From Academic Research on Museum Galleries to Practice-Based Research for Planning Shopping Malls

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ABSTRACT: This paper explores how findings obtained from a case study research on museum gallery layouts may provide insights for shopping mall planning and design. The case study research that this paper discusses has explored the effects of gallery layouts on visitors' movement patterns in museums, drawing upon Space Syntax methodology. In this exploration, the local visual cues are considered as important as global spatial structure. With this way, the effects of spatial layout can also explain the effect of attractor, displays contained in space. This paper argues that this approach can be utilized in the research analyzing pedestrian movement in shopping malls, while the findings themselves can provide insights on planning and designing the shopping environment. The case study research analyzing two exemplary museum gallery layouts, the Yale Center for British Art (New Haven, CT) and the Modern Museum of Art (New York, NY) can exemplify layouts that provide various potentials for visitors' spatial experience versus the goals of retailer developers. Within these potentials, this paper discusses the possible outcome that can guide architectural practice in design of shopping malls and suggest further research that can be conducted in practice to answer more specific questions regarding visitors' experience in shopping malls.
Conference theme: Building case studies
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INTRODUCTION

Museums and shopping malls have similar design objectives and share some characteristics in their layouts. Both are designed to be experienced through exploratory movement and the design objective is to facilitate visitors' contact with the displays. In museums, visitors' exploration of the entire space and their contact with displays can be important to convey the exhibition narratives as intended. In the shopping malls, the exploration of the entire space can be desired for more critical reasons: pedestrian access to the stores should be equalized so that the rent rates could be optimized (*Shopping Center Development Handbook*, 1999). Previous studies focusing space-use in shopping malls and museum layouts have investigated the influence of spatial layouts on pedestrian movement by considering the additional effects of attractors. This paper discusses how a research study exploring the influence of spatial layout explain the entire potential of spatial layout together with attractors, and thus the findings can inform design and planning of shopping malls.

1. PREVIOUS STUDIES ON PEDESTRIAN MOVEMENT IN SHOPPING MALLS AND MUSEUMS

1.1. Theoretical Explorations on Movement and Buildings

As acknowledged in the literature, museums and shopping malls are interesting environments to understand how spatial activity (pedestrian movement) can be related to built environments. This relationship between movement and building layouts is the central argument of the Space Syntax research. Within the theory of Space Syntax, Bill Hillier argues that "buildings are fundamentally about movement, how it is generated and controlled" (Hillier, 1996; Hillier & Penn, 1991; Hillier, Penn, Hanson, Grajewski, & Xu, 1993). On this basis of this argument, the methodology of Space Syntax conceives buildings as systems of configurations that consist of spatial units and the local and global relationship between them. Accordingly, buildings can be represented as configurations consisting of the nodes corresponding to spatial units and the links corresponding to topological relationships between them. The graph representations of buildings, called justified graphs, are used to represent these relationships within the logic of network. In the graphs representing the configurations as nodes and links, nodes refer to the spaces which are characterized by

occupation, and links refer to movement from one node to another.

By analyzing the patterns of movement through spatial analysis techniques, Space Syntax relates space and human activity to each other in two ways: spatial layouts may either *reflect* the existing social structures, or *generate* new structures in society. In the former case, a spatial layout can reflect or embody culturally or programmatically given pattern of usage, such as layouts of vernacular houses or a law court building. In such layouts, the potential movement through spatial units is determined by the building program; for instance, in a law court building the layout is designed with a specific program that determines entries and exits to certain court rooms, and thus the relationships between spaces and the patterns of usage afforded by the programmatic relationships that are predetermined before the spatial layout is conceived. As a result, in such buildings the potential movement is fixed and non-interchangeable. In the latter case, space can shape a social pattern by facilitating new encounters through permeability in the configuration where the usage patterns are not predetermined by a culturally given structure or a building program. For example, settings like office buildings are designed for more flexible usage, and do not impose a strict usage pattern. In such buildings, the relationships between the spaces arise from the way in which spatial layout applies the program. Within this framework, Hillier distinguishes settings that reflects existing social structure from the settings that generates new encounters by calling the former "strong program" and latter as "weak program"(Hillier & Penn, 1991). Accordingly, the weak program buildings are environments which are explored by "natural movement." In the same theoretical framework, natural movement is described as a movement… that is determined by the structure of the urban or building configuration itself rather than by the presence of specific attractors or magnets (Hillier, 1996).

