MUSEUM GALLERY LAYOUTS AND THEIR INTERACTIONS WITH EXHIBITION NARRATIVES AND SPACE USE PATTERNS: AN INVESTIGATION OF THE YCBA, THE MOMA AND THE HMA GALLERIES

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Architecture)
in The University of Michigan
2009

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TO MY MOM AND MY HUSBAND

ACKNOWLEDGEMENTS

This dissertation was completed under the supervision of Professor Jean D. Wineman and Associate Professor Sophia Psarra with partial funding provided by Doctoral Studies in Architecture at the University of Michigan. The work reported in Chapter V was completed as a part of a research program in the Doctoral Studies supervised by Sophia Psarra and contributed by Jean D. Wineman.

I would like to express my deep and sincere appreciation to the co-chairs of my doctoral committee, Jean D. Wineman and Sophia Psarra, for their valuable advice and guidance, academic support and encouragement during my doctoral study. My other committee members, Linda N. Groat and Raymond Silverman, have also contributed insightful and critical comments and suggestions.

My special thanks goes to the administrative and curatorial staff at the Yale Center for British Art in New Haven, the Museum of Modern Art in New York (MoMA) and the High Museum of Art in Atlanta for enabling my observational studies in their galleries and for providing me with additional material on their exhibitions.

Finally, I owe much to my family for always believing in me and encouraging me to achieve my goals. My husband, Kurt R. Rohloff, became a role model with his diligence and hard work, and motivated me focus on my academic pursuits. My mother, Ayla Yeralan, whom this dissertation is dedicated, has always been there for me with her generosity and steadfast emotional support.

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ABSTRACT

Museum Gallery Layouts and Their Interactions with Exhibition Narratives and Space-use Patterns: An Investigation of the YCBA, the MoMA and the HMA Galleries

by

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For exhibition installations and museum planning to be effective, it is important to have an understanding of how spatial layouts influence visitors' explorations in gallery space. This study explores the possible effects of gallery layouts on exhibition message and visitors' space-use. Focusing on one gallery floor each in the Yale Center for British Art (New Haven), the Museum of Modern Art (New York City) and the High Museum of Art (Atlanta), this study analyzes how the exhibition narratives is shaped and to what extent space-use patterns are predicted by the gallery layouts.

The gallery layout of each museum is described in terms of permeability and visibility properties using space syntax. These properties are compared and correlated with exhibition narratives and space-use patterns. These correlations account for both top-down and bottom-up characterizations of space to understand the effects of layouts on narratives and space-use patterns, in detail. The space-use patterns analyzed in this study are patterns of exploratory movement, viewing art work and visually scanning the galleries and atria.

This study presents several important findings. First, museum gallery layouts guide visitors' exploration with the most available levels of visual information, whether global level visibility among the galleries or visual access between neighboring locations. Second, at the scale that this information is most available (layout or room scale), these visibility properties facilitate alternative interpretations of the exhibition narratives by revealing visual comparisons, and thus frame the exhibition message based on top-down or bottom up interpretations. Third, display viewing behavior is motivated by popular paintings and conceptually strong narratives in visually isolated locations. Visitors are more engaged with paintings when viewing displays under low level visibility in galleries. In smaller and exposed rooms visitors view displays in conjunction with displays in other rooms. However, larger, more isolated rooms facilitate viewing displays in a contained environment. Fourth, museum gallery layouts also predict scanning behavior when visual information is opened up through atria voids. Finally, in the layouts where information can be captured from a wide array of spaces, visitors engage in explorative, display viewing and scanning behaviors, reflecting synergy among the various space-use patterns. In contrast, these patterns are dissociated in layouts with visually isolated galleries. These findings directly inform the installation of artwork and museum design.

CHAPTER I

INTRODUCTION

1.1 Relationship between Museum Space, Displays and Visitors

In contemporary museum practice, architectural design can help museums define their relationships with visitors. Museum galleries shaped by architectural design and renovations can be used to frame the curatorial message and to offer self-directed explorations for visitors. With the motivation of understanding the role of museum galleries in depth, this study examines how the spatial structure of museum layouts interact with exhibition narratives and visitors' space use patterns.

