Floorplate Shapes and Office Layouts

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Abstract

Two previously defined measures of floorplate shape are examined: compactness expressed as relativized grid metric distance, and convex fragmentation expressed as overlapping convex space distance. It is argued that these predict the directional distances of internal circulation patterns.

1. Metrics of floorplate shape that predict the integration of layouts

The distinction between the geometry of the building shell and internal layout is fundamental to office buildings. Internal layout can change many times over the life span of the shell. Understanding how the geometry of the office shell constrains the range of possible internal layouts becomes a fundamental question in office design (Duffy et al, 1976). Space syntax has been used to describe office interiors and to relate the spatial structure of their layout to patterns of space use, including movement, co-awareness, encounter, interaction and the creation of interfaces between different organizational groups, roles and statuses (Grajewski, 1993; Hillier and Penn 1991; Penn et al, 1999; Peponis and Stansall 1987; Rashid and Zimring, 2003; Serrato and Wineman, 1999; Spiliopoulou and Penn 1999). There have been no explicit attempts to apply space syntax to the description of office shells, or to the relationship between the structure of circulation and the underlying floorplate shape.

In this paper we assume that the descriptions of layouts offered by space syntax provide useful insights into the relationship between spatial organization and various aspects of organizational function and organizational patterns of space use. We ask whether an analysis of floorplate shapes can help us to predict a key syntactic layout measure, namely Integration, computed on the basis of a line map of circulation in the internal office plan. For the purposes of our argument the expression “floorplate shape” refers to the usable area of an office floorplate, usually contained between the perimeter and the service cores. Our aim is to develop metrics of floorplate shapes that can help us evaluate their suitability for different kinds of office layouts. This paper represents a first step in this direction rather than a complete theory.

Our argument is in three parts. First we use two measures of floorplate shape originally introduced by Shpuza (2001): metric compactness and convex fragmentation. Second, we present a theoretical model of the relationship between these measures and the integration of the interior layout represented as a pattern of intersecting lines of movement. Third, we present an analysis of theoretical layouts, produced by the consistent application of a small number of generators to fit within a sample of actual office floorplates. We argue that our floorplate metrics predict the likely Integration of the linear map of interior layouts.
2. Metric compactness and convex fragmentation

Each floorplate shape will be described according to a measure of metric compactness and a measure of convex fragmentation. In this section, we provide definitions of the two measures.

Compactness is considered first. Shapes which are characterized by smaller universal metric distances from each position to all others are essentially more compact. Thus, we will treat universal metric distance on a grid as a measure of compactness. The metric of compactness that we use is Relative Grid Distance (rgd) and is defined as follows.

First we compute “grid distance” (gd) as the sum of distances between any two locations on the floorplate.

\[ gd = \sum_{i=1}^{n} \sum_{j=1}^{n} gd_{ij} \]

where \( gd_{ij} \) is the syntactic distance between two unit cells \( i \) and \( j \), and \( n \) is the total number of unit cells in the shape.

Then we compute Relative Grid Distance rgd to express “grid metric distance” as a ratio to the grid metric distance that would be obtained for a square of the same area.

\[ rgd = \frac{gd}{gd(sq^n)} \]

where \( gd(sq^n) \) is the interpolated \( gd \) of a square with the same number of units.

The reason why we need interpolation is that there is not always a square with the requisite number of units, so that the theoretical value \( gd(sq^n) \) is extrapolated based on the values corresponding to the two squares that best approximate the given shape. For example, a shape of 137 units would be compared to an extrapolated square between the actual squares of 121 and 144 units. The extrapolation formula is:

\[ gd(sq^n) = gd(a) + \left( \frac{a^2}{b^2} - \frac{a^2}{n} \right)(gd(b) - gd(a)) \]
where if \( \text{Int}(\sqrt{n}) \neq \sqrt{n} \),
a = \text{Int}(\sqrt{n}) and b = a + 1

The \( gd(sq n) \) for an actual square of side \( \sqrt{n} \) is

\[
gd(sq n) = \sum_{i=1}^{n} (-\frac{1}{2})^{n-1} i^2 (i - 1) \tag{10}
\]

We now come to fragmentation. Convex fragmentation \( cf \) gauges the extent to which the floorplate is divided into different overlapping maximal convex areas (i.e. there are no convex areas which are subsets of larger convex areas). It is calculated as the sum of overlapping convex depths between any two locations on the floorplate. All unit cells within a convex area are set to have zero distance between them. Cells in other convex areas are set to have a depth value equal to the number of maximal overlapping convex spaces that must be traversed in order to reach the convex space that contains them.

