THE ARCHITECTURAL INTERFACE INSIDE-OUT

Interior-exterior relations, spatial models, and configurational mirroring

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Abstract

One of the early concepts of space syntax, from the Social Logic of Space, is architecture seen as an interface. This is sometimes interpreted as on one hand a singular transition between 'private' and 'public', or more gradually as a transition from 'public' urban space towards more and more private space on the other. Methodologically, the latter tends to consist of analyses that incorporate both interior and exterior space in the analysis. Similarly, it can be said that justified graphs drawn from the entrance – a commonly deployed practice – is the same kind of description, that is, they describe rather how interior and exterior relates based on the conditions set up by the 'exterior'. This paper, instead, explores how internal configurational properties sets up an interface description, applying a method of 'mirroring' that in certain ways of doing it rather than replacing an exterior in the analysis, emphasizes the internal configuration of the building with regards to its exterior and how it thus describes directionality and priorities of both the building as a whole and of its constitute parts to the surrounding environment. It is thus possible to analyse buildings as interface 'from the outside in' – that is, how entry conditions sets up an interface for visitors, a kind of public-private gradient – and 'from the inside out' – that is, how the building describes its relation to the various exteriors and to what extent 'inhabitants' share similar interfaces and relations as visitors. It further tests these different models to empirical data. The paper explores both a methodology for this kind of analysis and what the results may mean through a series of analysed buildings that makes possible to posit a range of different questions to architectural and configurative analysis.

Keywords: architectural interface; private-public interface; interior

Theme: Spatial Analysis and Architectural Theory

Introduction

While the idea of architecture, or space, as an interface can be considered to be old, depending on the demands put on specific terminology versus conceptual discussion, the intent here is to address it in the sense it exists from the very early publications of space syntax research (e.g. Hillier and Hanson 1984) as a question of how the arrangement of space through material boundaries and connections facilitate social relations rather than as in the more conceptual discussion of societal transformation and the changing character of the boundary-surface of e.g. Virilio (1984), even if the latter shares the concern of social relations. Within syntax research, the idea of 'interface' ranges from specific interpretations such as the interface maps (Hillier and Hanson 1984, 104-105) to more conceptual understanding of space as a social entity that interfaces between inhabitants, and inhabitants and the public, to recent discussions of purview interface (Peponis 2012). The form in which architecture operates as such an interface, and the degree to which societies invest their social relationships in spatial configuration, arguably, have changed over space and time (Hillier and Hanson 1984, Hanson 1998, Rybczynski 2011 [1986], Evans 1978, Virilio 2000 [1984]) yet is often, as demonstrated thoroughly in space syntax research possible to, read in space (c.f. Hillier and Hanson 1984, Evans 1978). This paper aims to approach architecture as a social and cultural interface, seen as a complex gradient saturated with qualities and a wide range of different social relations to manage at the same time. The intention is to after an initial theoretical exploration focus specifically on the way individual buildings formally construct an interface between 'inside' and 'outside'. This warrants attention since it has already been made clear that a building's relation to the outside holds significant importance for many questions (e.g. Hillier and Hanson 1984, Markus 1993, Hanson 1998, Koch 2007), yet is often treated through either a homogeneous 'exterior', or as operating under the conditions of the exterior configuration. In this sense, some of the investigation in this paper is at the formal level of spatial arrangements rather than specifically empirical, but tentative empirical support will be given and discussed on the way towards the more theoretical conclusion.

Spatial interfaces

Characteristic for the idea of architecture – or space – as an interface is that while taking on some different forms, the overarching concept is that architecture, space, and the city formulates interfaces between people, be they between individuals or materializations of the relations between socio-cultural concepts such as 'private' and 'public'. This, it must be noted, differs Hillier and Hanson's discussion from Virilio's in that, while both concern the way in which architecture and physical boundaries construct interfaces of relations between people, the latter is rather focused on the way the surface operates, and the 'opaqueness' of physical boundaries in a world where physical boundaries are (often) penetrated by electronic (nowadays 'digital') communication. Depending on how one reads Virilio's text, it can be seen as an argument for the 'material world' losing its importance. I would argue, however, it is rather a conceptual framing and hence pointedly written of how the role of physical boundaries for social relations and communication was changing and, in the long run, thereby the existence of 'private' spaces, or the meaning of 'privacy'. He is more concerned with the boundary itself (becoming an 'interface') than the way boundaries operate to construct spatial relations, in comparison to which Hillier and Hanson maintain focus on the material boundaries and their construction of interfaces, as in Hanson's statement that

> "Every building is therefore at least a domain of knowledge, in the sense that it is a
> spatial ordering of categories and at the same time a domain of control, in the sense

that it is a certain ordering of boundaries, which together constitute a social interface between inhabitants and visitors." (Hanson 1998, 6)

Which builds upon the discussion in The Social Logic of Space, which can be briefly yet illustratively reflected by the explanation that

> "A building may therefore be defined abstractly as a certain ordering of categories, to which is added a certain system of controls, the two con-jointly constructing an interface between the inhabitants of the social knowledge embedded in the categories and the visitors whose relations with them are controlled by the building." (Hillier and Hanson 1984, 147)

Less explicitly, or perhaps not present in these particular statements but in the discussions they also form interfaces between inhabitants, in Hanson's case members of the household. Architecture as a social interface through space thus needs to elaborate on (at least) 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. 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). This is true also for the degree of structure or distribution, as more structured social relations need to be maintained through social and cultural practices in a more distributed spatial layout, while more distributed social relations need to be maintained through social and cultural practices in a more structured spatial layout (transpatially) (Hanson and Hillier, 1987).

