Design as a Growth Process Represented Through GIS

Michael Batty

Centre for Advanced Spatial Analysis, University College London,
1-19 Torrington Place, Gower Street, London, WC1E 7HB, UK
Email: m.batty@ucl.ac.uk Web: www.casa.ucl.ac.uk

To explore the extent to which the domain of design can connected to, complement and draw from GIS, we must be clear about our definition of design. A narrow but suitable definition of design as it pertains to geographic systems which I take here to be 'cities,' is the process of generating physical artefacts which meet 'agreed' human (social and economic) goals pertaining to specific points or periods in time and space. Traditionally design has been articulated as an explicit and sometimes formal process of optimisation as in engineering or as a process of intuitive discovery, usually grounded in certain conditions or constraints but whose essence cannot be defined. More recently particularly in complex systems, the process of design has shifted from the analogy of 'manufacture' 'or 'construction' to one of 'evolution' with systems being 'grown' according to the kinds of rules that can be distilled from the way biological systems grow and evolve. This argument is appealing because it assumes that design is open-ended in that there is never a finished product, that designs are always subject to the uncertainty of the environment in which they exist, and must therefore respond to such uncertainties so that they might be sustainable.

In a sense, this view of design as a system that evolves or can be grown differentiates the systems to which it can be applied with respect to the environment in which the design exists. Systems that need to be constructed for stable environments tend to be treated much more as products and then the engineering design process is more relevant. Systems at the other extreme that are never finished, imply environments that are continually changing and thus pose a much wider set of constraints that need to be met pertaining to their sustainability. In this note, I will assume that the systems to which this latter focus applies are those that relate more to GIS—geographic information systems and science—with my exemplar being 'cities.' In fact, cities particularly at the urban design scale—layouts of buildings and streets—tend to be treated as products rather than organic growing systems but there is little doubt that the organic analogy is much preferable even at these scales in that it leads to systems that can be adapted incrementally and grow in sustainable terms through time as many design theoristis from Alexander (1964) onwards have called argued is the appropriate analogy.

There is a theory of design which is quite consistent with growing systems that argues that it is the way the constraints on design are incorporated that generates 'good' design. Indeed there

is even the argument that design from a blank sheet is simply not possible and it is the way the designer manipulates, interprets and moulds the constraints that determines good design. In a way, the search for locations that meet certain constraints which was and is a key method of landscape planning initially through overlay analysis (see Steinitz, Parker, and Jordan, 1976) could be treated as a design problem and it was in this arena that the first rudimentary GIS systems were developed. Indeed line printer mapping in the form of SYMAP was to generate these layers and then combine them into a synthetic layer as a composite constraints diagram that enabled solutions to location problems to simply fall out. Map algebra also came from this kind of problem but in one sense, the use of GIS for this task was really one of bounding the physical solution space. Overlay analysis is like piling on constraints as happens in mathematical programming with the last step—the insertion of some sort of objective function—left to the designer. There were plenty of analogies between this and the design process 30 or 40 years ago (Batty, 1971).

So the obvious feature of GIS that is of direct use to spatial design and planning of this kind is to bound the solution space, thus providing the designer with tools to manipulate the constraints in diverse ways. It could be said that the quality of the design is thus dependent on how the designer configures and orders and weights these constraints layers within the GIS although to call this design in the conventional usage is a stretch. A much more elaborate process of using the constraints is thus needed if design is to be embedded in GIS and just as GIS lacks focus on process, being more concerned with representation, any design activity which in and of itself is a human or decision process must be mapped onto GIS from the outside or the inside. There are various conflict resolution procedures in which the objective function is specified implicitly through conflict being resolved that can be linked to this kind of physical bounding of the solution space, and the author many years ago explored some of these from the technical perspective through to formal decision-making (Batty, 1974; 1984).

These activities are much more focussed on the activity of the designer than the processes that drive the system from the bottom up although the group decision approach has elements mirroring or simulating bottom-up action. In this context, a stronger link to GIS would be through embodying the growth and change process in the GI system in question using constraints on the solution in such a way as to bound the space (Batty, 2008). If one were to consider design as an incremental growth or change process operated from the bottom up in the same way that cities grow as some synthesis of multiple quasi-interdependent actions and nest this in a physical solution space which comes from GIS, then the obvious question is "where is the design." Manipulating the constraints is one part of the design is part of the answer of course but also knowing where to intervene in the decision and growth processes is another. In this sense, we have a model of a system which might be a growth or evolutionary process, a representation of the system in physical terms which is contained within a GIS, and a designer or group of designers even who then intervene to produce good designs by

manipulating the constraints and identifying leverage points in the process that would lead to good design. The question of what is good is still up for grabs in this characterisation but one assumes that this relates to the feasibility of the growth process, and the way this process meets its constraints. In fact, the objective function is often implicit or endemic in these systems and this makes this characterisation of design which I would argue is the way we should think of design in cities and complex systems quite different from product design or optimisation which are alternative views of design with respect to some characterisation of location problems in cities.

I would like to elaborate these ideas in the seminar and seek reactions from other with different perspectives on design. I am currently merging some of my previous ideas on design processes with the notion of evolving and growing systems from which good design emerges from the bottom up.

References

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