In this categorization, shopping malls can be considered "weak program" environments, as visitors' movement is not entirely dictated by the program despite the notable effect of attractors.

1.2. Studies Examining Movement in Shopping Malls

As discussed in literature, main concern of retail developers is the rent yield due to the attraction of visitors to certain stores, as movement is an index on which rent increases are estimated (Fong, 2003; , *Shopping Center Development Handbook*, 1999). Therefore, the planning and design of shopping malls can be guided by the intent to equalize the pedestrian movement exploiting the placement of certain retail groups. However, the spatial hierarchy engendered by design, such as the central location of some retail groups in relation to other store groups may have a strong influence on the pedestrian movement. The dynamics between spatial layout and potential attractors in the shopping mall layouts have been explored by a number of studies. In one of these explorations focusing on visitor's perception of shopping mall environment, Dennis and Newman (2005) suggest that general layout is one of the attributes that can be influential on the shopping activity. In their study focusing on the in-store environments, Newman et all (2002) discussed that customers often look for clarity in shopping environment, whereas ambiguous environments, frequent and unexplored changes in the merchandise may increase the shopping stress, and thus can be detrimental to shopping activity.

A number of other researchers explore to what extent the space-usage in shopping environments, in particular pedestrian movement, is influenced by spatial layout versus attractors. Drawing upon the Space Syntax methodology, One of these studies, Hussein (1991) which analyzed spontaneously developing urban shopping environments reports that that within the spontaneous development of shopping environment, attractors are deliberately created by profit motivated developers by inserting special types of retail. This study suggests, shopping environment that are created within the spontaneous development and programmatic concerns of retail developers, it is likely that the effects of spatial layout and attractors on movement would complement each other. Another study, Fong (2003) considers main attractors of the shopping mall layouts, and explores whether placing these attractors to the polar ends of mega-shopping mall blocks would really attract pedestrians over the influence of spatial layout, and thus they would function equalizing the movement rates in the shopping environments. This study reports reasonable evidence that that spatial configuration has a direct relationship with the distribution of movement within planned, artificial shopping centre environments, however, spatial layout is not a single isolated factor that would explain the movement alone, but overlapping effects of spatial layout and attractors should be considered. According to Fong, the inevitably created spatial hierarchy can be balanced using the attractors (Fong, 2003).

Parallel to these explorations focusing on the shopping malls, a fair number of studies focusing on museum galleries explore the effect of spatial layout on visitor movement as an independent property that the gallery layouts predict visitors' movement (Choi, 1991, 1999; Psarra, 2005; Psarra, Wineman, Xu, & Kaynar, 2007). Only a few of these studies consider the effect of attractors, and they report stronger association between spatial layout and movement by excluding the attractors (Psarra, 2005).

In both groups of studies, the tendency in research is to explore the effect of spatial layout is on the basis of global and local syntactical layout properties, such as *integration* and *connectivity* measures. In Space Syntax methodology, *Integration* as a global property describes

the extent to which spatial units in a layout is physically or visually connected to the every other units in that layout; and *connectivity* as a local property measures the extent to which spatial unit is connected to the other units in the neighbourhood. Theoretically speaking, the integrated spaces are those that can be reached (or seen) by crossing least number of spaces from all other spaces, and therefore those spaces are likely by visited most frequently. In a similar way, the highly connected spaces are in direct relationships with higher number of spaces and therefore it is more likely to be used. In the research investigating the influence of spatial layout on the movement, the collected data of users are compared and correlated with the integration and connectivity measures of the spatial units. The studies investigating these correlations in the museum layouts found strong evidence that the visitors' movement is associated with integration and connectivity properties.

As discussed within the previous studies in the body of architectural research, Space Syntax simulates all ways that a layout can potentially be experienced at a representative level; and thus provides techniques of a top-down exploration, such as the likelihood of movement paths in highly integrated parts of a layout. On the other hand, as discussed by some of the recent studies, a peripatetic observer can only absorb a limited amount of information and entire syntactical relationships may not be apparent to the observer at any point. If one considers that, the visual information can work as a reference for a peripatetic observer's navigation (Psarra & Grajewski, 2000), visual information may be in effect in the distribution of movement. A bottom up approach to investigating the link between usage patterns and visibility at both local and global level can provide a more concrete explanation of how and to what extent observers use visual information in their explorations, and thus demonstrate how the spatial layouts can predict the space use patterns.

