THE MORPHOLOGY OF EXPLORATION AND ENCOUNTER IN MUSEUM LAYOUTS

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0 Abstract

This article attempts to understand the relationship between the spatial structure of museum layout and the patterns of visitors' exploration and encounter. Eight art museum settings are analised using Space Syntax. The analysis suggests that the configuration of museum layouts provides a structure to the exploration of the collections and buildings by visitors. Layout also modulates the pattern of visual encounter between visitors rather than a pattern of encounter. The overall effects of museum layouts work according to two models. The deterministic model dictates viewing sequences and channels encounters in limited ways. The probabilistic model modulates exploration and encounter statistically according to the syntactic properties of the layout. The findings imply that curators and designers alike can work with the layout to differentiate and yet control the possible experiences of visitors without imposing a rigid spatial pedagogy.

1 Museums as spatial pattern

This article discusses the configuration of museum space and its functional implications with regard to the patterns of exploration and encounter of visitors. The word exploration is used to emphasize the explorative aspect of visitors' movement in museums, and the word encounter is used in the sense of *co-presence* rather than in the sense of active interaction. The question asked is whether the configuration of architectural space influences the two patterns, over and above the influence that may be exercised by the character and the messages of exhibitions.

The way in which visitors move in museums has been studied primarily from the point of view of their getting exposed to the objects on display and becoming receptive to the exhibition messages. The objects on display are usually grouped according to classificatory principles which may be as direct as chronological or geographical origin, or as elaborate as a refined stylistic discrimination. Museum space, in other words, provides a physical realization of classificatory principles which are supposed to make the collections accessible to understanding (Jordanova, 1989; Vergo, 1989; Markus, 1987; Peponis & Hedin 1983; Pevsner, 1976; Kent 1932). But the spatial arrangement of objects only becomes experientially available when visitors explore the buildings that accommodate the collections. Bataille's statement that *the rooms and objects of art are only a container, the contents of which is formed by the visitors* (1930, p.300) is perhaps alluding to this fact. Spatial arrangement may make some objects more accessible than others. Viewing sequences may be imposed by means of a restricted circulation pattern. These are the reasons why the arrangement of circulation has always been seen as central to the cultural functions of museums (Montaner & Oliveras, 1986; Levin, 1983; Gilman, 1923).

The empirical studies of visitors' movement, however, have mostly been conducted in individual exhibition rooms or confined areas (Bechtel, 1967; Lakota & Kantner, 1976; Shettel, 1973; Screven, 1969; Borhegyi, 1968; Kearns, 1940; Melton, 1933). These studies therefore tend to deal mostly with *local* aspects of the relationship between layout configuration and visitors' behaviour. Furthermore, there seems to be no systematic method for describing either the overall configuration of the museum setting or the spatial pattern of visitors' movement at a larger scale. As a result, the independent influence of the configuration of architectural space upon the pattern of visitors' movement is poorly understood.

Our understanding of the effects of architectural configuration is also limited in another respect. Exposing visitors to objects may be the overt function of museums but it is not the only function relating to the pattern of visitors' movement. Pfeiffer notices this implicit intention of visiting museums by saying that *people go to museums today not only to look at the works of art, but to come together with other people* (Stephens, 1986, p.61). This is a second function which arises as the by-product of the first. As visitors move about exploring the collections, they also become aware of one another. The act of seeing objects is complemented by the act of seeing and being seen by other visitors.

The creation of a field of reciprocal *social* visibility confers to museum visits their character as social occasions and public events. In some layouts, visitors meet in procession as they move through linear sequences of rooms. In other buildings, the spectacle of visitors pursuing independent routes becomes more transient. The awareness of other visitors may thus acquire a formal or an informal character (Hillier, Peponis & Simpson, 1983). The precise relationship between the layout of museums and the pattern of awareness that they engender is, however, poorly understood.

