Architectural Interfaces and Resilience
Modelling, diagramming, measuring

Daniel Koch
KTH School of Architecture
daniel.koch@arch.kth.se

Introduction

Writing an abstract or summary for my presentation to this event proves more difficult than expected – which lies in part at the heart of the event itself: it serves a dual purpose, at least. On the one hand the intention is to present, quite pragmatically, some results from the research project funding it. On the other hand, the intention is to raise questions on a higher level regarding architecture, modelling and spatial analysis. These are not contradictory, as the latter in part comes from the former, but it raises some issues as to whether to focus a summary on the results concretely, or the implications that were part of spawning the theme of the workshop. This 'summary', therefore, will have to wander somewhere in-between while aiming to definitively provide the former. I intend to get to this stage later on.

The project behind the research workshop *Architectural Morphology: Investigative modeling and spatial analysis*, Resilient Infrastructure and Building Security, asks several questions to spatial analysis that to certain extents are different than what we usually encounter – and similarly, in our experience, architectural analysis asks questions to the other fields involved in the project that are sometimes given little attention. What I intend to do in this presentation, is to try and extract and describe some implications and questions raised in this work, and set them in relation to a wider architectural and morphological context. Originating in specific questions, what I will try to discuss here is thus some more overarching results that I believe of more general architectural interest. These will be formulated through two core concepts that have grown forth as central within the research that seem interdependent: spatial interfaces and spatial resilience.

Models and diagrams

However, if I start in an end that comments on the subtitle of the workshop, concerning investigative modelling and spatial analysis, I will begin by suggesting they are very closely related – or rather, that they should be. The reason for this is ingrained in a shared central mode of operation: the model/diagram, where the distinction is largely, I would argue, a matter of degree. They facilitate analysis or design through their modus operandi which for now can be stated as selective abstraction/reduction, because this very abstraction offers possibilities that do not otherwise easily emerge. It is the same mode of operations that makes their use risky, seductive, and sometimes highly problematic (c.f. Châtelet 2000, Emmons 2006).

With little possibility to elaborate here I will, drawing on the work of Gilles Châtelet, simply state that the abstraction of *anything* into models and diagrams is also transformative, and that it is because it is transformative it is possible to work with both analytically and creatively. This transformative operation is the same that makes

them problematic – especially as analytical methods; models are not reality and are not meant to be. A model of behaviour is not behaviour, similar to how the concept of a dog does not bark (c.f. de Saussure 1966). I make the link also for another purpose: that models and diagrams are relevant in relation to a purpose, as the abstraction process that distils properties from a saturated, complex reality by necessity discards, caricatures, and transforms in order to elucidate or allow manipulation. That is, a central question for any modelling or diagrammatic work becomes what it is that is being modelled, connected to why and how. While these questions can be arbitrarily defined, relevant and meaningful results or answers to the questions can be claimed not to be, once the problem is formulated. 'Meaningful' is here used intentionally, in that I suggest that this is the purpose of models and diagrams: to say something meaningful about that which is investigated. I do not mean to pose this as a dramatic or especially new statement, but I believe it of central importance when trying to mediate between different forms of modelling that the purpose is not, and should not be, to distill or produce a model, or the best model, but to develop the understanding of how modelling can help to develop knowledge and design processes by sharpening and widening our understanding of how they work and what they offer.

With this said, I do not consider it a necessity to begin with establishing what a model represent and then make the model, presuming this to be true and discarding the model if it isn't. On the contrary, the 'investigative modelling' as it comes to spatial analysis means to rather try out models to see if they seem to be meaningful, and then to begin unpicking why and how. We can argue, that some types of models give more consistently and repeatedly meaningful information, that some tend to provide information valuable for a wider range of questions, and that some models are extremely useful in very specific situations – which turns to be an interesting study in itself so as to understand how come they do. It can further be argued that models and measures discussed by many of the presenters at the workshop belong to the first two categories (at least), and that a central challenge for research that is still to be addressed is to develop on questions of why and how – as well as to understand how they relate to proposals and propositions in architecture (Peponis 2005).