2. A CASE STUDY RESEARCH EXPLORING THE GALLERY LAYOUT'S EFFECT ON MOVEMENT

2.1. Scope of the case study

A recent study exploring the effect of spatial layout on visitors' movement utilizes both top-down and bottom-up approach by considering the role of local and non-syntactic visual cues on the modulation of movement.

The motivation of this research was to understand how morphological characteristics of museum galleries may play role in shaping the museum experience. More specifically, the study aimed to explore to what extent the spatial layout properties influence the space use patterns and how it shapes the exhibition layout. In order to detect the role of morphology on the space use patterns and exhibition layouts, this study examined the effect of visibility relationships that can be visualized in fine grain. Second, the investigation is conducted in three art museum gallery layouts which share similar spatial attributes within some variation in their morphologies. These gallery layouts are the main galleries of the Yale Center for British Art (YCBA), the Museum of Modern Art (MoMA) and the High Museum of Art (HMA). Here, only the results obtained from the first two case studies, the YCBA and the MoMA are discussed, as these two cases presented contrasting results due to the variation in their morphological characteristics that reveal different local and non-syntactic visual cues to visitors.

2.2. Anecdotal Observations

As can be seen from the floor plans (Fig. 1), the MoMA and the YCBA gallery layouts share key spatial attributes, such as having atria voids visually linking galleries across space and room configuration allowing multiple routes. On the other hand, the gallery layouts show some variation in their morphologies which is determined by the location of atria voids in the gallery space and their relationship with the gallery rooms in third dimension, such as openings to the rooms and their relationship with periphery and centre.

The YCBA and the MoMA's galleries exhibit paintings and sculptures from different art historical context by utilizing different display strategies. The YBCA's gallery layout exhibits British painting and sculpture from sixteenth to mid-nineteenth centuries, which are display objects are figurative rather than iconic and geometric. These objects can best understood within a close distance viewing and reading the labels in depth. As a display strategy, the paintings and sculptures are installed in the gallery by exploiting the some architectural properties, for example being grouped in aesthetic combinations and framed through atrium openings to be seen across distance. During the observations in the gallery, these compositions were not noted with an attractive power to change movement patterns, but it is recognized that they captured visitors' look from distance. The MoMA's fourth floor galleries exhibit painting and sculptures of the Late Modern and Pre-Contemporary art. Among the displayed objects, there are well-known masterpieces, such as late Post-Cubist works of Picasso, and mural paintings of Jackson Pollock and critically acclaimed examples of Pop-Art, such as Andy Warhol's *Campbell Soup Cans.* Therefore, the displayed objects have an iconic power in space both due to their fame and their geometric and non-figurative appearance in space. In fact, this potential is recognized by the curatorial team and the paintings are placed at the end of visual axis through gateways in order to attract visitors to the adjacent rooms.

Indeed, the anecdotal observations in the galleries suggest that visitors experience in the YCBA is more serene and spiritual going along with experiencing space and architecture. In contrast, the visitors' experience in the MoMA seemed to be more akin to aggressive urban exploration consuming the joyous feeling of finding and viewing the well-known masterpieces. On the basis of these explorations, the

spatial experience in the MoMA can be resembled to the spatial experience of shopping.

2.3. Methodology of the Study

To investigate the gallery layout's potential influence on visitors' patterns of explorations in the YCBA and the MoMA, the research study analyzed movement patterns and compared the measures of those patterns with visibility relationships the gallery layouts.

Data of visitors' patterns of exploration was collected through detailed observation studies conducted in the the YCBA's and the MoMA's fourth floor galleries. The visitor data samples include the records of 35 randomly selected individuals' movement paths. The patterns of spatial exploration were observed in paths of movement entering the gallery rooms, and proportion of movement lines directed to the available directions at the choice points.