The intricate relationship among museum galleries, artifacts and visitors has evolved since museums first emerged in the eighteenth century. When European royal families preserved their collections and displayed them for private visitors, an underlying motivation was to impress visitors with their royal possessions (Duncan, 1995). Public museums in nineteenth century Europe still conceived the relationship between viewer and collections as one that intended to impress visitors (Duncan & Wallach, 1980; Bennett, 1995). Thus, the museum visit experience in the nineteenth century was considered akin to a ceremonial ritual, a "contemplative" experience where viewing displays was part of appreciating the represented civilization (Duncan & Wallach, 1980).

Indeed, viewing artifacts in the earliest public museums depended on prescribed viewing sequences, based on how visitors "move through a programmed experience that casts the visitor in the role of an ideal citizen." In this sense, the museum space was where visitors were expected to act in a certain way during their visit in order to appreciate the knowledge of the "civilized past" represented (Duncan & Wallach, 1980, p. 451). This phenomenon is discussed by Bennett (1995) in the context of museums' cultivating role in society: he considered nineteenth century museums as places "where civilized forms of behavior might be learnt and thus diffused more widely through the social body" (Bennett, 1995).

Within this cultivating notion, nineteenth century museums displayed their collections by classifying artifacts and specimens according to the way in which they were studied. The museums were conceived as places as much for research as for spaces diffusing knowledge (Yanni, 1996; Roberts, 1997; Noordegraaf, 2004). These two missions were achieved through specific display techniques such as dense arrays of historically classified artifacts in monumentally scaled museum halls. These display techniques suggested that for museums exposing the collections within their classifications was enough to educate visitors (Noordegraaf, 2004). This consideration implied that the visitor was considered by those museums a mere receiver of the knowledge presented, and therefore visitors were offered a passive relationship with the artifacts exhibited.

By the early twentieth century, techniques for displaying artifacts had changed by taking observers into consideration while forming display strategies. This change was partially explained by the ways in which exhibited artifacts had been studied: science education was now more based on experimentation, and works of art also began to be viewed within temporary exhibitions where curators interpret artworks in various installations in space. This practice with temporary exhibitions motivated early twentieth century museums to install their works of art in gallery rooms that were at a residential scale where various display combinations could be explored conveniently (Noordegraaf, 2004). Another change in display techniques came with modern works of art, which were to be studied and understood in a de-contextualized environment. As a result of this shift, early twentieth century museums favored neutrally colored surfaces of room-scale galleries, placing works of art at eye level and spaciously bringing these works to the visitor's "field of vision" (Staniszewski, 1998; Noordegraaf, 2004; Newhouse, 2005). The Museum of Modern Art in New York, opened to the public in 1929, was a pioneer institution that initiated such changes in display techniques. As evident in MoMA's mission, the museum conceived its galleries as laboratories where works of art are compared, studied and appreciated (Lowry, 1998, 2005). Thus, museums aimed at bringing displays into visitors' direct experience without mediating the relationship between viewer and objects (Staniszewski, 1998). This means that museums refused to present works of art by framing them in their historical or social context; rather, they allowed objects to speak for themselves without background information.

As discussed in the literature, museums during the post-war years showed a stronger tendency towards bringing displays into visitors' direct experience without providing displays' contextual information. Noordegraaf explains that, similar to department stores where the furniture, text panels and a sales clerk who presents products to shoppers disappeared from the scene; in museums, everything that stood between the observer and the museum had to be removed (Noordegraaf, 2004). This strategy in displaying art in fact, overestimated visitors' capabilities, acting as if these visitors would naturally relate to artworks and understand their meaning (Noordegraaf, 2004). Indeed, this display strategy did not address the expectations of a broad group of visitors, and was also quite problematic with respect to achieving educational goals.