Architectural and spatial interfaces

Moving towards the question of architecture as interfaces, if we return for a moment to the abstraction-prothesis process involved in modelling and diagramming as proposed by Châtelet, and how this simultaneously clarifies and distorts that which is modelled, a similar argument can tentatively be conducted about architecture if we allow ourselves to consider it (in its realisation into material objects) to be models. That is, if we rest for a moment on the notion that architecture attempts to model society and culture (or parts thereof) through giving it shape and order, then this model can respond in many ways to expectations, which can be read in a range of different intended and unintended ways, and there will further always be a dissonance between intended message and reading. However, it may be possible to take one step further what Thomas A Markus (1993) states – that buildings are 'useful', in the widest sense of the word, when they are meaningful in the field of social relations.

That is, architecture seen as an approximation or an attempt to model society and culture while always inadequate to do so for several reasons. Perhaps most fundamentally because of its physical limitations – there is no way to respond to all of the many and conflicting relations inhabiting even a single building, while there are many possible ways to architecturally respond to any given social constellation, and often many different social constellations can inhabit similar architectural responses because these become meaningful in different ways; or, the social relations architectural configuration capture and respond to makes sense for many different constellations in that they respond to portions of the social relations the inhabiting constellation collectively consider important enough to give spatial/material shape. This, according to Markus, also explains why buildings can come out of use, as if there are changes in social relations (practices, values, relations, hierarchies), buildings might stop being a meaningful architectural response to the inhabiting constellation. Furthermore, similar buildings can be inhabited by seemingly radically different constellations, just as changes in social practices and values may reconfigure constellations to find reasonable response in spatial arrangements that previously were inappropriate, or even unthinkable.
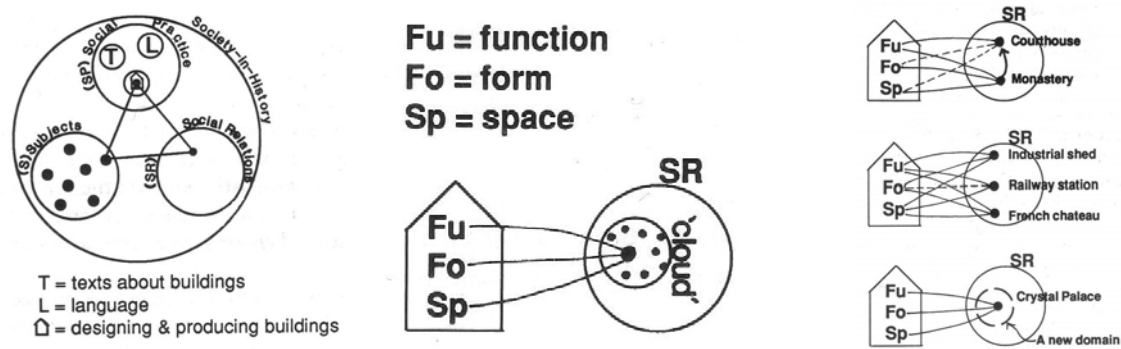
Figure 1: The way buildings become meaningful in society according to Thomas A. Markus. Architecture gains meaning in the interplay of social practices, social relations, and subjects (in society-in-history), and specifically through how function, form and space come together in the field of social relations in a meaningful way. Figures from Markus (1993), pages 8, 31, and 33.

While it can thus be argued that architecture has to make too 'decisive' or 'singular' descriptions of relations, it does not offer proper 'statements', as there are simply too many radically different ways to read it. Conversely, however, scope and possibilities are too restrictive to offer full freedom and there are significant power practices in operation through the arrangement of space. That is, as Tschumi (1996) argues, architecture seems situated just in-between *langue* and *parole*, too imprecise to be a statement, and too restricted to offer itself as a system for expression.

This brings me to the two main points of the presentation, that of 'architectural interfaces' and 'syntactic resilience'. They are highly intertwined, for a rather simple reason: reasonably, when discussing 'resilience' of anything, this is an unanswerable problem unless we first answer the questions of resilience *of what*, and *for what*? The portion of research presented in this workshop builds on the idea that the question is resilience of architecture as an interface, for deformations to its spatial configuration. As it turns out, it becomes an investigation also in 'degrees of change' in general by ostensibly small changes.

