examining their form at different levels of spatial hierarchy down to the most local scale, the concentration and de-concentration of different activities can be highly varied as the forces that define location and density operate in ever more convoluted ways.

It is only when we get to the most local level that we see the clear separation of form and function. This is because from the start of the industrial revolution when new building and transport technologies first appeared, the production of form which we define here as the built environment – the assemblage of streets and buildings, rail lines and related physical infrastructure that is at present provided for and designed by quite separate groups of actors – has little to do with the processes that define the functions that occupy and relate more generally to this environment. The obvious distinction between form and function involves the time taken to develop each and the extent to which the physical environments is disconnected from the time taken to implement various functions that occupy the city. In short, the stock of buildings and related physical components as well as its geometric organisation has much greater longevity than the processes that define the activities that occupy these environments. The functions that lead to the location of activities in cities can occur at very high frequency, even second by second and although these frequencies can vary quite substantially with some taking place over similar time periods to the longevity of building – decades, generations, centuries even, they usually change at much faster rates than the physical environment itself (Batty, 2018).

A fruitful way of thinking about form and function is to consider the processes that give rise to each. Very different groups of actors and agencies are associated with each. Although form

and function are two sides of the same coin, form is quite different from function in that we might think of form as reflecting the supply of the environment and function as the demand for activities being located within that environment. But supply is determined quite differently from demand although at any one point in time, at least in the past, demand and supply should be close to balance. Inevitably a precise balance which is the definition of an economic equilibrium is unlikely to ever exist but the closer the situation is to such a balance, the closer is form to function. The simplest models of such balance would be where demand and supply for a set of activities generated processes which were sufficiently fluid to enable surplus demand to lead to an increase in supply or too little demand to a decrease. Prices would adjust to ensure that an equilibrium emerged but within this, there can be many different movements in supply, demand, and price that would continually distort the balance. This of course assumes that the resources are in place to enable such changes in supply and demand to be feasible. If there are deep-rooted changes in the way we supply the built environment or in the demand for various activities, then the process may be always out-of-equilibrium as we will imply below.

The simplest mismatch between supply and demand or between form and function involves the differences in the rates of change for each dimension of the problem. The supply of physical infrastructure changes rather slowly and incrementally as buildings are retrofitted with new technologies that emerge at faster rates than such buildings age. The various processes of regeneration that are needed for renovation of building with long lifetimes in general means that as such buildings last longer, their purposes change and they need to be adapted to changing demands. At any point in time, this is the greatest mismatch between form and function and it is clear that as new technologies are being invented at faster and faster rates, the gap between what a building is originally designed for and what its purpose might be now is getting greater. Before the pandemic in US cities, the proportion of office workers who worked from home was about 17% and this rose to about 44% due to the pandemic. This figure is very uncertain and it appears from Google Mobility data, that the number of persons working from home is now about 35%. This varies substantially across different sizes of cities but informed speculation suggests that we will never return to pre-pandemic levels and thus the vacancy rate of office space certainly in large cities will probably remain some 20% below the old normal. Whatever the actual rate converges to, this is a measure of the mismatch between form and function. These vacancy rates however are based on several forces that combine such as the relative obsolescence of the space for new functions, the liquidity of the market, competition for other types of building function, and several other more idiosyncratic factors. But a key issue is in the underlying nature of demand, the way demand is changing structurally with people changing their behaviour at work, and in the relationships between work and home and other functions such as retailing.

In fact, form no longer follows function at fine scales in any case and if detailed time series are examined, insofar as we have good data on such vacancies and changes in the use of existing buildings, it is clear that there are a succession of changes in the use of buildings by land use and types of activity. We can produce a measure of how much change takes place by concatenating successive changes in building, street and other infrastructural usage to produce an overall level of the extent to which the dynamics of form and function capture change at the most detailed level. The only data we have for this dynamics is from activity that has been computed during the pandemic where occupation of workplaces has fallen dramatically; in London, for example, this level fell to about 25% of normal at the start of the pandemic and has moved back about 65% of the old normal at the time of writing. This suggests a sea change in working from home and this is likely to have a major impact on the occupation of offices (and residences and related services) in our largest city centres. What we need is detailed data

about the succession of uses in different buildings over long periods of time that we can match with changes in activities. In short, we need good data at the finest scale so that we can really begin to figure out the extent to which form does follow function (or in fact does not) over long periods of times during which new practices, technologies and urban behaviours particularly in terms of travel and related communications impact on the form of the city. To explore what any form of new normal might be like after the pandemic subsides and becomes endemic, we need models that focus on the disconnect between supply and demand as represented in buildings and activities and how these disconnects change through time.