2 Syntactic analysis of eight museum settings

Eight settings which are parts of art museums were selected for the study: The second and fourth floors of the High Museum of Art; the third floor of the Anderson building, the second floor of the Ahmanson building and the second floor of the Hammer building, all in the Los Angeles County Museum of Art; the ground floor of the Museum of Contemporary Art; the third floor of the Oakland Museum of Art; the second floor of the Asian Art Museum. The layouts of the eight settings at the time of the study are shown in Figure 1. The selection of the sample was aimed at including a variety of layout configurations as much as possible. Two criteria were used: 1) Whether their pattern of subdivision was based on clearly defined rooms or on a *free plan;* 2) whether their pattern of circulation approximated a sequence or a network of connections. While it has not been possible to represent each possible layout type equally in the small sample of case studies, the sample represents most configurational possibilities. For example, while the Hammer is a single sequence of clearly defined rooms, the Anderson is a matrix of same kind. As the Oakland is a free plan with a dense circulation network, the Asian Art is a free plan around an atrium.

The eight settings were analised using the theory of space syntax (Hillier & Hanson, 1984). Space syntax describes layouts in terms of the relational pattern of spaces. Previous studies indicate that syntactic variables are related to the

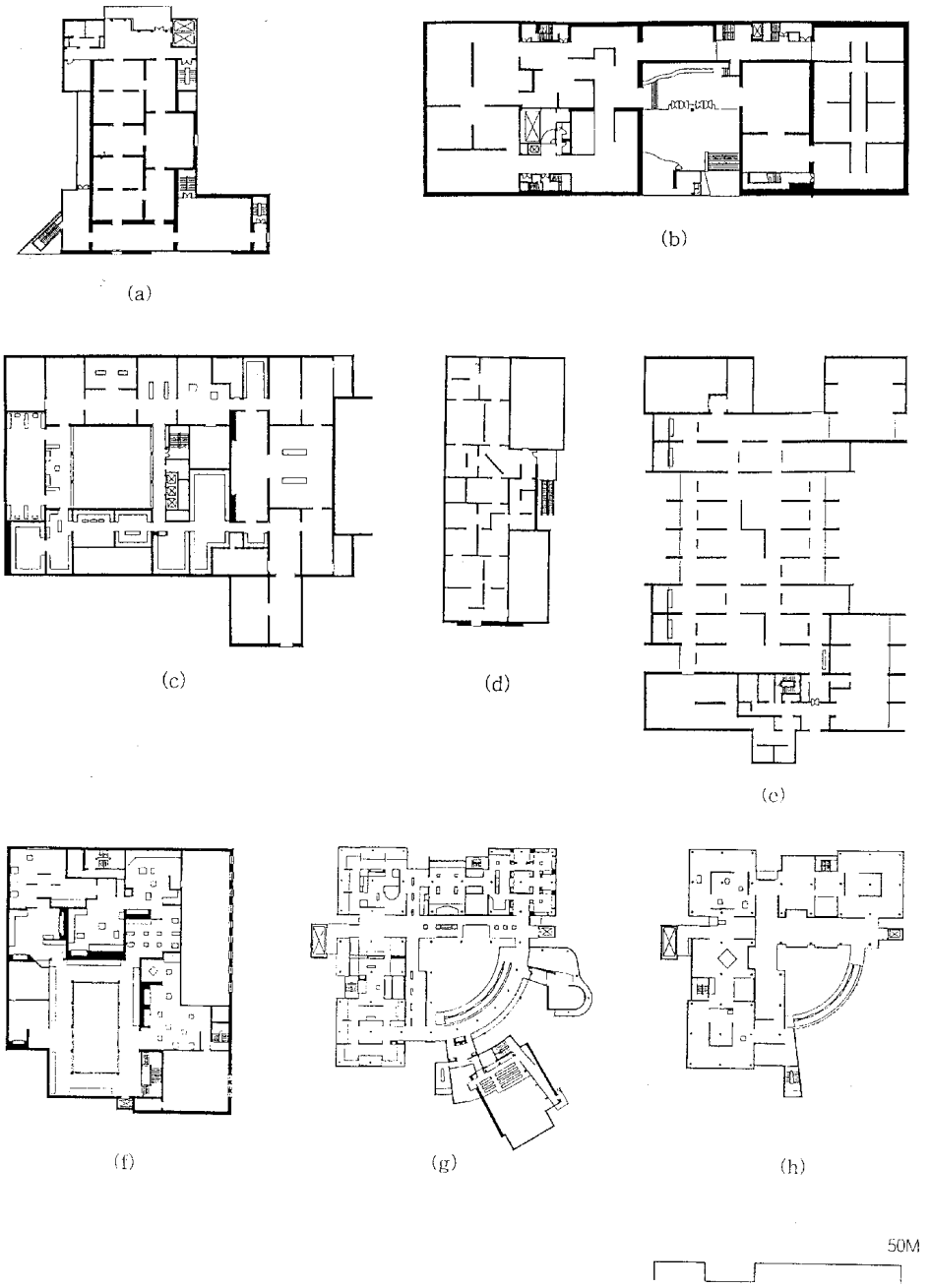

Figure 1. The Layouts of Sample Settings;
(a) the third floor of the Anderson, (b) the ground floor of the MOCA, (c) the second floor of the Ahmanson, d) the second floor of the Hammer, (e) the third floor of the Oakland, (f) the second floor of the Asian Art, (g) the second and (h) fourth floors of the High Museum of Art.

pattern of movement and encounter inside buildings (Hillier & Penn, 1991; Peponis, Zimring & Choi, 1990; Peponis 1985) as well as in urban areas (Hillier et al, 1987; Peponis et al, 1989).

Syntactic analysis entails two ways of identifying the spatial constituents of a plan and thus representing it: 1) The convex map shows the fewest and fattest convex spaces that are needed to cover the system; 2) the axial map shows the fewest and longest lines that are needed to cover all the convex spaces and make the connections of permeability between them.