Perhaps, a difference between Virilio's and Hillier and Hanson's discussion on 'interface' can be understood in this sense, as discussion of spatial and transpatial interfaces and therefore somewhat complementary. While a simplification of their respective positions, it points to societal changes that may be in operation at current to redefine just what some configurative properties of space 'mean'. However, it is also worth noting that the latter react to descriptions such as Virilio's that tend to, in their meaning, overemphasise and/or even dismiss one or the other.

This notion of what configuration 'means' and how it relates to spatial interfaces can be further discussed through the works of Thomas A Markus (1993), though with a bit of moderation: Markus' main point, is that buildings are 'useful' when they are meaningful in the field of social relations. However, since architecture cannot respond to all of the many and sometimes conflicting relations inhabiting a building, 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 they 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.

Markus further develops this to suggest that there are three modes in which architecture operates to become 'meaningful' in the field of social relations: form, function, and space [Figure 1]. In a sense, it could be likened to symbolic, programmatic, and configurational, and this is also how much of the analysis continues, but the use of other terms appears partially intentional to not confuse configuration for the 'only' spatial property that matters. Function, furthermore, needs to be understood as a looser description than the functionalistic sense, and rather to describe the pragmatics of uses, practices and programmes inhabiting the building.
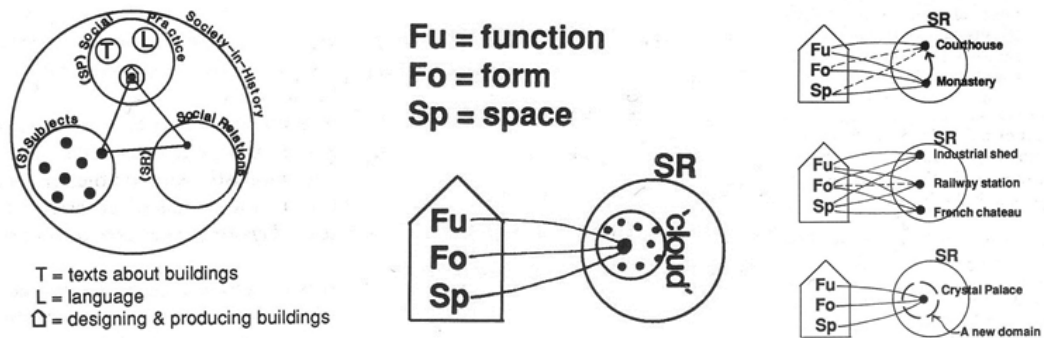
Figure 1: The way buildings become meaningful in society according to Thomas A. Markus. Architecture gains meaning in the interplay of social practices, social relations, and subjects (in society-in-history), and specifically through how function, form and space come together in the field of social relations in a meaningful way. Figures from Markus (1993), pages 8, 31, and 33.

The reasoning is also used to describe generative possibilities of architectural solutions in that architecture not only responds to but suggests social relations: it can propose new meaningful relations, or transform existing relations, in the same way as it supports them. It could be argued, although Markus does not quite do so, that this always is the case simply because of the inability of architecture to fully respond to the complex set of social relations inhabiting it, partially caused by its position between over- and interermination – or, as Tschumi (1996) argues, its position between the specificity of *parole* (statements) and the generality of *la langue* (language system). This ambiguity-enforced lack of 'fit' then enforces at least some adaptations and transformations of practices and relations to take place even if these changes can be between relations acting spatially or transpatially.

Markus' reasoning works well to develop the idea of interface, even if some care must be taken as it runs the risk of finding set relations between for instance configuration and social practices, which also at times comes through in the continuing analysis of various forms of building types important in the 18th-19th century, and which run risks of leading to correspondence thinking (Hanson and Hillier 1987; c.f. Steadman 1983).

Outside, inside, between, beyond, towards, through, from…

At this point, it seems possible to describe spatial interfaces as a dual problem of on the one hand mediating relations internal to the building, and on the other mediating relations between inhabitants and strangers, visitors, or the public (or 'the Other'). This duality is explicitly studied by Hanson (1998) but otherwise tends to often be discussed separately, or at least with a dominant focus on one or the other. In this sense, studies of e.g. museums, libraries, and consumption space (Markus 1993, Choi 1999, Peponis et al 2004, Psarra 2009, Koch 2009,

Tzortzi 2011) tend to focus on architecture as an interface to the public, and studies of workplaces such as offices or hospitals tend to focus on internal interfaces (Sailer 2007, Lu, Peponis and Zimring 2009, Steen and Markhede 2010, Cai and Zimring 2011, Sailer and McCulloh 2011, Koch, Steen and Öhlén 2012). This is a somewhat unfair simplification, but the tendency to focus on one or the other usually comes in order to properly explore specific research questions. There is also a difference between analyses that discuss internal relations between categories or places in museums or consumption space, and analyses that discuss the arrangement of things in relation to the public, with some altering between both. A clear example of altering between both is Hanson's study of Rietveld's Schröder house (1998), comparing the different states of configuration possible through manipulation of movable walls in comparison to the social constellations and occasions in which the various states were commonly employed.

Technically, this further raises some questions since architecture behaves 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. Movement patterns in internal interfaces, however, seldom do and tend to be radically affected by programs and spatial practices (e.g. Sailer 2007, Koch and Steen 2012). To some extent, this makes the conditions for analyzing the two kinds of interfaces different, as one becomes heavily invested in the programmed occupancy and the ordering of things, functions, and people in space, whereas the other can to a higher extent focus on the way space structures contact (visible or permeable) between visitor and content, e.g. art. The investigation of Hanson (1998) and many others (e.g. Markus 1993, Psarra 2009, Peponis 2012) clearly show that there are many different ways in which configuration has effect in buildings, including distributing, structuring, integrating, separating, sequencing, insulating spaces with, to, or from one another.