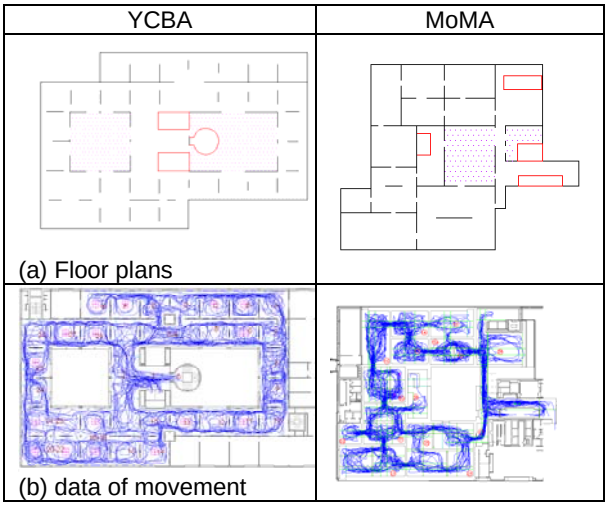

Figure 1. Floor plans of the analyzed layouts and the movement data collected.

In this study, visibility relationships engendered by the gallery morphologies are described and visualized through computer aided spatial analysis techniques developed within the Space Syntax research. Space Syntax research applies a visibility polygon, "isovist," introduced by Michael Benedikt, to the spatial analysis methods. According to Benedikt's definition, an isovist is a polygon that defines the visible area from a vantage point in 360 degrees; in other words, the boundaries of isovist are descriptive of the region where the radials of sight projecting from the vantage point can permeate until they meet physical boundaries (Fig. 2). In order to describe visibility relationships syntactically in a configuration, point isovist (visual field) technique was applied to computational applications. These applications generated point isovists from every point of an assigned grid on floor plans (Dalton, 2001; A. Turner, Doxa, O'Sullivan, & Penn, 2001). Using isovists generated in each grid point, the computer applications achieved to calculate visual fields overlapping throughout the space, and obtained syntactical measures that describes visibility relationships (A. Turner, 2003, 2004; J. Turner, Wineman, Psarra, Jung, & Senske, 2006). Resulting graphs are able to demonstrate "visibility structure" in floor plans of a configuration through color rendered graphs and quantified measures (Fig. 3). These applications provided potentials to compare visibility structure with potential movement and other human activity in built environments.

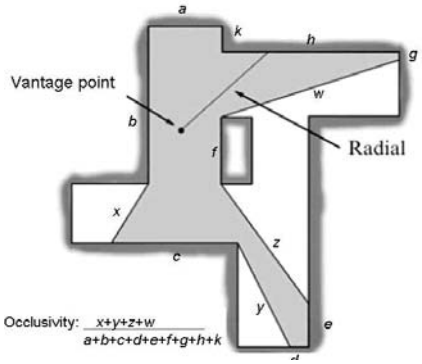

Figure 2. Visual field polygon and occlusivity measure (Source: Benedikt, 1979)

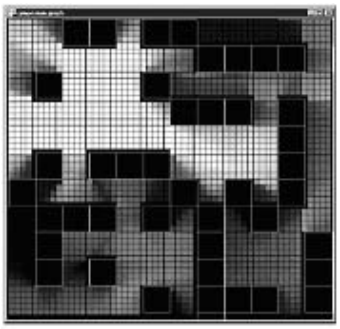

Figure 3. A sample visibility graph analysis by *Depthmap*.

By assigning a grid to a floor plan, *Depthmap* creates visibility graphs by calculating the mutual visibility relations between grid points on the basis of various measures. Among the visibility graph measures *Depthmap* devises, visual connectivity and integration measures are particularly meaningful to examine the visibility structure in gallery layouts.

Visual connectivity is based on the concept of mutual visibility of the assigned grid points and represents the degree to which pair grid points can see one another. In the connectivity graphs the areas that have higher degree of mutual visibility are considered advantageous areas in terms of visual access. Visual access is the information reached from a particular location (Archea, 1977). For museum buildings, visual access indicates the degree to which observers have direct interaction with pieces of art in their

neighborhood. Visual integration as a global measure indicates the extent to which entire gallery layout would be visually accessible using the fewest number or steps (or through the shortest paths) (Hillier & Tzortzi, 2006). For museum layouts, visual integration is significant as it indicates through which areas an observer might capture a vision of the entire exhibition and spatial layout with minimal effort.