A third representation is also employed, which is derived from Benedikt's idea of an *isovist* (1979). An isovist was originally defined as the total area visible from one point. For the purposes of this study, isovists were drawn not from single points but from complete convex spaces. Thus, an individual isovist represents all the areas that are visible from any part of a convex space.

The three representations correspond to three distinct aspects of spatial experience. By definition, a convex space is an area all parts of which are completely available to inspection. On the other hand, an isovist extends into areas at least some parts of which are available to inspection. Finally, an axial line represents the longest stretch which is available to inspection in one direction only.

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With the spatial constituents identified, the pattern of their relationships is quantitatively described by the computer models associated with space syntax. Three relational variables are central to this analysis. Integration is a key syntactic variable, and its value of a space can be measured based on the number of other spaces that must be traversed in order to reach all the other parts of the system. Connectivity, on the other hand, measures the number of other spaces which are directly connected to a space. Thus, integration is a global measure describing the relation of each space to the system as a whole, while connectivity is a local measure describing the relationship of each space to its neighbours. Another variable generated from the isovist idea is added, which is the number of convex spaces that are at least partly visible from each space. This measure may be called *visual range*.

3 The pattern of visual encounter as a static property

Using a common technique of observation, the location of each visitor was recorded on a building plan during ten rounds of observations at regular intervals. Though people moving and standing when they were observed were identified separately, the observation data provides a *static description* of the visitor group. The question is whether the spatial distribution of people can be explained in terms of configurational variables.

Prior to dealing with configurational variables, it was checked whether the spatial distribution of people was affected by the spatial arrangement of objects. The result showed that there is no strong or consistent correlations in the sample. Whereas in some settings the number of people were correlated with the numbers of objects in terms of both convexity and axiality, in other settings there was no correlation at all.