The introduction of the idea of 'interface', though existent earlier in many forms, owes largely to a highly inspirational keynote by John Peponis in Santiago de Chile in January 2012, where he suggested to revisit chapter two of the Social logic of space (Hillier & Hanson 1984) under this heading. Such a discussion needs to be navigated carefully – more carefully than there is room for here. Tentatively, architecture as a social interface through space needs to at least elaborate on two sets of different social relations: that of relations between people and groups within the household or programme, and that of relations between them, and people from outside, i.e. strangers, visitors or the public (c.f. Hanson 1998). This is further complicated by how different members of the 'inside' can have different relations to different sets of people on the 'outside', and that even internally the relations rarely neatly fit into a singular, stable set of relations that can be responded to by spatial configuration and that, therefore, some relations need to dominate (spatially) whereas others need to remain otherwise maintained (c.f. Evans 1978).

Perhaps counter-intuitively, such relations through space can often be better understood by investigating relations *of* space than relations of people *to* space, since the latter locks down the analysis in a dichotomy between subject and object where the subject acts in relation to the object, whereas relations through space is about subjects acting in relation to one another in the field of possible actions and reactions defined by relations of space. If this is the case, it is because the conditions of action are *first* social and *then* spatial. The relations of individuals to one another therefore need to be taken into account early on in the analysis; i.e. collective patterns need to be integrated in initial stages of the model. One way to study this is, paradoxically, through the arrangement of space, since the arrangement of space is one of the ways through which collective

(i.e. multitude of subjects formulating a culture) reifies and communicates itself. Or as Sharon Zukin (1995) would put it, negotiates itself into being.

Technically, this further raises some questions since architecture operates rather differently seen as internal and external interface: in many regards it can be argued that buildings, or portions of buildings, that operate as public interfaces more closely resembles the way in which cities work, whereas those that operate as internal interface have a different way of structuring and responding to social practices and relations. While a broadly sweeping statement, it is based on that buildings that operate primarily as public interfaces consistently have observable patterns of behaviour mediated by space similarly as in cities – or, in simplified terms, there seems to be a strong correlation between movement flow and integration in these buildings as there are in cities, whereas movement patterns in internal interfaces seldom do. To some extent, this makes the conditions for analyzing the two kinds of interfaces different.

However, the internal arrangement of space and boundaries, and how these configure interior space, also configure a set of relations to the exterior that participate in the description of social relations communicated through space. That is: the back door is not only a back door on the outside, but is also commonly configured differently than the main entrance from the inside. While somewhat self-evident, it is not quite clear how to make this into spatial analysis of configurations as in space syntax. Or rather, the three most common approaches to analyzing buildings in relation to exterior context consist of: selecting a main entrance (of interest); unifying the exterior as equidistant to all entrances; and creating an exterior graph that influences the values inside the building. While valid, they show some shortcomings in understanding the way the building 'itself' conveys how it interfaces with the public. Such a study needs to on the one hand neither unify nor ignore the exterior, and on the other not let the exterior dominate the analysis as by adding large portions of exterior. Within the RIBS project, we have developed ways of doing this which I will not give the technicalities of here, but which are based on strategies to limit the analysis to the morphology of the building, while using it to construct a description of how it relates to the exterior through a process of diagrammatic mirroring.
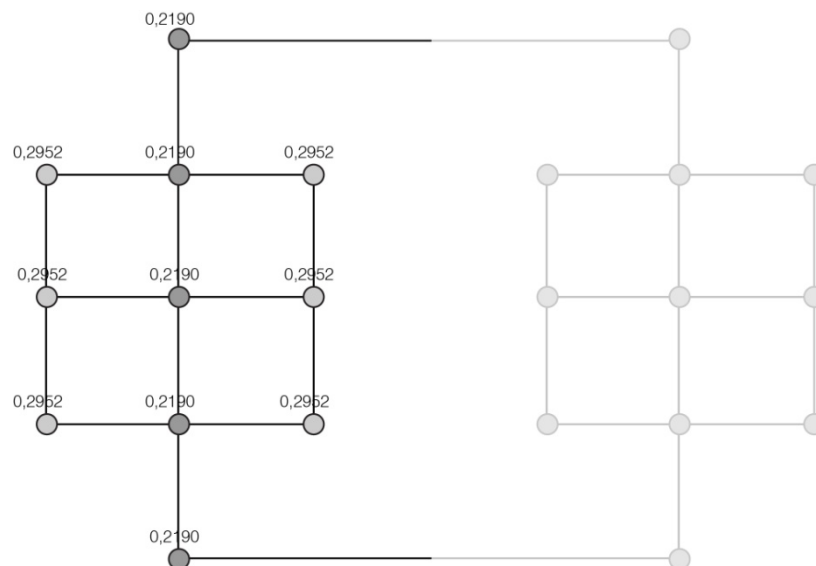
Figure 2: Illustration of the mirroring principle in a symmetrical, 'perfect grid' 3x3 configuration. To capture relations to the exterior, a 'copy' is made of the graph and the entrances/exits of both graphs are connected. The 'mirror' is then discarded. The figure shows relative asymmetry values.