In addition to examination of the gallery layouts with syntactical measures -- visual connectivity and integration -- this study investigated the role of non-syntactical visibility properties on the prediction of space use patterns. To this end, visual field graphs that demonstrate the extent of visibility using the isovist measures are utilized. A visual field (also called an isovist) defines a 360 degree visible area from a vantage point, where the extent of visibility can be described in various ways through visual field polygon measures such as *area*, *perimeter*, *occlusivity*, and *compactness*. *Area* denotes the size of visible region and *perimeter* is the total length of the edges of a visual field. *Occlusivisty* is the ratio of the length sum of the occluding portion of the perimeter to the entire perimeter (Fig 2.). This interesting measure describes the occluding portion of the visual field perimeter that is not defined by real walls, and thus denotes the information behind the corner that could be seen when moved further. *Compactness* is the ratio of area to perimeter, and describes the degree to which shape of the visual field approximates a compact form and expresses coherence in visual information.

2.4. Results: Prediction of Exploratory Movement

Visual integration and connectivity graphs of the YCBA and the MoMA demonstrate how visibility structure in each layout is characterized through their morphology. In the YBCA, two atria voids are largely open to the gallery space with atrium openings at their four sides. This characteristic defines highest visual connectivity values inside the atria void and around the atria openings as it enhances the capacity of seeing neighbouring locations around the atrium. The two atria also concentrate the visual integration in the diagonal direction the west atrium towards the southeast direction inside the Main Galleries. Along with the physical and visual continuity in the longitudinal direction, the moderately integrated values are extended through the gateways in that direction. In the MoMA the atrium is largely open to the circulation space only, and its relationship with the gallery space is limited with two openings towards the south galleries. This enhances the capacity of seeing neighbouring locations in the circulation hall, and the south gallery room which is likely visited last in the suggested sequence. The capacity of seeing all other locations (visual integration) is enhanced by atrium in that sought gallery and circulation space. The interrelationship between the rooms and atrium locate the other visually integrated spaces along the east-west and northwest-southeast (diagonal) directions in the south galleries.

The analysis comparing and correlating the space-use measures with syntactic and non-syntactic properties provided interesting results that explain the influence of the gallery layouts on the space use.

To investigate the gallery layout's influence on exploratory movement, the visibility properties of each room is correlated with the number of movement lines crossing the rooms. The results suggested that the YCBA's gallery layout movement is strongly associated with visual integration property whereas less strongly

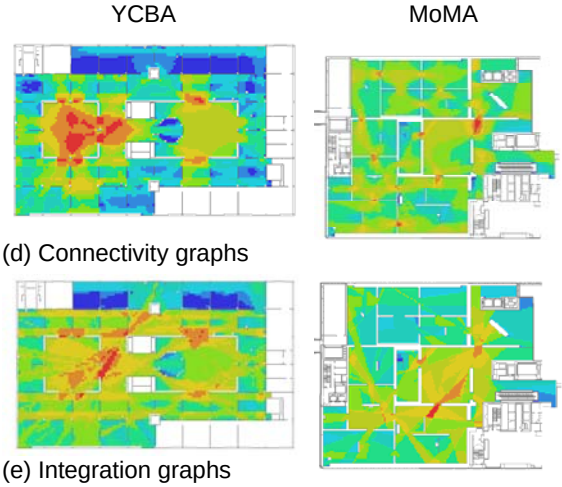

Figure 4: Comparison of Gallery Layout in terms of their Spatial Layout Properties

related to connectivity. In the MoMA, the results are opposite; visual connectivity has a greater role on the prediction of exploratory movement, however, the effect of visual integration is quite weak. These results suggest that the gallery layout of the YCBA predict the exploratory movement through the gallery rooms' capacity of being seen from every other spaces, whereas, the MoMA guides visitors through the visual access to neighbouring spaces, in other words by revealing the visual information step-by-step to visitors (Table 1).