Since the 1980s, museums have had a growing need to attract large groups of visitors so as to protect their institutional and financial autonomy and, at the same time, maintain their educational missions[1] (Tilden & Rocheleau, 2004). By pursuing ways to attract visitors, museums have presented displays to be appreciated for their experiential qualities in addition to their

[1] As discussed Roberts (1997), the withdrawal of government funding in 1980s increased the importance of museums' financial autonomy.

significance in art history. Many museums have promoted their collections and facility as a place for "thrill seeking visitors" (Noordegraaf, 2004). This approach can be detected in the contemporary debates on the didactic or entertaining role of museums. To some, it is neither possible nor desirable for contemporary museums to convey a complete historical interpretation of art, primarily because the history of late modern and pre-contemporary art is itself complex with artistic individuality at its core. Accordingly, emphasizing the experiential qualities of works of art in an exhibition – for example, by designating rooms that focus on individual artists with unique styles -- is a reasonable alternative to presenting art within a didactic historical framework (Serota, 1997). On the other hand, some argue that the interpretation and experience of art are inseparable, as understanding art enhances the pleasure of viewing it. In the end, it seems reasonable to conclude that museums can embrace the experience of viewing art while they can also be a medium of interpretation (Berger, 1972; Elderfield, 2004).

Literature exploring the interaction between art and architecture in museums discusses how physical properties of the gallery space, such as shape and size of rooms as well as color, texture, and length of wall surfaces, can influence the perception of works of art (Staniszewski, 1998; Newhouse, 2005). Indeed, these gallery physical properties can be used by curators and exhibit designers to accentuate the meaning of artworks and thus enrich visitors' experience with art in gallery space. On the other hand, as renowned architectural critic Michael Brawne notes, the organization of gallery space and circulation in museum buildings, which create certain viewing sequences, is an essential part of the viewing experience. In other words, for Brawne the museum experience is defined by the order of viewing art along the promenade of galleries (Brawne, 1982). Along with explorations of Newhouse and others, Brawne's discussion points to the key ways in which architectural design can enrich visitors' museum experience by defining the ways in which artworks are exposed to visitors, and thus clarifies the position of this dissertation.

> "…[O]ur experience of an exhibition is nevertheless always some kind of a mosaic built up in our minds as the result of serial viewing; it is after all impossible to comprehend a whole museum or even the exhibits within one space at a glance. This is fundamental to the design of museum and gallery spaces." (Brawne, 1982)

1.2 Problem Statement: the museum experience shaped by architectural design

Museum institutions consider the architecture of their buildings as a part of their institutional presentation. Many museum institutions tend to commission buildings that offer impressive architectural appearance. This approach to museum design, however, overlooks the contributions that a museum building can provide the museum visit experience through museum buildings' interior spatial structure. This study's motivation is to explore how the spatial properties of a gallery layout contribute to the museum visit experience in art museums.

Museum visit experience can be influenced by many factors (such as visitors' individual interests and other activities offered); however, two key factors that will serve as a basis for this study's investigation are exhibition narratives and visitors' space use patterns. For this reason, this study investigates how spatial properties of gallery layouts influence exhibition narratives and predict visitor patterns. This investigation particularly focuses on gallery layouts that are configured by atria and interior partitions, because such layouts often allow multiple routes for visitors' exploration and enrich the experience by visually linking the galleries across space. These attributes of gallery layouts may play a critical role in facilitating the interests of a broad group of visitors to museums.

The central elements of the research investigation are spatial layout properties, exhibition narratives, and visitors' usage patterns. The description of these elements in the context of this research investigation constitutes the framework of this dissertation.

1.2.1 Spatial Structure: Permeability and Visibility Relationships

Spatial structure of a physical layout can be described in terms of a network of permeability and visibility relationships among the spatial units (Hillier & Hanson, 1984; Hillier, 1996). In general, permeability structure refers to the network of spaces through which one moves in a built environment, and permeability property of a space is the relation between that space and other spaces in terms of how one can move from one to another. In museums, gallery partitions determine the permeability structure as they define the gallery rooms where visitors can explore. Visibility structure refers to the network of spaces that can be visible from each other, and visibility property of a space is the relations between that space and other spaces in terms of the extent to which one can see other spaces from a space. In a museum layout, atria voids may enhance visibility throughout the galleries by visually connecting gallery spaces located at distant corners, while openings between gallery partitions also provide visual access to visitors' prospective routes.