The measure \( cf \) is calculated by the formula

\[
cf = \sum_{i=1, j=1}^{n, n} \frac{ocd_{ij}}{n^2} \tag{11}
\]

where \( ocd_{ij} \) is the overlapping convex depth between two unit cells \( i \) and \( j \), and \( n \) is the total number of unit cells in the shape.

3. Floorplate shape metrics and layout directional distances: theoretical experiments with basic shapes

Actual office layouts are determined by a number of requirements arising from the spatial needs of the occupant organizations and by the ability of designers to negotiate the constraints imposed by the structure of the building shell, including the floorplate shape. In this section we will use simplified hypothetical examples to look for generic relationships between floorplate shape and the directional distances of internal circulation patterns. This is a preliminary step, before embarking upon the analysis of actual floorplate shapes.

All internal layouts will be cell farms, that is individual cubicles attached to rectangular circulation grids. An important distinction is drawn as follows: In directionally unbiased layouts, cubicles will be clustered in sets of four, so that two sides of each cubicle are adjacent to a circulation space and the other two sides to other cubicles. This is too generous an arrangement from the point of view of circulation but it has the advantage that the pattern is the same in both directions. In directionally biased layouts, back-to-back pairs of cubicles will be grouped in longer strings, four or more in a row. This arrangement is more economical from the point of view of circulation. In this case, the density of cubicles per circulation line is higher in one direction, and the density of intersections between circulation lines is higher in the other. Two kinds of directionally biased layouts will be used. The fishbone-type layout will consist of major circulation lines in one direction and secondary circulation lines in the other, with cubicles attached to the secondary lines. The offset-type layout will consist two intersecting peripheral axes, with secondary circulation spaces branching off them to form pair-wise intersections. Figure 33 shows a grid, a double fishbone and an offset layout set on a square floorplate; the line map representations of the layouts are also shown.

In order to show the effect of floorplate compactness and fragmentation upon circulation Integration, we insert unbiased grid layouts in 4 simple shapes, square (a), oblong (b),
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Elongated oblong (c) and L-shape (d). We chose the unit cell area to be equal to four cubicles. Each floorplate consists of 36 unit cells and consequently accommodates 144 cubicles. Figure 34 presents the results of the analysis. The first four rows of the table describe grid layouts inserted in the 4 basic floorplate shapes. The 4 shapes are ranked as follows with respect to Integration: elongated oblong oblong square L-shape. This rank order differs from the rank order of Depth which is: square oblong elongated oblong L-shape. The apparent discrepancy is solved when we notice that the number of lines involved also varies and remember that Integration values are relativized according to the number of lines. From an intuitive point of view, the Integration values make better sense. Indeed, while the most compact rectangular floorplate, the square, minimizes grid distances, it is the elongated oblong that will tend to minimize directional distances, as it will tend towards a single double loaded corridor. For these simple floorplates, populated by unbiased grid layouts, less compactness implies greater circulation Integration. Fragmentation, however, is associated with less Integration.

A different situation arises with directionally biased layouts. For example, the double fishbone can be loaded with a vertical or horizontal orientation of the dominant axes, and thus we have to deal with 7 cases, not 4. The integration inequality is as follows: elongated oblong horizontal > oblong horizontal > L-shape vertical > square > L-shape horizontal > oblong vertical > elongated oblong vertical. Thus, the same floorplate appears in opposite ends of the inequality depending upon the manner in which the layout is loaded onto the floorplate. An important methodological conclusion follows. When we deal with directionally biased layout principles, the Integration of circulation is not only affected by floorplate shape but also by the independent design decision of how to fit the layout onto the floorplate. By implication, unbiased layouts allow us with a better opportunity to study the pure effects of floorplate shape. We will return to this issue in a later part of our argument.