The comparison of movement lines with non-syntactical properties helps to understand through which visual information at local level movement might be modulated in the layout. The results show that, in both the YCBA's and the MoMA's layout, *occlusivity* and *perimeter* measures are correlated with movement lines. *Occlusivity* measure denotes the occluding portion of the entire perimeter, and implies the hidden places behind the corners. The correlation between movement and *occlusivity* suggests that visitors are drawn to the potential to discover the hidden places. The correlation with *perimeter* at the same time suggests that visitors are drawn to the information of exposed wall surfaces (Table 2). These results suggest that the wall surfaces that include displays, along with the potential of exploring hidden regions have important roles in modulating the movement. These results are quite consistent with the results reporting the influence

of visual properties on the direction of movement that the standing visitors would choose (Table 3). According to the results, in both YCBA and the MoMA, the potential to explore hidden regions is still an important property that motivates standing visitors to move. Along with this property, in the MoMA the exposed wall surfaces attract visitors, whereas, the coherence in visual information is more effecting in visitors' choice of movement directions.

Table 1: Correlation of movement lines & syntactic visibility measures in each gallery in the YCBA and the MoMA

		Visual Integration	Connectivity	
Number of movement lines crossing each gallery	YCBA	0.76	0.60	*r*
		0.000	0.000	*p-*
		0.58	0.36	R^2
	MoMA	0.43	0.68	*r*
		0.047	0.000	*p-*
		0.18	0.46	R^2

Table 2. Correlation of movement lines & non-syntactic visibility measures in each gallery in the YCBA and the MoMA

		Occlusivity	Perimeter	
Number of movement lines crossing each gallery	YCBA	0.67	0.69	*r*
		0.000	0.000	*p-*
		0.45	0.48	R^2
	MoMA	0.64	0.72	*r*
		0.001	0.000	*p-*
		0.41	0.52	R^2

Table 3. Correlations between Path Ratio and Isovist Division Ratios in the Available Movement Directions at the Choice Locations (both Stent and Wieland Wings)

		Peri.	Occl	Compac	
Movement line ratio in available Directions	YCBA	-	0.58	0.40	*r*
			0.002	0.044	*p-*
			0.33	0.15	R^2
	MoMA	0.45	0.39	-	*r*
		0.012	0.031		*p-*
		0.20	0.15		R^2

Table 3: Correlations of stops at displays (normalized by number of displays) and syntactic visibility measures in each gallery

		Visual Integration	
Stops at displays (normalized by n. of displays)	YCBA	0.45	*r*
		0.012	*p-*
		0.20	R^2
	MoMA	-0.51	*r*
		0.019	*p-*
		0.26	R^2

Table 4: Correlations between rate of other stops in all stops and syntactic visibility measures in each gallery

		V. Integ.	Connect.	
Percentage (%) of displays viewed in each room	YCBA	0.50	0.62	*r*
		0.005	0.000	*p-*
		0.24	0.38	R^2
	MoMA	0.48	No correlation	*r*
		0.025		*p-*
		0.23		R^2

2.5. Discussion of the Results

First of all, the results provide strong evidence that both the YCBA's and the MoMA's layouts predict the space use patterns through visibility relationships. However, the visual integration as a global property that describes relation of spaces to every other space is not the absolute property that would predict the movement. Rather, the way in which the spatial layout predicts the space-use is very much related to how the morphological properties reveal the visual information to the visitors. The fact that the global visibility properties do not influence visitors' movement in a standardized way shows that visitors can grasp the entire layout through local and non-syntactic properties, and then their exploration can be guided by global syntactic properties. These results can be understood further by comparing the YCBA and the MoMA in terms of visual intelligibility property and the layouts strenths and weaknesses in different visibility relationships.

In the theory of Space Syntax, spatial *intelligibility* is described as the degree to which a gallery layout can be understood through a spatial experience. This description technically refers to the degree to which its global spatial properties (described by integration measure) can be grasped by an observer through local spatial properties (Hillier & Tzortzi, 2006). With this definition, spatial intelligibility of a layout is measured by the correlation between its global and local measures. The spatial intelligibility concept and its technique can be applied to visibility structure. Thus,

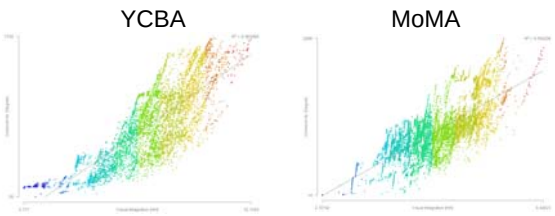

Figure 5. Scatter grams of visual connectivity and visual integration measures in the three gallery layouts