To provide a glimpse of how form no longer follows function, I will catalogue the changes in land use and activity in a small area of the City of London around St. Paul's Cathedral. In terms of the supply of buildings, there has been little change in the iconic form dominated by the Cathedral, the Central Criminal Court (The Old Bailey), the new General Post Office (GPO) from 1880 and its extension in 1916. In the last 40 years, about half the area has been redeveloped on existing sites mainly as offices and these contain uses such as the New Stock Exchange, and various financial services such as Investec. Before the pandemic began, the new GPO building which was sold off to Nomura Bank in the 1980s, had been rented out to diverse scientific university and medical agencies, while the British Telecom HQ built on the site of the General Telegraph Office in the 1980s was sold to a hedge fund and is currently being repurposed. In short, most buildings are now near empty or have new uses very different from their original functions. A number were being redeveloped during the pandemic itself and now that the pandemic has subsided, the picture is one of widespread vacancy and redevelopment. About 80 percent of the available floorspace is no longer in use but much of it is being prepared for another wave of financial services if one ever comes. In fact if you were not to know the history of this area, then you would be surprised by how the many uses had changed, by the rate of redevelopment, *in situ* of course for the street pattern is largely intact and has not changed for 50 years, and by the fact that many of the activities that now occupy these buildings are so different from those that originally occupied these sites. Scale this picture up to the entire City, then to the central areas of London, then to the London metropolis itself, and form clearly does not follow function, although as one aggregates up and looks at the overall spread of the metropolis, then one might be forgiven for thinking that the shape of London – its form – has remained pretty stable for at least the last 100 years, if not the last 200. However its functions have changed dramatically as reflected in its employment and demographic structure and it a clear illustration of the fact that form can last far longer than function.

This focus on the supply and demand for different kinds of locations in cities suggests that we should exploit this paradigm much more thoroughly. In progressing many models of urban systems which is one of the core missions of this journal, there is a very clear distinction between demand and supply. Models of how buildings get developed are very different from the processes that determine how they are occupied. In fact when urban economic models were first developed in the 1960s, it was widely thought that one should be able to build models that dovetailed into one another determining a general equilibrium between demand and supply. In fact, it soon became clear that this would never be the case. The agencies and actors, the fluidity between the way we mobilise demand for various activities in cities and the way we embrace them within buildings mean that models of supply are lumpy, lack good data on the decision-making process, and are highly sensitive to the aggregative urban, national, even the international economy. Models of demand are much more flexible being based on multiple actors with similar behavioural aspirations. These difficulties have been pointed out by many urban scholars such as in the series of models pioneered by Richard Muth (1969) in his book **Cities and Housing**. In fact most model builders focus on building models of demand and even

today most of the land use transportation models as well as agent-based structures such as those based on UrbanSim (<https://urbansim.com/new-page>) and microsimulation tend to assume the supply side is largely exogenous to their simulations.

To an extent as soon as we split form from function, we generate a series of issues pertaining to how we connect them back again to one another using a myriad of processes. In fact progress with a physicalist approach that planning adopted early in its institutionalisation can only begin in earnest if we disconnect form from function, or rather if we go beyond the notion posed by Frank Lloyd Wright that ‘form and function are one’. If you examine the range of theories and models that we now have, it is possible that we have most of the components that provide the elements for much better simulation models of how city systems evolved and we now have the elements that enable us to explore different ways of using these tools to help us build more sustainable, efficient and equitable cities. Far from throwing away the physicalist viewpoint which is unlikely anyway as there is an intrinsic logic to approaching cities in this way, we need to move beyond it and fashion new ways of building key relationships between form and function in such a way that our explanations of urban change are much more insightful and relevant than they have been so far.

## References

Batty, M. (2008) The Size, Scale, and Shape of Cities, **Science**, 319, (5864), 769 – 771.

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

Lubin, G. (2013) Why Architect Le Corbusier Wanted To Demolish Downtown Paris, **Insider**, August 20, 2013, <https://www.businessinsider.com/le-corbusiers-plan-voisin-for-paris-2013-7?r=US&IR=T> (accessed 24 July 2022).

Muth, R. M. (1969) **Cities and Housing: The Spatial Pattern of Urban Residential Land Use**, University of Chicago Press, Chicago IL.

Sullivan, L. H. (1896) The Tall Office Building Artistically Considered, **Lippincott's Magazine**, March 23, 403-409; <https://archive.org/details/tallofficebuildi00sull/page/n111/mode/2up> (accessed 24 July 2022).

Wikipedia (2022) [https://en.wikipedia.org/wiki/Form\\_follows\\_function](https://en.wikipedia.org/wiki/Form_follows_function) footnote 1 about Viollet-le-Duc (accessed 24 July 2022).

Wright, F. Lloyd (1954) **The Natural House**, Horizon Press, New York; <https://archive.org/details/naturalhouse0000wrig> (accessed 24 October 2022)

Wurster, C. B. (1963) ‘The Form And Structure of the Future Urban Complex’, in L. Wingo, Jr. (Editor) **Cities and Space: The Future Use of Urban Land**, The Johns Hopkins University Press, Baltimore MD.