4. Floorplate shape metrics and layout directional distances: theoretical experiments with systematically modified shapes

In this section we proceed to discuss how floorplate shape affects circulation integration when we are dealing with shapes which differ not only in their basic proportion, or underlying type, but rather in more detailed elaboration. Our analysis draws inspiration from the theory of partitioning proposed by Hillier (1996). We take a simple floorplate loaded with a grid layout and proceed to study the effects that arise when the shape becomes more complex as a result of our removing one or more of the constituent unit cells. Put simply, we look at shapes with indentations and/or holes. There is, however, an important conceptual shift with respect to Hillier’s work on partitions. Hillier held and underlying shape constant and treated it as a field for generating alternative interior layouts, even though some of the operations he studied modified the shape (insertion of holes). We treat shape and layout as independent entities, with independent metrics associated. Rather than develop a theory of how layouts are structured through particular operations and design moves, we develop a theory of how a certain kind of layout is affected when inserted in different shapes.

Hillier’s principle of centrality applied to the theory of partitioning tells us that a more centrally placed partition leads to greater depth gain. We could expect a similar finding regarding the depth gains due to removing unit cells from the shape thus causing...
Figure 34: The interaction between simple hypothetical shapes and hypothetical layouts.
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Figure 35: Non-equivalent ways of removing one cell from a 6x6 square floorplate.

interruptions in the circulation map. This, however, is not quite the case. The effect of removing cells does not depend upon the coordinate position of cell with respect to the floorplate, but rather upon the position of the cell with respect to underlying shape-regions. The presence of these regions, and the determination of their boundaries is a major finding resulting from our analysis. For rectangular shapes, square or elongated, there are 3 underlying regions. First, the four corner cells, which we call region C; second the edge cells, not including corners, which we call region E; third the cells in the entire middle zone contained by C and E, which we call region M. The directional depth gain in circulation produced by removing a cell is constant from whichever part of the same region the cell is removed.

The effects of regions are demonstrated by considering figure 3. This exhausts the non-equivalent ways in which a cell can be removed from a square of 36 cells. The resulting 6 shapes are all different according to the metrics of compactness and fragmentation. However, the removal of a cell from a more or less central position in region E produces exactly the same effect upon circulation Depth. The same is true regarding the removal of cells from different positions in region M. Only the integration values, which are more sensitive to the number of lines involved, follow the centrality principle. Thus, the presence of regions leads to a modification or refinement of the centrality principle.

The analysis of the 10 non-equivalent ways of removing a cell from the oblong produces similar results and the same structure of regions. The analysis of the 36 non-equivalent ways of removing a cell from the L-shape results in a much more complex underlying structure of regions. We show these different structures of shape regionalization in figure 36. The principle of regionalization for rectilinear closed shapes without wholes loaded with unbiased layouts seems to be as follows: First, offset all edges inwards by one cell unit and extend the offset lines until the meet the edges; second, extend the sides of concave angles until the meet the first offset lines. The non-overlapping convex areas produced in this manner are the regions in question. We are still in the process of testing this proposition.

The significance of establishing a rule of regionalization lies in demonstrating that the regionalization of floorplate shape with respect to unbiased layouts is entirely driven by the properties of the shape: the shape alone decides what the effects of its own modification through indentations and holes are likely to be.

To look for the equivalent of Hillier's principle of contiguity (that inserting two con-
tiguous boundaries leads to greater depth gain than inserting two non-contiguous ones) we studied the effects of removing two cells from a square floorplate. We took all possible combinations of cells with respect to the regions, as shown in figure 37. In all 4 cases where removing two contiguous cells could be compared to removing non-contiguous cells with equivalent region membership, the contiguous removal caused less depth gain. We conclude that an inverse principle of contiguity seems to apply. Having said that, we also observed than in the 3 cases where we removed cells which were joined corner to corner the depth gain was greater than that of alternative combinations of cells with equivalent region membership.

The modification of the principle of centrality according to the effect of regions and the discovery of an inverse principle of contiguity (removing two contiguous cells leaves the circulation layout with greater Integration than removing two non-contiguous ones) suggests that there are systematic relationships between floorplate shape and the syntactic structure of circulation provided that the layout loaded upon the shape is directionally unbiased. This is a rather important restriction. We have already shown above that directionally biased layouts can have widely different Integration values depending on how they are oriented when loaded on simple shapes. It is obvious that they will behave even less systematically if we consider the effects of cell elimination. Thus, the elimination of the same cell will have a different effect not only depending on how the layout is oriented, but also depending on where the dominant circulation spaces are located. In the double fishbone, for example, we can shift or rotate the location of the dominant lines without changing the syntactic characteristics of the layout; any shift, or change of orientation, however, can cause the removal of a cell to interrupt, or not to interrupt a dominant circulation line, almost at will. This is why a systematic study of the effect of shape transformations upon biased loaded layouts is not worth pursuing.