It should be acknowledged, that for all datasets we have available, this way of modelling increases correlation between movement flows and configurative measures across the board with about ten percent, but also that

while not belittling this I consider it secondary but for one thing: it holds implications for how to understand how buildings serve to describe relations between themselves and their context, and it can be used as a general checkpoint for whether the model is relevant or not. That correlations are higher is neither the aim nor the main point, however much it is useful in specific circumstances. It does raise questions about some common assumptions however, which largely remain to be answered.

Spatial Resiliences

With this in mind, resilience can for our work be considered as 'resilience of configurative properties formulating interfaces in the sphere of social relations and cultural communication', a problem that tends to have a dual-dual setup. That is, we can consider *functional* and *performative* resilience, and *similarity* and *sameness*. The former differentiates between whether something can still be done, and whether the new situations allows things to take place in a similar way as before. Similarity and sameness differentiate between whether configurations remain the same, or if they *offer similarly meaningful architectural interface responses* as one another (or before-after). Sameness, it turns out, is easier to analyse – as is functional resilience.

It should also be said, that some of what is to be presented reacts to literature and research in security related fields such as CPTED, which on an overall level tends to treat architecture and space as given, instead of as plastic, changeable material – contributing to proposed security measures being blunt, unnecessarily intrusive, and often having significant and unnecessary side-effects aesthetically, socially, and culturally. It also reacts to somewhat simplistic discourses on relations between architecture and 'use' that seems to pervade this body of theory. This is why we have chosen to rather consider it in relation to the complex framework of the building as an 'interface', and how this interface is affected by various forms of change, including changes introduced as security measures (such as bottlenecks or reduced path choices).

Through the RIBS project, we have developed a range of methods to investigate such a concept of resilience, building on knowledge regarding relations between architectural configuration and various forms of occupation, to see the extent to which changes to the configuration would affect occupation. Such changes can be for many reasons, and it is not self-evident that they would be problematic. On the contrary, it may be the purpose of alteration to break up and change existing patterns for a range of reasons. So more specifically, the question becomes *if the aim is to maintain a similar occupation and operation inside the building, where is it sensitive, and how sensitive is it, to change*. Under such conditions, we can identify how different locations have different impacts, in terms of *range*, *degree*, and *type*. We could summarize it as local or global range, large or small effect, and something that could be approximated as *difference* and *dissonance*. Introducing dissonance means, simply put, to introduce some noise or disturbance into the configuration, while the overall logic remains the same.
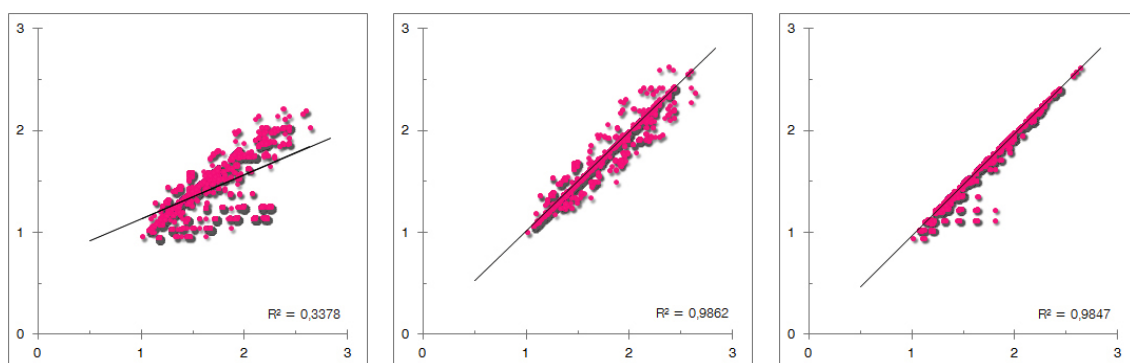
Figure 3: Scatterplots of the relation between integration measures in a building, The different effects show a high, global difference, a moderate global noise introduction, and a local high impact, resulting in alterations that are of physically smaller to larger scale (left to right).