It was subsequently explored whether the spatial distribution of people was correlated with the configurational variables. The number of static people was found to bear no systematic correlation to any configurational variable. The number of moving people per convex space was correlated with connectivity in some museums, but the correlation disappeared when axial units of analysis were considered. The result so far indicated no clear logic for the spatial distribution of people, suggesting that the pattern of encounter as a by-product of museum visits is largely independent of spatial variables and only sometimes dependent upon the spatial distribution of objects.

The next step of the analysis, however, provided a more promising result. As shown in Table 1, the number of people visible from each convex space was consistently correlated not only with the visual range of the space but also with its integration into the setting as a whole. That more people are visible from spaces which have a stronger visual range is hardly surprising. The correlation between the number of people visible and integration, nevertheless, deserves some discussion.

Table 1

Museum	*RRA*	*Convex Connecti-vity*	*Control Value*	*Visual* Range
Anderson	-0.700*	(0.375)	-(0.069)	0.668*
Ahmanson	-0.408*	0.370*	(0.128)	0.538*
Hammer	(0.126)	-(0.059)	(0.026)	(0.145)
Oakland	-0.884*	0.767*	0.393	0.945*
MOCA	-0.446*	0.654*	0.594*	0.827*
Asian Art	-0.713*	(0.186)	(0.148)	0.661*
High2	-0.574*	0.475*	0.278*	0.859*
High4	-0.600*	0.398*	(0.279)	0.651*
Mean	**-0.525**	**0.396**	**0.222**	**0.662**

Notes.
1) RRA (Real Relative Asymmetry) is the main measure of integration.
2) Control Value is a modified connectivity measure which takes into account the connections of each neighbour of a space.
3) A * indicates correlations significant at 1%
4) A parenthesis indicates correlations which do not meet the 5% level of significance

Table 1. Correlation between the Number of People Visible from Each Convex Space with Convex Configuration Variables.

The syntactic studies mentioned above have reported strong correlations between the integration of spaces and the people in them. Insofar as the number of people in a space is related with configurational variables, it is suggested that space generates and structures a morphology of encounter. Hillier has proposed the term *virtual community* to describe this systematic morphological pattern (Hillier et al, 1987; Hillier, 1989). The word *virtual* acknowledges that the phenomenon bears no necessary link to active interaction, but the word community equally acknowledges that the systematic pattern of awareness of other people is a form of social relationship.

In museums, literal co-presence seems to lack a clear spatial pattern. The extended pattern of co-presence which includes people visible from a space, however, is related not only to the visual connections between spaces but also to the integration of spaces in the layout as a whole. Thus, the spaces which integrate the building most powerfully may not have more people in them but they make more people visible. The awareness of other people becomes related to the experience of spatial structure. This seems to suggest a different form of virtual community, which may be based on *visual encounter* rather than *encounter* that is bounded in individual spaces.

4 The pattern of exploration as a dynamic property

Twenty people in each museum setting were tracked and their journey through the premises was recorded on plan. Tracking data offers information about the whole process of exploration and thus provides a *dynamic description* of the movement pattern of the visitors.

The terms *tracking score* and *tracking frequency* are used to refer to the number of people and the number of visits that each space received. It was found that the tracking score of each space was not systematically correlated with the number of objects. In six museums a significant correlation was found between the tracking scores of convex spaces and the number of objects visible from them. In some others, there were also significant correlations between tracking scores and the number of people previously observed to be in as well as visible from convex spaces. However, these correlations were neither very strong or consistent.

Next step was to explore the influence of configurational variables. With few exceptions, all configurational variables were correlated with tracking scores for both convex and axial spaces as indicated in Table 2. Although both global and local variables are correlated with tracking scores, integration shows strong and consistent correlations.