5. The theoretical relation between floorplate shape metric and circulation integration

To explore the systematic relationship between floorplate shape and the Integration of circulation in a loaded unbiased grid layout, we ran correlations between the shape metrics and the circulation Integration values for all 74 theoretical layouts previously analyzed.
Figure 37: Non-equivalent ways of removing two cells from a 6x6 square floorplate.

<table>
<thead>
<tr>
<th>Region</th>
<th>Region</th>
<th>Shape Analysis</th>
<th>Layout Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>136 cubicles</td>
<td>Grid Distance</td>
<td>4330 80</td>
<td>Number of Lines</td>
</tr>
<tr>
<td></td>
<td>Fragmentation</td>
<td></td>
<td>Mean MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean Integration</td>
</tr>
<tr>
<td>34 cells</td>
<td>4340 96</td>
<td>12 1.515</td>
<td>2.669</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>corner-edge CE</td>
<td>4370 80</td>
<td>12 1.515</td>
<td>2.669</td>
</tr>
<tr>
<td>corner-middle M</td>
<td>4408 152</td>
<td>13 1.692</td>
<td>2.454</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4386 178</td>
<td>13 1.718</td>
<td>2.369</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4492 278</td>
<td>14 1.931</td>
<td>2.079</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4486 358</td>
<td>14 1.857</td>
<td>2.109</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4456 152</td>
<td>13 1.692</td>
<td>2.454</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4464 200</td>
<td>14 1.846</td>
<td>2.212</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4458 254</td>
<td>14 1.931</td>
<td>2.059</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4450 272</td>
<td>14 1.888</td>
<td>2.129</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4652 418</td>
<td>15 2.057</td>
<td>1.867</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4658 418</td>
<td>15 2.019</td>
<td>1.900</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4614 392</td>
<td>15 1.881</td>
<td>1.962</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4756 590</td>
<td>16 2.100</td>
<td>1.803</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4654 608</td>
<td>16 2.093</td>
<td>1.822</td>
</tr>
<tr>
<td>cc cc</td>
<td>aa16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cc cc</td>
<td>4692 472</td>
<td>16 2.093</td>
<td>1.856</td>
</tr>
</tbody>
</table>
The results are shown in the first column of figure 38. Fragmentation has a powerful effect whereby more fragmented floorplate shapes result in less integrated circulation grids; the correlation is as high as -0.840. Grid Distance has a less clear effect. The overall correlation with Integration is negligible ($r = 0.063, p = 0.595$). However, a more careful look at the scattergram reveals bands of points that move along parallel negative slopes. Each band corresponds to a basic underlying shape, the square, the oblong and the L-shape. Given such an underlying shape, there is a clear tendency for circulation Integration to decrease as grid distance increases - as a consequence of removing cells. However, the pattern is not consistent across the whole sample of underlying shapes. In anticipation of later discussion, we therefore draw a distinction between the actual floorplate shape, taking into account indentations and holes, and the “hull” (or underlying basic shape) from which the floorplate shape under consideration is constructed.

The fact that biased layouts have Integration properties that cannot as well be predicted by floorplate shape is underscored by the poor correlations obtained when we look at the correlations for the 35 such theoretical layouts that have been analyzed as part of our work. These correlations are weak and insignificant (Integration and Grid Distance: $n=35$, $r=.373$, $p=0.027$; Integration and Fragmentation: $n=35$, $r=.231$, $p=0.183$). When we add the 35 biased layouts to the sample of 74 unbiased layouts previously analyzed, the correlation between floorplate shape metrics and circulation Integration drops significantly as shown in the second column of figure 38. In the next section we approach the analysis of actual floorplate shapes. Given the findings of our theoretical analysis, we entered the exercise expecting mixed results.

6. A sample of actual floorplates loaded with hypothetical layouts

A sample of 23 floorplates is chosen, 17 from buildings designed by SOM and built in the USA between 1958 and 1990 and 6 among the portfolio of buildings administered by
the GSA, figure 7. The choice was aimed at including the maximum variety of designs within the framework of “best practice” - SOM being commonly considered as one of the leading firms in international office design. The question is whether the circulation values of hypothetical layouts inserted in the floorplates will vary according to floorplate shape. We are considering hypothetical layouts for obvious reasons. Actual layouts, even if they were to be available in all cases, would be subject to not only differences in the nature of occupant organizations, but also to differences in design approach. Thus the comparison would be inconsistent. By looking at hypothetical layouts we treat floorplates in a consistent manner.