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 also configured differently than the main entrance from the inside. In the latter, simpler version of stating it, this may seem self-evident. It is, however, not quite as clear how this makes it 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. Selection of entrance means selecting points of importance – which may be not only valid but the best way to respond to certain research questions, but gives little response to the generic relation to the exterior described by the building. The second, unifying the exterior, is often used in j-graphs to illustrate 'depth' into a building, which again can be quite relevant but sometimes does not respond to research questions; 'back doors' may be irrelevant, or there may be social distinctions in who uses what entrance distorting the analysis for a range of research questions. The last one seems to pragmatically work well for public interface buildings, partially in that it provides a good range of correlations between movement flow and spatial measures, but it lacks in that it, fundamentally, is an analysis of how the public relates to the building and not the other way around – which potentially could be just why it works for these

sets of buildings specifically.

It should be noted that added to this, 'internal' analyses also produce relevant information regarding a building's relation to the exterior; a j-graph from an internal space indicates not only internal relations but, of course, relations to the exterior (c.f. Hillier and Hanson 1984), and e.g. a VGA analysis without an exterior show how entrances/exits are configured in relation to the internal arrangement of space. It is from this point I would like to continue; that of how the internal arrangement of space describes a relation to the exterior. However, this relation needs to, on the one hand, neither unify nor ignore the exterior, and on the other hand, not let it dominate the analysis as by adding large portions of exterior. This discussion begins with something of a serendipity in a research process, and for several reasons it is of interest to give account for the background and how the end-point was reached.

A note on earlier findings

First, as noted earlier, in many buildings operating as public interfaces (commercial, public, etc.) the emergence of a correlation between (any) measure of spatial configuration and movement flow depends on the analysis taking into account the relation to the exterior. While this can technically be done in different ways (step depth, added exterior model, etc.) it seems to be a generic property of these types of buildings. The more 'complete' version from many perspectives, and conceptually in line with discussing the interface as a gradient shift through space, is to add an exterior – but the problem is then where to limit this addition. It has been proposed (Koch 2007, 2009) that this 'limit' can be considered as when further addition no longer affects internal relative distribution of spatial measures inside the building, which also seems to consistently provide rather high correlations. However, exactly where this 'limit' is becomes a case of judgment, and trial and error, and also becomes a problematic point for comparisons. In relation to this, step-depth has the benefit of clarity and consistency but the problem of being unable to differentiate between entrances.

Second, the way this functions mathematically, which is of importance for the continuing discussion, is that for certain building layouts, especially those with only one entrance, the point of adding an exterior boils down to 'adding space', as the specific configuration exterior to the building has no effect whatsoever on the configurational values of space interiorly aside from how far it draws integration max towards the entrance. In this case, 'enough' is fairly easy – it is when the integration core is at the entrance. This is also what instigated a 'mirroring' technique to create this very phenomena (Koch 2012).

It is not as simple for buildings with several entrances, however. Especially not if they are internally differentiated where, potentially, different values on the adjoining exterior spaces could radically push the integration core around inside the building. This theoretically poses a double problem: not only does one need to add 'enough' exterior, but one also needs to add *representative* exterior that captures the system in which the building operates which, conceptually, could be a uniform or an asymmetric extension depending on context.

To investigate this, it is of interest to instead of continuous enlargement of the context to reach similar exterior values as, say, in a segment analysis of the exterior grid, rather *shrink* the exterior to see when it stops producing the interior effects sought in terms of correlations between movement flows and integration. This has been done in two cases, the department stores of Åhlens City and Debenhams in Stockholm City. The results are somewhat surprising: basically, the exterior could be reduced to modelling the closest paths between the entrances