Table 2

		Convex			*Axial*		
Museum	*RRA*	*Connectivity*	*Control Value*	*Visual Range*	*RRA*	*Connectivity*	*Control Value*
Anderson	-0.789*	0.577	(0.339)	0.562	-0.872*	0.771*	0.701
Ahmanson	-0.376*	0.542*	0.408*	0.596*	-0.645*	0.662*	0.612*
Hammer	-(0.107)	(0.334)	(0.358)	0.408	-(0.346)	(0.255)	0.456
Oakland	-0.438	0.637*	0.480*	0.462*	-(0.256)	0.407	(0.324)
MOCA	-(0.257)	0.343	(0.198)	0.378	-(0.265)	0.512*	0.360
Asian Art	-0.767*	0.439*	0.367*	0.394*	-0.825*	(0.271)	0.356
High2	-0.288*	0.670*	0.593*	0.469*	-0.428*	0.563*	0.523*
High4	-0.617*	0.547*	0.461*	0.316	-0.424	0.501*	0.556*
Mean	**-0.455**	**0.511**	**0.401**	**0.448**	**-0.508**	**0.493**	**0.486**

Note. For explanation of variables see notes to Table 1

Table 2. Correlations between Tracking Scores and Configurational Variables.

Tracking frequencies, by contrast, were most clearly and consistently correlated with connectivity, as indicated by Table 3. These correlations were not only significant statistically but also quite strong. Integration still had a clear effect in some cases, but in the sample as a whole its influence was less strong.

Table 3

		Convex			*Axial*		
Museum	*RRA*	*Connectivity Value*	*Control Range*	*Visual*	*RRA*	*Connectivity Value*	*Control*
Anderson	-0.669	0.770*	(0.542)	0.808*	-0.803*	0.871*	0.743*
Ahmanson	-0.422*	0.644*	0.503*	0.608*	-0.588*	0.929*	0.906*
Hammer	-(0.336)	0.607*	0.699*	(0.000)	-(0.002)	(0.263)	0.531
Oakland	-0.437	0.798*	0.589*	0.554*	-0.613*	0.790*	0.792*
MOCA	-0.320	0.864*	0.814*	0.513*	-0.528	0.551*	(0.153)
Asian Art	-0.706*	0.506*	0.464*	0.475*	-0.673*	0.408*	0.560*
High2	-0.331*	0.776*	0.717*	0.480*	-0.364*	0.575*	0.674*
High4	-0.653*	0.720*	0.701*	0.301	-0.443*	0.599*	0.566*
Mean	**-0.484**	**0.711**	**0.629**	**0.467**	**-0.502**	**0.623**	**0.616**

Note. For explanation of variables see notes to Table 1

Table 3. Correlation between Tracking Frequency and Configuration Variables.

This analysis suggests, therefore, that tracking scores and tracking frequencies are much more systematically correlated with the configurational properties of layouts, as compared to the spatial co-presence based on observations. This result somewhat contradicting to the previous syntactic studies needs to be discussed further.

The description of the complete path of exploration means that all spaces visited are fully recorded. By contrast, the observation of space-use is more likely to *catch* people at the spaces in which they linger rather than at the spaces they quickly pass through. The findings in this study indicate clearly the role of configuration in structuring the pattern of exploring spaces. But as this pattern of exploration turns into a pattern of contemplation of objects, as people begin to stay in some spaces more than in others, the effect of configuration in determining where people are is reduced. In other words, space seems to determine the dynamic more than the static description of the system.

This does not, however, mean that the effect of space is limited to the pattern of exploration. As discussed above, the pattern of visual encounter which arises as the by-product from exploration is itself related to configurational variables. The dual effects of space upon the pattern of exploration and upon the pattern of visual encounter suggest a clarification of the cultural functions of the museum. From the point of view of the visitors' experience in museums, the patterns of movement and encounter can be seen as the two sides of the same coin. Because museums cannot engender one without also engendering the other, they not only *spatialise* collections of objects by virtue of arrangement but also *socialise* them by virtue of placing them in the context of a spatially sustained pattern of visual encounter.