Table 5. Comparison of Visual Intelligibility, Mean Connectivity and Mean Integration measures along with the gallery areas measured by number of grid cells

	YCBA	MoMA
r	0.82	0.75
R^2	0.67	0.56
Mean connectivity	782.58	916.46
Mean integration	8.24	6.08
N. of grid cells	6466.00	11033.00

visual intelligibility of a layout refers to the degree to which local visibility in the individual spaces reveals the visual information of the entire layout. Thus, visual intelligibility of a layout could be described by correlating its visual integration and connectivity values.

With this in mind, visual intelligibility values of the YCBA and the MoMA are described by correlating their visual integration and connectivity graph values. The correlation values indicate that in the YCBA's fourth floor, %67 of visual integration values are predicted by visual connectivity values, whereas this value is %56 for the MoMA's fourth floor (Table 5). These values show that both galleries can be considered visually intelligible due to the strong correlations between the visual connectivity and integration values. However, the stronger correlation found in the YCBA's layout suggests that this layout is visually the more intelligible than the MoMA. These results can be evaluated by looking at the mean connectivity and integration values along with the number of grid cells designated in each floor, which indicates to the gallery layouts' area. Accordingly, the YCBA layout has lower value mean connectivity, than the MoMA has. This is consistent with the gallery layout area denoted by the number of grid cells; the bigger gallery layout would have higher connectivity values in general as the cells would see higher number of cells. When the mean integration values are compared, the results are more interesting. Although the YCBA's layout has a smaller area and the MoMA is almost twice as big as the YCBA, the mean integration in the MoMA is quite low. Together with lower visual integration, the weaker visual intelligibility indicates that in the MoMA's fourth floor gallery observers would need to explore larger amount of space in order to grasp the entire layout, as the local cues do not reveal the global properties all at once. In contrast, the highest mean value of the YCBA and highest visual intelligibility makes the YBCA's fourth floor layout can be much easily grasped.

These observations indicate that the YBCA's high capacity of visually linking most of the spaces to every other spaces characterizes visitors' spatial experience by guiding them through rich visual interrelationships in space. This may result in reading the displays and the layout within its entirety, and as a total and ambient image of displays. In this spatial exploration, hidden regions behind the corners attract visitors. This means, while spatial layout can be revealed to visitors all at once, potential to explore hidden regions on the side is quite attractive for visitors. On the other hand the MoMA's lower capacity of revealing the visual information all at once obviously influences the visitors' spatial experience: the galleries are explored step-by-step and through a temporal progression. In this exploration, the exposed wall surfaces provide an important property to guide visitors. This property may explain the potential of displays on the exposed wall surfaces to be attractors modulate visitors' movement. While this model of investigation considering the effect of non-syntactic and local visual properties can explain the attractor's role on movement, and confirms that the effect of attractors and the layout appear to be quite inseparable in art museums.

3. INSIGTHS FOR DESIGN AND PLANNING OF SHOPPING MALLS

In the case study research discussed above the the YBCA's and MoMA's gallery layouts can exemplify two shopping mall layout types: The former illustrates a layout where the shopping environment is revealed all at once and the total experience of space and the experience of shopping coincide. The latter exemplifies a layout that would guide visitors step-by-step revealing the stores through a temporal progression. Both shopping layouts may have different advantages. In the former type, there is a higher potential to grasp the space in its totality and to encounter or be aware of larger group of people within the exploration of small amount of space. In this case, there might be higher chance to be aware of attractors across distance. Within the non-iconic nature of the British art displays, such an effect of attractors could not be observed. However, if a similar potential of grasping and understanding the space was available in a shopping mall layout, the effect would have been different. Visitors in such a shopping mall layout might be attracted to a number of stores of their interest simply by seeing the iconic store signs from distance. However, this may create extremely explorative behaviour weakening the chance of visitors' focus on the stores in the visited locations. On the other hand, visitors in such shopping layouts might be less likely overwhelmed and tired due to way-finding and orientation issues. As can be understood from these potentials, a shopping layout similar to the YBCA's fourth floor gallery might be advantageous for visitors'

experience of space as it evokes the sense of space and sense of community, but could be less advantageous for retailers.