In terms of physical layouts, neither permeability nor visibility relationships may be immediately obvious to observers. These relationships remain constant with respect to a peripatetic observer's temporary location; visitors' can grasp permeability relationships when they move through spaces (Psarra, 1997; Psarra & Grajewski, 2000). However, what is visible and what is not varies according to viewers' vantage point, which changes as they move through space, thus making it more difficult to define visibility relationships in space. As these vantage points constantly change along with the spatial experience, visibility is considered a highly dynamic property. Thus, the ways in which visitors grasp layout, move inside galleries, and access exhibition content may be influenced by visibility and permeability relationships.

1.2.2 Exhibition Narratives

A discussion of exhibition narratives requires the basic concept of narrative to be understood. In its simplest definition, a narrative refers to a form of story telling, not the entire content but rather a form through which particular parts of that content are told within a sequence. Thus, the story is only the parts of a content from which the narrative is constructed (Cobley, 2001). Together with the story, a narrative requires other elements such as a storyteller (narrator) and a reader (audience) as well as a sequence (structure) that carries the reader from the beginning to the end. In addition to these elements, a narrative requires a medium through which the audience, or reader, can be reached. This medium can be textual as in forms of literature, visual as in silent movies, or a combination of both as devised by exhibitions (Lotman, 1977; Cobley, 2001).

Although exhibition narratives share common features with other forms of narrative, they are unique in several respects. First of all, elements of exhibition narratives can be artifacts that are collected for their aesthetic, cultural, and ideological values rather than as creations for a specific narrative story. The exhibition narratives are constructed through collective interpretation of a group of artifacts. While becoming a part of the narratives, artifacts, like art, or other iconic objects (e.g. cars and motorcycles), retain their individual significance. Another feature distinguishing exhibition narratives from other forms of narrative is described in terms of audience perspective. In this sense, exhibition narratives are not confined to printed media or the screen; rather, they are presented in galleries with an audience.

In the context of art museums, exhibition narratives are formed by curators in order to convey certain stories or themes derived from certain art historical content represented by museum collections. Initial forms of exhibition narratives can be shaped by curators using concept diagrams. These diagrams describe the exhibition themes and outline the relationships among the themes, which curators intend to represent in galleries. Later, these themes and conceptual relationships are mapped onto space by curators and exhibit designers. This placement is intended to express conceptual relationships using spatial properties while creating viewing sequences for visitors. Thus, exhibition narratives are given final form by curators and exhibit designers through experimenting with various organizations and placements of artifacts in gallery spaces. In forming the narratives, curators and exhibition designers often utilize certain display techniques or strategies. These strategies can be derived from physical and spatial properties of gallery layouts, as in symmetrical, linear or juxtaposing arrangements. Thus, narratives are first conceived according to curatorial intent and then achieve their final forms (spatial narratives) through the organization and installation of gallery displays and through techniques of installation.

As can be understood from this formation of exhibition narratives, spatial layouts are an integral part of structuring exhibition narratives in museum galleries. Therefore, examining how spatial properties of layout relate to arrangement of display objects and to forming exhibition narratives is one of the primary investigations of this study. Considering the role of curatorial teams in formulating these narratives, this study obtains the conceptual structure of narratives through interviews with curators and exhibition designers. However, as exhibition narratives take their final form through organization and placement of artifacts in gallery spaces, this study traces the conceptual structure in the spatial organization of the installation in order to understand narratives more completely.

1.2.3 Visitors' Space Use Patterns

Visitors' patterns in exploring gallery space, viewing exhibitions and grasping the layout can be considered spatial behaviors from which characterizations of the museum visit experience can be inferred. Based on this consideration, this study looks at observable patterns of space-use in order to identify only the spatial components of museum visit experiences.[2] Visitors' observable patterns of space use include movement for navigating through the gallery rooms and locating the works of art displayed, stopping and viewing the works of art, and getting the general "feel" of exhibition and museum settings. In this respect, this study outlines these patterns in three groups: (1) patterns of spatial exploration and (2) patterns of contact with displays and (3)

[2] According to the "place theory" discussed in environmental psychology research by David Canter, Linda Groat and others, "experience" of a space can be understood by exploring what meanings individual users draw from that space based on activities and physical characteristics of space, exploration of which requires detailed surveys beyond observations.

visually scanning of the physical setting. The patterns of spatial exploration are observed in movement paths visitors take to both navigate in the galleries and to follow the viewing sequences. The patterns of contact with displays are identified within the rates of stopping and time spent to view the works of art. Another aspect of the museum experience relates to visually scanning the physical setting which involves visitors' attention to the spatial layout itself. This scan is observed in the patterns of visitors stopping to visually survey the gallery environment in order to retain their orientation, while also taking a restorative break from the routine of viewing.