[Figure 2] – although these still need to be modelled rather than equalized. In rare cases, an equalized exterior (i.e. step depth from all entrances) provide correlations to movement on par with or slightly better than the integration value with a minimal modelled exterior (Åhlens), but in other cases it is noticeably inferior (down to 54% in Debenhams) – and the correlations shift in favour of step depth when there is either lack of data for the 'back' entrances, where 'back' and 'front' entrances either intersect early on in the system, or where 'back' entrances tend to have their shortest paths to other spaces run 'through' spaces that are already closer to the main entrance. This is not the point here, although a consistent survey of these values in relation to movement is of high interest. The point here is rather that, for there to be a correlation in a building like Åhlens or Debenhams with an exterior compressed down to just the few shortest paths between the exits the building itself, internally, has to be configured to support this pattern. Otherwise these mere few connections would not be enough to support this focus of integration. Rather than self-evident, it must be seen as remarkable the extent to which a 'significant exterior' can be reduced down to a mere few connections with comparatively small amount of vertexes in them. At the same time, the asymmetric relations between entrances seem to be quite effective in distributing integration values towards 'main' entrances (i.e. the ones most in use). This warrants some further investigation.
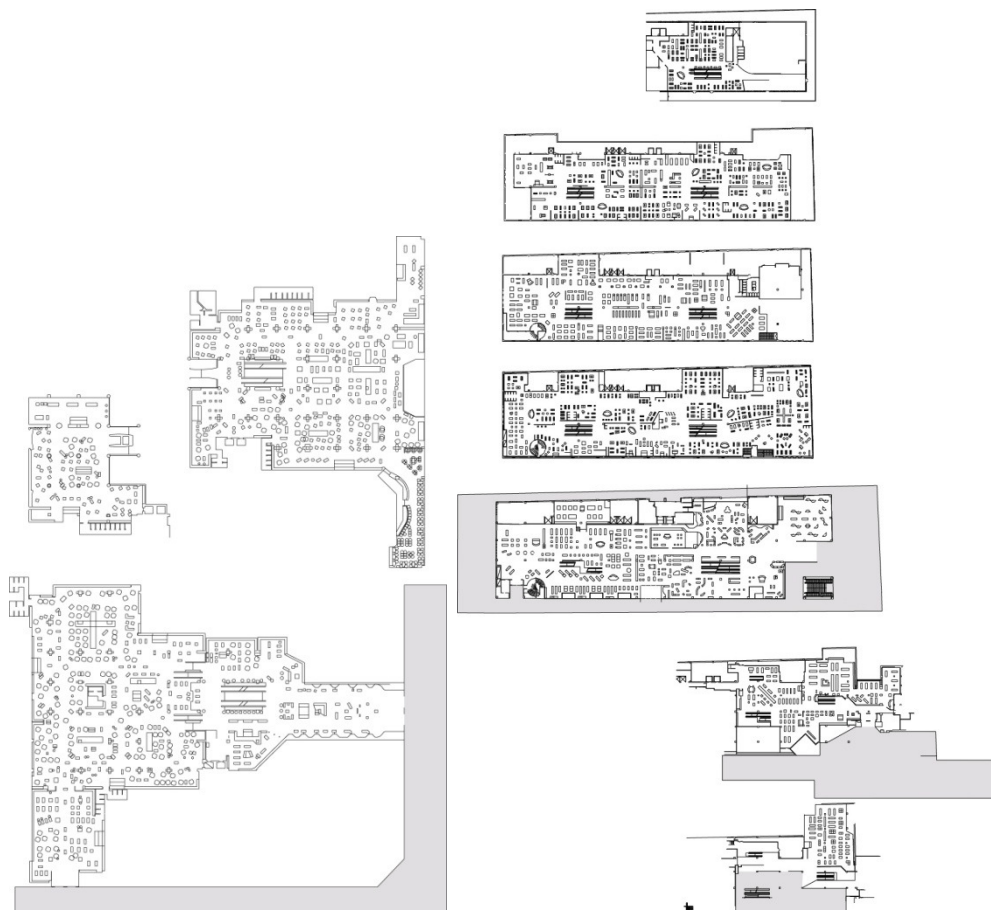

Figure 2: The amount of area needed to be added to Debenhams (left) and Åhlens (right) respectively in order to reach high correlations of integration to movement flow. In the case of Åhlens, the area is made to connect to a small set of vertical exterior connections.

At this point, it is of interest to return to the proposal of 'mirroring' (Koch 2012). That is, to use a mirrored graph of a building, connecting the entrance of the original and the mirror, first devised in order to push the integration core towards the entrance. In line with the 'single entrance' reasoning, this works quite well for analyzing buildings with either (a) one entrance, or (b) one decidedly main entrance that allows for discarding the other entrances/exits for the purpose of analysis. This begs the question: how does a multi-entrance building behave in this kind of operation?

Mirrors and exteriors

To cut to the chase, I will start by showing a simple building by Ed Sullivan, an office built in a complex for the National Farmers' Bank in Owatonna, 1907-1908. This is because it raises questions which I intend to try and give answers to: rather than the integration core ending up by the entrances, it rather strengthens the pattern of integration to end up on one of the entrances, and then on the first floor (Figure 3) even though a large portion of space is allocated on the other side of the ground floor. Now, this is configurationally logical for this specific building. Logical, in that with only two floors, and so little space in two (locally) disconnected entrances on the ground floor, this is in hindsight bound to be the result. At this point, the operation of mirroring may seem questionable – providing we assume what it offers is a description of the social interface of the building as how the public reaches in towards the private.
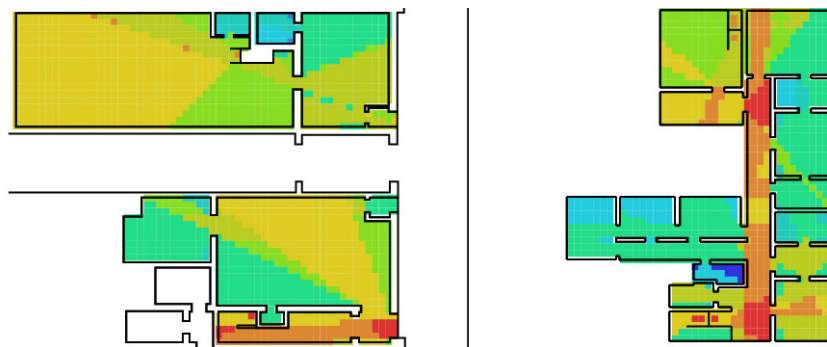
Figure 3: Louis Sullivan's office portion for the National Farmer's Bank in Owatona analyzed by mirroring the plans and connecting the two entrances on the ground floor (left hand side). The integration, rather than reaching from the entrances in, focuses on one of the entrances and the upper connecting corridor. Figures made with Depthmap 10 by Alasdair Turner (Turner 2001).