In the type of layout the MoMA exemplifies, the layout may reveal only the attractors in the neighbourhood, and this may provide visitors with opportunity of focusing on the displays in the visited rooms and recognizing only the stores in the adjacent locations. Due to the limitation and required effort to grasp the entire layout, the spatial experience provided by the MoMA's layout may be less advantageous for visitors in terms of having a total sense of space. As the total size of the layout gets bigger, limited capacity of viewing the other spaces and inability of grasping the entire layout may be more problematic in terms of way-finding and orientation. On the other hand, the gallery rooms of the MoMA are sizable to accommodate big group of people and thus in such a layout a visitor can still encounter large group of people. With these features, the gallery layout with the potentials of the MoMA would be advantageous for retailers to attract visitors and facilitate their concentration on the displays, yet could be less advantageous in terms of visitors experience.

In the design of shopping malls, the task of creating sense of space and sense of community may conflict with retail developer's and store owners' objectives of achieving increase in sales through planning. This paper tried to explore how a research conducted in museums can provide insights for design development stage of shopping malls. In fact, this exploration should be considered a humble attempt to transfer outputs of an academic research to practical considerations. The hope is this attempt would trigger further research that can be shaped with specific considerations in design development of shopping centres.

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REFERENCES:

Archea, J. (1977). The place of architectural factors in behavioral theories of privacy. *Journal of Social Issues, 33*, 116-137.

Choi, Y. K. (1991). *The spatial structure of exploration and encounter in museum layouts.* Unpublished Ph.D thesis, Georgia Institute of Technology Atlanta, GA.

Choi, Y. K. (1999). The morphology of exploration and encounter in museum layouts. *Environment and Planning B: Planning and Design, 26*(2), 251-264.

Dalton, R. C. (2001). Omnivista: An Application for Isovist Field and Path Analysis, *3rd International Space Syntax Symposium*. Atlanta, GA.

Fong, P. (2003). *What makes big dumb bells a mega shopping mall?* Paper presented at the 4th International Space Syntax Symposium, London, U.K.

Hillier, B. (1996). *Space is the machine: a configurational theory of architecture*. New York: Cambridge University Press.

Hillier, B., & Penn, A. (1991). Visible Colleges: Structure and Randomness in the Place of Discovery. *Science in Context 4*(1), 23-49.

Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural movement: or, configuration and attraction in urban pedestrian movement. *Environment and Planning B: Planning and Design, 20*, 29-66.

Hillier, B., & Tzortzi, K. (2006). Space Syntax: The Language of Museum Space. In S. Macdonald (Ed.), *A Companion to Museum Studies*. Oxford: Blackwell Pub.

Psarra, S. (2005). Spatial Culture, Way-finding and the Educational Message: the impact of layout on the spatial, social and educational experienced of visitors to museums and galleries. In S. Macleod (Ed.), *Reshaping Museum Space: architecutre, design, exhibitions* (pp. 78-95). New York: Routledge.

Psarra, S., & Grajewski, T. (2000). Architecture, narrative and promenade in Benson+Forsyth's Museum of Scotland. *ARQ: Architectural Research Quarterly, 4*(2), 123-136.

Psarra, S., Wineman, J., Xu, Y., & Kaynar, I. (2007). Tracing the Modern - the Museum of Modern Art in New York and its Latest Expansion, *6th International Space Syntax Symposium*. Istanbul, Turkey.

Shopping Center Development Handbook. (1999).). Washington, D.C.: ULI- Urban Land Institute.

Turner, A. (2003). Analysing the visual dynamics of spatial morphology. *Environment and Planning B: Planning an Design, 30* (657 - 676).

Turner, A. (2004). Depthmap: The Researcher's Handbook. London, UK.: Bartlett School of Graduate Studies, UCL, London.

Turner, A., Doxa, M., O'Sullivan, D., & Penn, A. (2001). From 'isovist' to visibility graph: a methodology for analyzing the architectural space. *Environment and Planning B: Planning an Design, 28*(1), 103-121.

Turner, J., Wineman, J., Psarra, S., Jung, S. K., & Senske, N. (2006). Syntax 2D. Ann Arbor, MI: University of Michigan.