5 Probabilistic and Deterministic Models

In the discussion above, the Hammer was quite frequently an exception in many analyses with regard to the correlations between variables. This lack of correlation does not seem to arise arbitrarily, since the Hammer is the only setting in the sample which eliminates all circulation choices and structures the whole museum visit as a single viewing sequence. Other than minor *backtracking* most people simply move through the sequence in the same direction. What the Hammer represents, in other words, is a deterministic model for controlling visitors.

On the contrary, most of the museums in the sample seem to operate according to an opposite model which can be identified as a probabilistic model. In a probabilistic model, movement and presence are not forced nor random but statistically structured by the pattern of spatial connections. It is quite clear how to produce a deterministic model. All that is required is the elimination of circulation alternatives.

However, how to make probabilistic models work is more subtle and thus requires more profound understandings. To do so it is necessary to eamine whether there are configurational properties of the setting as a whole which make the patterns of exploration and visual encounter statistically more predictable from configurational variables. Statistical predictability is after all the distinguishing feature of probabilistic model as distinct from deterministic one.

The analysis shows that syntactic intelligibility and integration are two key system variables to affect various relationships. Syntactic intelligibility is defined as the correlation between the immediately available relationships to neighbouring spaces, as measured by connectivity, and the relationship to the pattern as a whole, as measured by integration. It is found that syntactic intelligibility affects the predictability of tracking scores according to integration as well as tracking frequency according to connectivity. It also affects the predictability of visual encounter according to integration.

Integration as a system variable plays a similar role. More integrated layouts make tracking scores more predictable according to connectivity. They also make tracking frequencies more predictable according to both connectivity and integration. Finally they make visual encounters more predictable according to integration. Some of these correlations are shown in Figure 2.

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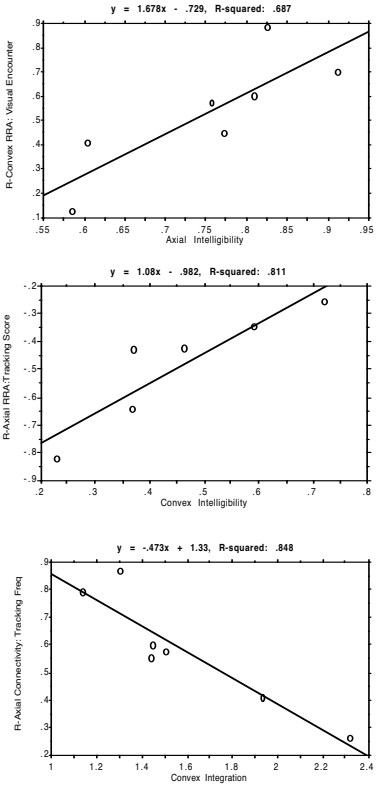

Figure 2. Correlations between system properties and predictability;

(a) axial intelligibility and the predictability of visual encounter according to convex RRA (r=.928, p=.0075; excluding the Asian Art),

(b) convex intelligibility and the predictability of tracking score according to axial RRA (r=.901, p=.0143; excluding the Anderson and MOCA),

(c) convex integration and the predictability of tracking frequency according to axial connectivity (r=.921, p=.0032; excluding the Ahmanson).

In this probabilistic model, it is also possible to describe and thus modulate the spatial characters of visitors' itinerary, which are generated and structured by museum layouts. Three questions are proposed; 1) the question of whether individual visitors are selective or exhaustive with regard to the spaces of the museum that they visit, 2) the question of whether museum spaces are evenly or unevenly visited over a population of visitors, and 3) the question of the degree to which visitors' itineraries are consistent or inconsistent. In the analyses concerning these three questions the Hammer is excluded for obvious reasons.

It is assumed that higher average tracking scores indicate more exhaustive itineraries while lower scores indicate selective ones. The analysis shows that itineraries in the sample settings become more selective as the number of convex spaces increases (r=.947, p=.0012). At the same time, the number of convex spaces increases according to the number of objects (r=.686, p=.06) rather than according to the museum's area (r=.165, p=.6969). It suggests that as museums get increasingly subdivided in response to the number of objects, visitors move more selectively.