However, returning to the department stores referenced before, the question becomes how they respond to a similar operation – a question which is begged by the impact of small additions of exterior. It is further of interest, as there is actual empirical, behavioural data to compare with. As it turns out, the pattern of integration as seen 'with a significant exterior' and 'mirrored' is (as different from in the Sullivan building) very similar. Comparing to movement flow turns out as in Figure 4.
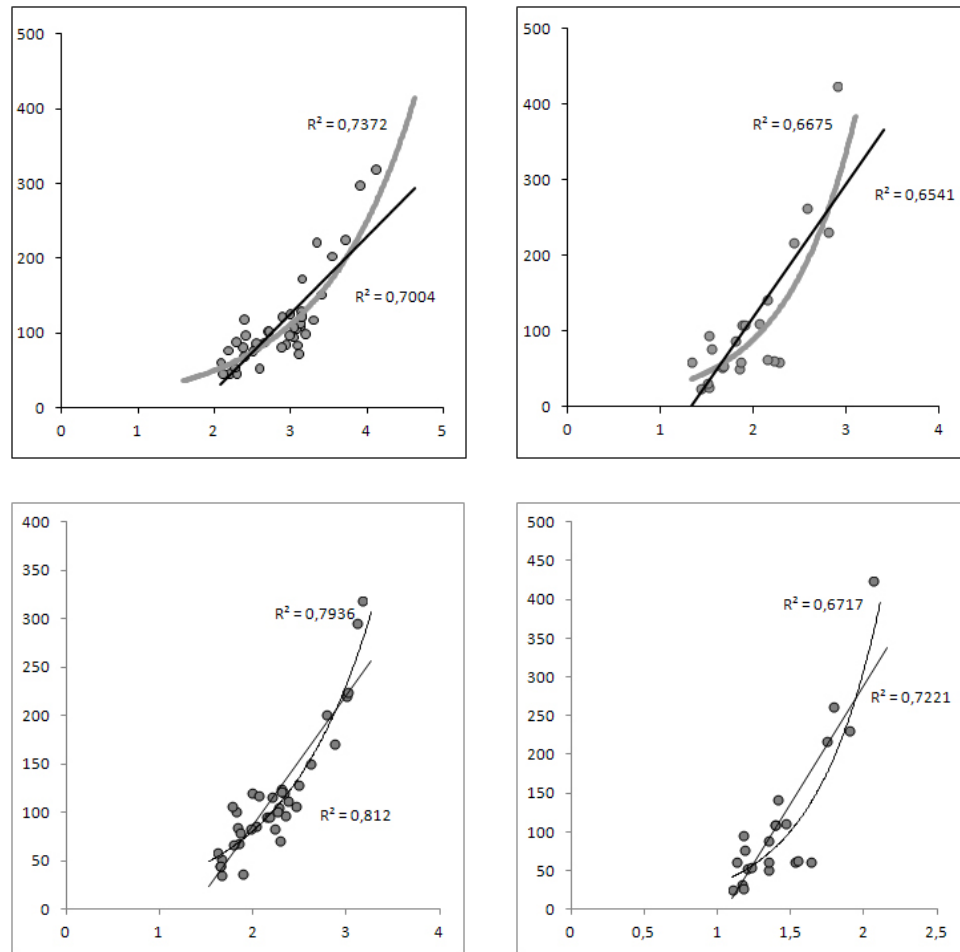
Figure 4: Correlation scattergrams of Debenhams (left) and Åhlens (right), with earlier correlations first (above) and the 'mirrored graph' correlations after (below). The correlations are measured compared to a linear and an exponential growth as this was done in earlier studies.

The correlation of the mirrored analysis to movement flow is in both department stores even higher than for the analysis with an added exterior (81% instead of 74% in Debenhams, 72% vs. 67% in Åhlens). This can only be the case if the internal arrangement of space in the relation to the entrances makes this description. However, there are two possible *reasons* why this is the case: one is that these establishments are so well adapted to their surroundings that they have – intentionally or unintentionally – arranged their interiors to internally respond to an exterior that would lead to this patterns of movement all the same, and the other is that the influence of the internal configuration of spaces set in relation to how they mediate access in relation to the entrance is powerful enough to override the influence of the exterior. The more likely explanation is that it is a bit of both. There are a series of 'mistakes' in spatial configuration compared to sought effect in the department stores that suggest knowledge is tacit or emergent (trial-and-error). It is further more or less obviously the case that secondary entrances (with lower flow) are turned to less populated streets, even though in the case of Åhlens some of this is marginal and would not explain some of the behavioural patterns.

It is beyond the scope of the current paper to further delve into this empirically, and it is something that needs a significantly added amount of data to test, in a variety of different configurations that may, for simple reasons, be difficult to obtain: the likelihood of finding many cases of a deliberately inverted internal configuration relative the external is, it can be assumed,

low and time consuming. Instead, it is of interest to continue the investigation into just what the mirrored integration value means, how it works, and what it can potentially say. This will be done in two ways, one is to introduce a pair of additional examples to illustrate additional phenomena found through the research process, and the other to expand the discussion through investigations of basic geometric figures. The discussion will begin in this, latter end.