Five basic cubicle farm generators were implemented. In all cases, the cubicle dimension is originally set at 7.5 feet but is freely adjusted according to the mullion interval: very often, the mullion interval was 5 ft and the original cubicle module neatly corresponded to 1.5 mullion intervals with no need of adjustment. The circulation width is set at half of the cubicle dimension.

The first generator, G1, starts with arraying cubicles along the floorplate perimeter and then moves inwards by successive offsets, alternating bands of cubicles and corridor ribbons, until the core has been reached. It is stipulated that the core be always surrounded by a corridor. After this process is completed, transverse corridors are added, one for each major core face providing access onto the floor.

The second generator, G2, starts from a corridor loop surrounding the core, and extends each corridor line outwards up to the perimeter, in one direction, to create a spinning wheel. Smaller transverse corridors are then added linking the elements of the spinning wheel to the perimeter, with cubicles arrayed on either side. For the sake of simplicity, we might think of G2 as a fishbone pattern taking a spinning wheel as its spine.

The third generator, G3, proceeds from the core to the creation of a spinning wheel, but instead of filling space with a large number of transverse corridors, it proceeds to deploy secondary corridors parallel to the elements of the spinning wheel. For the sake of simplicity, we might think of G3 as a windmill pattern, based on a spinning wheel.

The fourth generator, G4, seeks to bisect the floorplate with a corridor running through the core. Where alternative bisections are possible, the longest corridor is chosen. The corridor is then used a basis for developing a fishbone plan, with the additional stipulation that the core is, surrounded by a corridor loop, as in all previous cases. For the sake of simplicity we might think of G4 as an approximation to a linear fishbone pattern, with a central hub.

Generators G1-G4 are intended to simulate relatively dense layouts (low proportion of area devoted to circulation) with a clear hierarchy of access. The fifth generator, G5, is a regular grid designed to encompass clusters of four cells. Thus, G5 replicates layouts similar to the unbiased layouts that were previously loaded onto theoretical floorplate shapes. The five generators are illustrated in figure 40.

The hypothetical layouts were compared to actual layouts for the 8 cases for which the latter are available. The correlation for the corresponding circulation integration values is: for G1 $r = 0.533, p = 0.174$; for G2 $r = 0.862, p = .006$; for G3 $r = 0.764, p = 0.027$ and for generator G4 $r = -0.755, p = 0.030$. Thus, generator 2 produces hypothetical layouts which most closely resemble actual layouts in their circulation Integration. Generator 4, on the other hand, produces layouts which are inversely related to actual layouts. Given the small sample, these results are of course tentative.

The correlations between floorplate Fragmentation and circulation Integration for generators G1 to G5 are as follows: $G1 : r = -0.461, p = 0.027; G2 : r = -0.423, p =$
Figure 39: The sample of 23 actual floorplates.
The correlations between Relative Grid Distance and circulation Integration are:

- $G_1: r = -0.672, p = 0.001$
- $G_2: r = -0.613, p = 0.002$
- $G_3: r = -0.865, p = 0.001$
- $G_4: r = 0.198, p = 0.365$
- $G_5: r = -0.512, p = 0.011$

These results are interesting in several ways.

From the point of view of fragmentation, circulation layouts react to actual floorplate shapes in essentially the same way as they react to the hypothetical simplified floorplate shapes discussed previously. Greater shape fragmentation leads to less circulation integration. The correlation is very strong as far as unbiased densely connected layouts are concerned. It becomes weaker when other kinds of layouts are introduced, but retains at least 5% significance for $G_1$ and $G_2$. In the case of the fishbone layout, $G_4$, the correlation is not significant and reverses direction. The strong bias of the fishbone plan seems to interact with floorplate fragmentation in unpredictable ways.

From the point of view of compactness, the findings are less consistent. For the simplified hypothetical layouts, compactness (measured by Grid Distance) had no significant effect upon circulation Integration. In the case of actual layouts we have a clear tendency whereby greater Relative Grid Distance is associated with less circulation integration, with significant correlations for $G_1$, $G_2$, $G_3$ and $G_5$. Thus, in actual floorplates, compactness becomes associated with more integration. The effect, however, is weaker for the densely connected unbiased circulation grid than it is for the other generators.