The second question is whether all parts of the layout have even chances to be visited when populations of visitors are considered as a whole. It is measured in terms of the standard deviation of the tracking scores of all the spaces of the museum expressed as a ratio of the mean. The data indicates that museums with more convex spaces and more axial lines are unevenly visited (r=.868, p=.0112; r=.848, p=.016). At the same time, convexly more integrated and more intelligible layouts are more evenly visited (r=.844, p=.017; r=.866, p=.0118). This means that in museums with higher intelligibility and integration individual spaces tend to be visited more evenly.

The effect of intelligibility upon the consistency of itineraries is much clearer. Consistency can be measured by the mean of the standard deviations of the visitors' tracking frequencies per space. Greater inconsistency thus implies that the tracking frequency of each space is unequally contributed by the various visitors. While the number of unit spaces has no effect upon consistency, more integrated and more intelligible layouts are clearly used more inconsistently (r=.931, p=.0023; r=.919, p=.0035). This suggests that intelligibility encourages greater differentiation of visitors' itineraries. This seems compatible with the previous suggestion that it may also encourage a more even use of spaces by a population of visitors.

Unfortunately, in such a small sample it is difficult to establish an affirmative effect of museum layouts on the pattern of visitors' itineraries. Nonetheless, further study of larger sample may test the three hypotheses that emerge from this analysis. 1) Quite evidently, layouts which offer choices of what to see allow visitors to be selective. 2) It is suggested, however, that intelligibility and integration may help to preserve an even use of the layout as a whole. 3) It is equally evident that differentiation in terms of itinerary could be enhanced by intelligibility. It seems that in practice visitors venture to take different routes when the spatial structure of the building is clearly understood.

6 The architectural experience of museum visits

This article has discussed the relationship between the configuration of museum space and the patterns of exploration and encounter of visitors. The analysis has suggested that there certainly are underlying principles which are not obvious prior to this study. More particularly, it has been suggested that these effects can be described as general laws which are, to a large extent, independent from the particular contents and messages of the exhibitions.

Based on the findings, it is possible to distinguish between two models according to which the overall effects of museum layouts operate, the deterministic and probabilistic models. The deterministic model dictates viewing sequences and channels encounters in limited ways of controlling visitors' movement. The thrust of the article is, however, to demonstrate that deterministic patterns are not the only kind of structure in which the patterns of exploration and encounter can be predicted and thus modulated properly. The probabilistic model modulates exploration and encounter statistically according to the syntactic properties of the layout. If, for example, it is intended that some spaces should encourage comparisons across the categories of objects identified by curators, then well connected spaces should be considered because these are the spaces to which people will return more frequently. Similarly, if certain parts of the exhibition are thought to address the more general public while others are thought to be of more specialized interest, then the former should be placed in more integrated spaces than the latter.

Furthermore, visitor itineraries can possibly be modulated by adjusting the syntactic properties of museum layouts. Probabilistic systems permit selection but can still make for a well used layout. Also, they generate differentiation but they do so to the extent that differentiation is absorbed within an intelligible spatial background. These findings mean that curators and designers alike can work with the layout to differentiate and yet control the possible experiences of visitors, without imposing a rigid spatial pedagogy.

Both the pattern of encounter and the pattern of exploration are important parts of the spatial experience of museum visits and thus influence its quality. Museum architecture, and probably all architecture, includes the experience of movement and of encounter as an intrinsic aspect of experiencing it. Movement in the form of exploration is central to appreciating its spaces as well as its contents that cannot be seen *all at once*. Encounter is central to social forms in which *seeing* is complemented by the awareness of *being seen*, and where reciprocal visibility gives rise to a sense of spatial culture over and above the appreciation of the contents. In museums this is more important precisely because the *spatialisation* and *socialisation* of displays are their institutional aim.

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