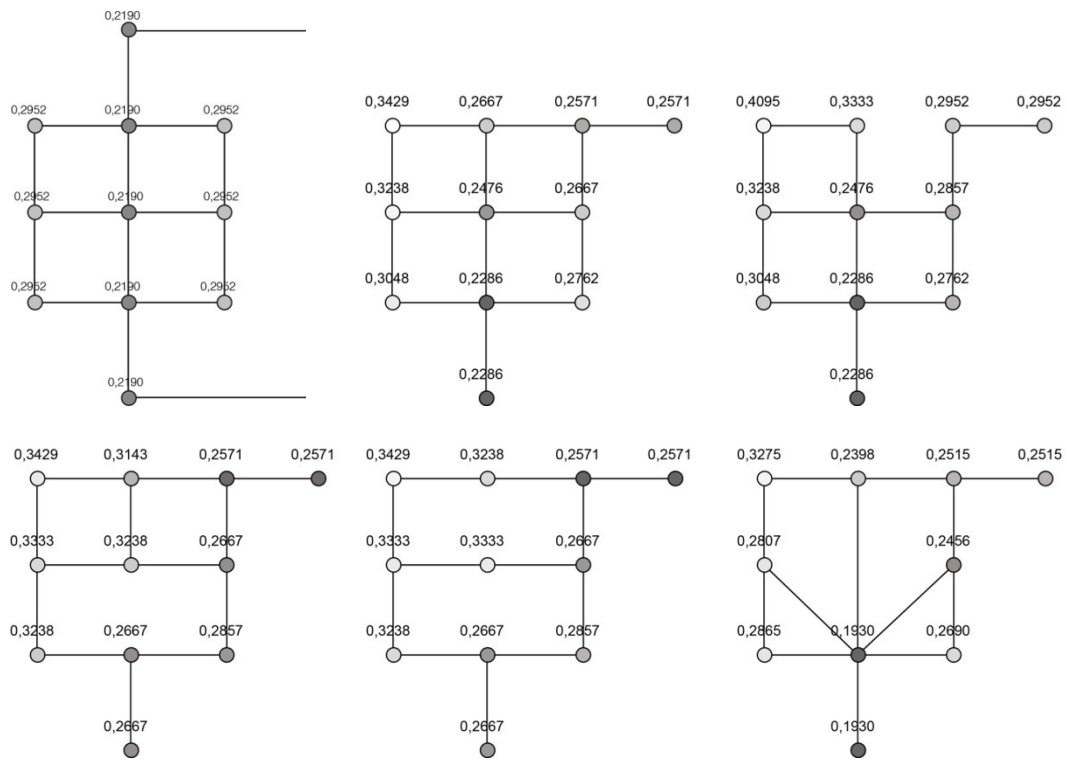## Configurational Kit-of-Parts

A basic figure often reproduced in space syntax (Hillier and Hanson 1984, Markus 1993, Hillier 1996, Hanson 1998), used repeatedly in architectural analysis and education from Wittkower, Rowe, and Hejduk although not in the same manner (Love 2003, Rowe 1976), is that of the 3x3 square cell 'building', sometimes modulated to have the central space join the entry space – usually because this, it is argued, brings it closer to a reasonable building plan (e.g. by having no dark rooms). Their role within space syntax research is to illustrate how ostensibly minor alterations can have radical configurational impact. For Hejduk, it was a way of focusing architectural studies on spatial and compositional principles. For Wittkower and Rowe, they were rather figures to analyse and compare plans to in order to understand their formal geometrical properties; in this discussion, I intend to begin at the former and somewhat end up towards the latter.

For this exercise, the point of interest is the description retrieved by the use of mirroring. In this particular case, in order to make the diagrams more readable, I have added a singular "in-between" space as well between the "entrances" which somewhat affects exact values, but not their relative distribution. The investigation furthermore starts with 'a perfect grid' (c.f. 'perfectly cyclic graphs', O'Hare 1976) – that is, all spaces of the grid interconnected, to investigate the effects in a similar manner as in "the laws of the field" in *Space is the Machine* (Hillier 1996)*,* only in a mirrored situation. The point is the possibility to manipulate the situation and relate the results to the 'perfect grid' situation. It could be noted, that for this experiment, the 3x3 diagram is additionally suitable because it, as deduced from Shpuza (2006), contains only highly influential links whereas a larger similar diagram will increasingly equalize the impact of changes to links not located along the edges. Finally, the interest here is a multi-entrance situation, why the manipulation will begin in a two-entry situation [Figure 5].
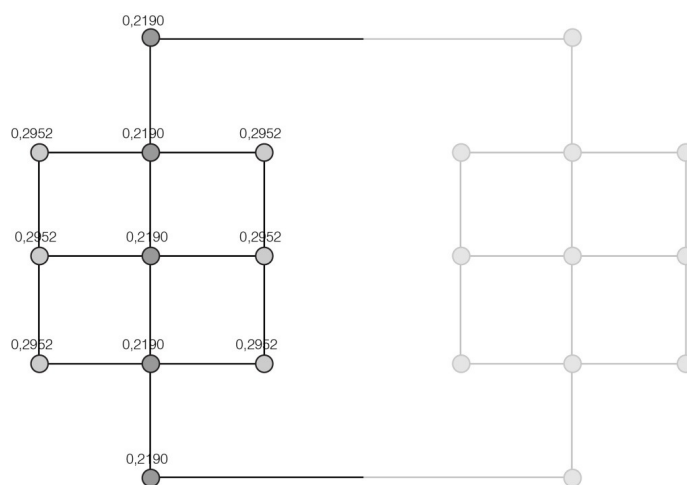
Figure 5: Illustration of the mirroring principle in a symmetrical, 'perfect grid' 3x3 configuration. In order to draw configuration to how it relates to the exterior, a 'copy' is made of the graph and the entrances/exits are connected. The 'mirror' is then discarded (and will hence not be included in following figures). The figure shows Relative Asymmetry values.

Looking at these diagrams and the effects, showing Relative Asymmetry (RA) rather than Integration, there are several things noticeable. One is how a symmetrical, 'opposite' position of two entrances create a corridor of equally integrated spaces through the 'building' with symmetrical distribution of values along the sides. Another is how just a small adjustment of one exit to be from a corner and one from a middle space pushes integration towards the latter compared to this symmetrically arranged entry situation [Fig 6a to 6b]. That is, by very marginal shifts in locations of two entrances, one is better integrated into the rest of the building than the other, and the 'integration core' is shifted not only towards one exit, but also to one side. In a second step, a simple removal of one of the links to the already slightly segregated entrance has as most effect in its local context, further segregating both the entry itself, and the spaces close to it far from what is now established as the 'main entrance'. Similarly, removing the link to the central space from the 'main' entrance in the 'perfect grid' redistributes integration to instead focus on the former 'secondary' entrance. That is, what we get is an image where the entrances are 'ranked' according to their relative position to the interior, but with an indicator of their role in relation to the exterior.