These mostly have bearing on the softer occupational values, whereas functional resilience has a more 'hard value' type. The softer measures are more difficult as they relate on the one hand to how the building operates as an interface overall, and on the more local, small scale connections that affect use of other kinds – a composite problem that is far from trivial and not commonly addressed in for instance graph theory. We have therefore developed a kind of measure that combines centrality measures (that by correlation have shown to be important for interface descriptions) and local measures of how much additional distance is introduced (i.e. the smallest ring size) to combine an overall role of locations with a local effect. This is still a preliminary measure, but it seems to respond well to a range of questions central to the project. It also proves to be dependent not on a more detailed, precise and saturated spatial analysis, but on a higher degree of (relevant) abstraction into discrete spatial elements capturing certain connectivity logics of spatial configuration. In relation to how this so-called summary began, it can be noted that the measures are perhaps even more interesting as a general study of effects of alteration, not dissimilar from the investigations of Ermal Shpuza (2006), with implications for completely other questions of design relevance – i.e. questions of the potential impacts on configuration by manipulation of different 'nodes' and 'links' in the system, as well as it has furthered our understanding of the strengths and weaknesses of different types of graphs or representations.

References

Châtelet, Gilles. 2000. *Figuring Space: Philosophy, mathematics, and physics*. Trans. Robert Shore & Muriel. Zagha. Dordrecht: Kluwer.

Emmons, Paul. 2006. "Embodying Networks: bubble diagrams and the image of modern organicism." *The Journal of Architecture*, 11:4, 441-461.

Evans, Robin. 1978. "Figures, Doors and Passages." *Architectural Design*, 4:267-278.

Hanson, Julienne. 1998. *Decoding Homes and Houses.* Cambridge, UK: Cambridge University Press.

Hillier, Bill & Julienne Hanson. 1984. *The Social Logic of Space.* Cambridge, UK: Cambridge University Press.

Markus, Thomas A. 1993. *Buildings & Power: Freedom & Control in the Origin of Modern Building Types*. London: Routledge.Hillier & Hanson 1984

Peponis, John. 2005. "Formulation." *The Journal of Architecture* 10, 119-133

de Saussure, Ferdinand. 1966. *Course in General Linguistics*. Ed. Charles Bally & Albert Sechehaye with Albert Riedliger. New York: McGraw-Hill.

Shpuza, Ermal. 2006. *Floorplate Shapes and Office Layouts: A model of the effect of floorplate shape on circulation integration*. Atlanta: Georgia Institute of Technology.

Tschumi, Bernard. 1996. *Architecture and Disjunction.* Cambridge, Massachusetts: MIT Press.

Zukin, Sharon. 1995. *The Cultures of Cities*. Oxford: Blackwell.

Daniel Koch is an architect and researcher in architecture and urban design at the KTH School of Architecture and a practicing architect at Patchwork Architecture Laboratory. After doing his Ph.D. work on complex public buildings (libraries and department stores), his research has repeatedly bridged the gap between building complexes and urbanity, either within projects or between projects, weaving together and developing theories and tools that are often developed predominantly for or within one of the arenas. This includes studies of suburban centres, walkability research, and academic campii, but also Sweden's largest hospital complex. His research has lead to a number of invitations to speak at conferences as well as writing book chapters, and lectures given nationally and internationally. While focusing on spatial morphology and cultural (re)production, the research has an increased focus on discussing the emergent performative effects on the one hand, and refining research results towards principles and terminology that can be used within the design process on the other.