Shape fragmentation and shape compactness are not independent variables in either hypothetical or actual floorplate shapes. They are also correlated to each other (for hypothetical layouts $n = 74, r = -0.374, p = 0.001$; for actual layouts $n = 23, r = 0.490, p = 0.018$). Less compactness is associated with greater fragmentation. With a relatively small sample of actual layouts it is not easy to disentangle the multiple relationships between shape fragmentation, shape compactness and circulation integration. It would seem, however, that fragmentation is the most powerful descriptor of floorplate shape insofar as predicting the likely integration of circulation is concerned and that its effects are exercised directly as well as indirectly, through the effect upon compactness.
7. Discussion

As stated previously, this paper represents a first step towards modeling the impact of floorplate shape upon internal circulation integration in office layouts. Our analysis leads to one relatively clear conclusion and to the identification of two issues that must be pursued through further work. We conclude that floorplate fragmentation leads to less integrated internal circulation. Therefore, fragmentation can be used as a floorplate metric which helps to evaluate floorplates according to their likely consequences for at least one functionally critical aspect of internal layout. In addition to its practical significance, the finding has some theoretical interest that we would like to notice. Fragmentation is a 2-D measure based on overlapping convex depth. Circulation Integration is a 1-D measure based on linear direction changes. Our finding suggests that we can potentially develop theories regarding the dependence of 2-D and 1-D measures applied to the description of buildings from a functional point of view.

The effect of compactness upon layout is more puzzling. From an intuitive point of view, compactness is indeed associated with conflicting implications. On the one hand, a linear floorplate shape could lead to a double loaded central corridor layout, which would be the most integrated possible layout, with all accommodation attached to a single direction of movement. Thus, lesser shape compactness seems to lead to greater circulation Integration. On the other hand, when circulation grids or other more complex layouts are inserted, compactness, especially when associated with large floorplates, would intuitively imply that more connections can be made in two directions. Thus, greater compactness could also lead to greater integration, when a simple double loaded corridor or simple fishbone plan is out of the question.

Not only does compactness have different intuitive associations, it also bears a complex relation to fragmentation. As discussed earlier, a layout can be fragmented in different ways. It may be fragmented through indentations and holes inserted in an originally compact underlying shape, or “hull”. These, potentially very local interruptions can clearly affect circulation integration, depending on the bias of a layout and the alignment of its dominant axes. Fragmentation can also occur by coiling a very elongated original shape, without additions of local indentations or holes. In this second case, the impact upon circulation is far more predictable: there simply must be directional changes in the major circulation axes, in order for the internal layout to connect. The two ways in which fragmentation occurs have different direct effects upon compactness and therefore different indirect effects upon circulation integration. Thus, more work is needed to properly formalize the issues involved and to decide how best to real with floorplate compactness in addition to shape fragmentation.

The final issue to be raised is substantive more than methodological. It pertains to the distinction between modeling generic relationships and modeling organizational typologies. It was shown that it is easier to model the effect of shape upon unbiased, densely connected circulation grids, by comparison to the effect upon biased layouts placed upon the floorplate in more deliberate ways. This can be stated in an intuitively more accessible manner. When the layout inserted is not uniform, when there is a clear hierarchy of access and perhaps a clear pattern of differentiation of local parts, the interaction between the layout and the floorplate shape is in principle more susceptible to the impact of specific design decisions. Depending on how other factors play out, including the required density of accommodation, the different sizes of departments, or the required pattern of inter-departmental connections, a designer can find different ways of inserting the layout into
the shape. Thus, the effect of shape becomes less predictable according to generic models, such as the one introduced here.

One response to the unpredictability of the relationship between floorplate shape and internal circulation in biased layouts is to compare specific design solutions to generic layout types inserted in the same floorplate, so as to quantify different aspects of design choice. Another response, which is more relevant to our argument, is to formulate more precisely the generative principles which are associated with particular organizational types, so that floorplate shapes can be evaluated against specific organizational requirements. In essence, this implies that the evaluation of floorplate shapes has to become dependent upon the prior development of theories regarding the spatial requirements of different kinds of organizations. From this point of view, the present paper can be looked at as a first cut at establishing what the generic constraints that govern the relationship of floorplate shape to circulation integration are, in order to be better able to ask questions about constraints that have socio-cultural origins.

Literature