Figure 6: Experiments with spatial configuration in a 'kit of parts' building' and the resulting Relative Asymmetry (RA) values, referred to as a-f from top left to bottom right.

Now, if joining two spaces by one entrance, a simple operation done in Hillier and Hanson (1984) or Markus (1993) [Figure 6f], the effect is noticeable – perhaps even remarkable. While the general level of asymmetry lowers in the whole 'building', the differentiation of entrances increases radically. The simple operation performed thus, as it comes to the relative situation of the two entrances, is not innocent but of fundamental importance for the relation of the configuration to the outside studied as internal configurational description. If we were to study the volumes and spatial articulation of Åhlens and simplify it into a representation that can fit into the 3x3 matrix – a comparison method that comes close to Wittkower's or Rowe's – it would seem that we are close to the entry situation and flows of Åhlens. The final manipulation to reach that stage – which also corresponds quite well with the integration and flow patterns of

the department store – then is to add an entrance on the other 'side', in the centre, essentially simulating three hierarchically different entrances based on their relation to the *interior configuration as described in relation to the exterior.*

The values produced in this manner, as it turns out, are quite different from a 'contextualized' description that can be very sensitive to small shifts in the exterior configuration. Of course, the degree of sensitivity may vary between forms of analysis and since in many cases of VGA analysis the exterior configurative steps between entrances is close to negligible it can turn out even to be *difficult* to manage any larger shifts of interior configuration through exterior manipulation. Rather, further experimentations suggest, that it is with increased exterior configurational distance between entrances that this becomes a significant factor.

That is, seen as an interface between 'inhabitants' and 'exterior', these kinds of 'mirror' analyses seem to describe something about how the inhabiting social constellation relates to the exterior through their internal arrangement of spaces, which also, as it seems at this point, relate to how the building comes to be used seen as a public interface. If we return to Sullivan's Owatonna office, I would at this point argue, that the shift of integration from entrances to top floor is not a problem but rather a very descriptive phenomenon: the way the building is configured internally, e.g. for its inhabitants, the relation to the entrances is tied to the strategic location in the centre of the top floor, close to both, whereas proximity to any of the other entrances simply creates more distance to the rest of the building than it creates closeness to the outside. The building, as it is, socially 'turns into itself' instead of reaching out.

Split Interfaces

Before rounding up the argument, then, there is another part of 'interface' that may need to be given some attention – namely that of the difference between the building as a visual interface and as a permeable interface (Hanson 1998, Marcus 1993, Psarra 2009, Koch 2010, Zhu 2012, Peponis 2012). The reason for this is another discovery in the exploration of the interface 'inside out': rastered isovist analyses (VGA) of a series of buildings to test out how it works in different conditions. I have already noted how in the Sullivan example, there is an odd effect of the permeability core shifting to the top floor rather than the entrances in this form of analysis, which I will return to shortly. The currently topical example, however, is that of the centre complex in Falun by Hultman and Holmér, 1970-74 [Figure 7] (from Andersson 1939).

Studied first as a permeability structure, what emerges is, more or less, that of the symmetrical layout. A string of integration core runs through the building from one entrance to the next, indicating how the building operates both as a centre, and as a thoroughfare, which are also intended shared purposes. However, if considering the *visibility* relationships of the atrium structure [Figure 7, right], somewhat remarkably what happens is something similar to the Sullivan building: centrality leaves the entry points and expands over the atrium, essentially focusing the visibility core all inside the building. That is, the complex in Falun is a building that permeability wise is configured as a thoroughfare, but visibility wise is configured to focus on the interior. This is a feature that may be shared by several atrium buildings – that is, that visibility is pulled *from* the exterior *to* the interior, in a somewhat centripetal – centrifugal complex. While this is in need of further studies to state more clearly, this situation would serve well as a commercial vehicle at the same time facilitating movement through and around space and attention across and beyond.
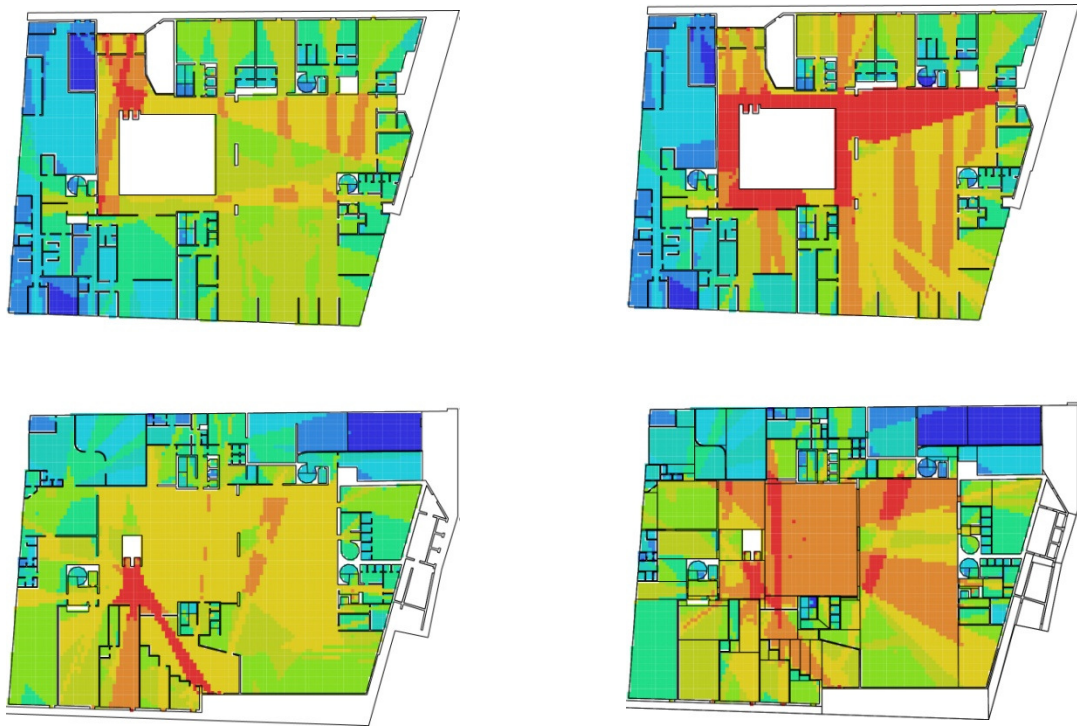
Figure 7: Centre complex in Falun by Hultman and Holmér, integration patterns produced by 'mirroring' all entrances. Permeability to the left and visibility to the right. Figures made with Depthmap 10.

As it turns out such effects, the Sullivan internal focus and the Falun visibility refocus, is difficult to reproduce in the simple figure kit-of-parts figure, analysed through convex space graphs. This partially has to do with conditions of connectivity between a visibility graph and the convex space graph 'stepwise' permeability analysed in the figure. An implication of this is that one of the results of an open plan solution, potentially, is an increased focus on relations *internal to* the building, as compared to *related to the exterior*, which seems logically reasonable. But it is also partially due to how space is configured and articulated into convexes and isovists that produce different results even in simple figures (c.f. isovist analysis of 3x3 figures by Markhede, Figure 8).
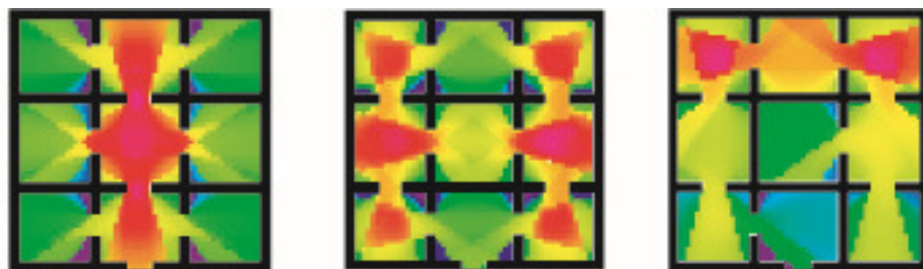
Figure 8: Integration values of three plans (Tree, Network, Series) in rastered isovist analysis. While this particular figure is not showing values weighted to the exterior, it is clear how axes heavily influence values in a way that conflates distances as compared to the convex space graph, essentially increasing connectivity overall. Figure by Henrik Markhede, made in Depthmap 10.

Architectural interfaces

The proposal of this paper is on a formal as well as a social level. While contextualizing and discussing the concept of interface and how it relates to architectural configuration in general, it also more specifically addresses the question of what 'a building' communicates seen as an object in its own right – that is, how the spatial manipulations of architects can serve to describe how a building – and the activities, things, and people inhabiting it – relates to its surrounding context within the boundaries of a 'project'. The proposal is that this is best understood by on the one hand making sure that measures and models address the relation to the exterior, but that, on the other hand, these should not be made in a way that hands influence over solely to the exterior, or the choices of how to model the exterior. It further provides some empirical support for that this 'internal' description of how the relation to the exterior is described through spatial configuration has high importance for building performativity. The herein proposed and investigated model, which operates through a process of 'mirroring' the plan investigated and then connecting entrance-to-entrance in the original and the mirror, then has three beneficial sides. First, it makes a description that seems to capture important properties of architectural configuration, including hierarchies of different entrances and a generic description of relations of spaces to 'the exterior'. Second, the descriptions and measures are rigorous, repeatable, and comparable, in that arbitrary choices of how and to what extent to model an exterior are replaced by a distinct and clear methodological operation. Third, the modelling method allows to capture and describe properties of architectural design that differentiates architectural solutions from one another in what could tentatively be described as 'facing', or how architecture 'turns itself' to the exterior. It shows, for instance, that the two department stores studied explicitly 'turn themselves' towards one entrance and 'away' from another. It shows how an atrium building facilitates thoroughfare on the one hand, but focuses visibility to its interior on the other. And it shows, furthermore, how it is possible for architecture to produce buildings that are for all intents and purposes 'facing inward' both as permeability and visibility configurations. It is thus tentatively possible, for instance, to analyse buildings that for inhabitants 'face' a courtyard, while still, by a contextualized model, analyse how visitors may relate to it from a 'street' side.

Tentatively, it has thus been argued that what is analysed is architectural interface 'from the inside out', as different from a model that analyses it 'from the outside in', which has its merits. For instance, Sullivan's office might well operate like the 'mirrored' analysis for those working in it, but as a 'contextualized' analysis for visitors. The extent to which this specific differentiation between analyses is true remains to be established, however, especially since the analyses of the public portions of the department stores suggested that there is a better correlation analysed by a 'mirror' model than by a contextualized model. It is furthermore not necessarily true that it is 'from the inside out', since the main relation remains to a more conceptual 'exterior'. Rather, the analysis is *internal to* a building. The main point remains, thus, that the description retrieved in the way investigated here is of the way the interface between interior and exterior is described by the object 'itself' as compared to as an extension of the exterior, and that this can be of significant interest, but it is *reasonable* to believe that the behavioural effects differs between programmes, purposes, culture, and inhabiting social constellations. Correlations and performative questions aside - as a method for analyzing architecture, and the different characters and design choices constituting its material realization into, for instance, a building, it seems to offer many possibilities that other methods have difficulties capturing.

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