Previous studies of museum galleries suggest that the ways in which visitors move through layouts to make contact with exhibits and gallery spaces are related to the overall structure of visibility and permeability of these layouts (Choi, 1991, 1999; Peponis, Dalton, Wineman, & Dalton, 2004; Psarra, 2005; Psarra, Wineman, Xu, & Kaynar, 2007; Wineman & Peponis, 2009). This dissertation attempts to explore this particular issue through a detailed examination of how spatial exploration as a whole relates to global spatial properties, and how spatial exploration on a step-by-step basis is influenced by local spatial characteristics.

1.3 Research Questions and Objectives

Previous research in museum studies has demonstrated that visitor circulation and orientation can be greatly influenced by physical space (Melton, 1972; Parsons & Loomis, 1973; Peart, 1984; Bitgood & Patterson, 1993; Bitgood & Lankford, 1995; Bitgood, 2006). Studies in architecture have furthered these explorations demonstrating that space-use patterns can be predicted by spatial properties of gallery layouts, including both permeability and visibility relationships (Choi, 1999; Peponis et al., 2004; Psarra, 2005; Psarra et al., 2007; Wineman & Peponis, 2009). Most of these studies demonstrate that museum gallery layouts may influence both aggregate movement and stopping behavior through their global spatial structures; in other words, the prediction of space-use patterns are explained on the basis of top-down characterization of space.

Previous studies in architecture have also discussed how spatial layout properties would potentially shape the presentation of exhibition content (Peponis & Hedin, 1982; Pradinuk, 1986; Psarra & Grajewski, 2000; Stavroulaki & Peponis, 2003; Tzortzi, 2003, 2004; Psarra, 2005; Tzortzi, 2005; Psarra, 2006; Tzortzi, 2007). These studies also explored how the exhibition message can be shaped using overall spatial properties of gallery layouts, and only a few studies looked at how exhibition messages can also be formed by local spatial characteristics and how their narratives interact with space-use patterns.

The primary question we explore in this dissertation is how museum gallery layouts interact with exhibition narratives and visitor space-use patterns. Although this question was also investigated by previous studies, in this study we take a slightly different approach to the problem of understanding the effects of gallery layouts on space-use patterns and exhibition narratives. This study considers the fact that an observer actually understands the gallery layouts through gradually unfolding information, as well as through local visual cues. Therefore, the underlying hypothesis of our investigation is that by exploring the effects of morphological properties based upon both top-down and bottom-up characterizations of space, the interactions among the gallery layouts, exhibition narratives and space-use patterns can be understood in greater depth.

The research investigation is formulated around this primary question concerning the ways in which museum layouts interact with exhibition narratives and space-use patterns. This study describes museum gallery layouts through visibility properties because these properties reflect not only the spatial structures but also morphological characteristics of the gallery layouts. To investigate this primary question, this study will answer a series of related questions: (1) how visibility properties can potentially shape the exhibition narrative in terms of the ways in which the content is presented (i.e. didactically or not) and (2) to what extent visibility properties predict space-use patterns.

To investigate the first research question, this dissertation examines how visibility relationships described at both global and local levels relate to exhibition narratives, and explores how gallery layouts can either work in concert with intended narratives or generate new interpretations. To investigate the second research question concerning space-use, this study analyzes the effects of visibility properties on space-use patterns at both local and global levels. This dissertation evaluates the results obtained from the first two investigations and seeks to explain the role of morphology in shaping a museum visit experience as described by interactions among spatial layouts, exhibition narratives and visitor space-use patterns. By understanding these potentials of layout in relation to morphological characteristics, the core of this dissertation provides an in-depth explanation of how gallery layouts work to shape a museum visit as described by exhibition narratives and space-use patterns and the interactions between the two.

Within this framework, this study focuses on certain types of morphology in art museum gallery layouts that are characterized by configuration of interior partitions and atria; further, it addresses the primary research questions through an examination of three museums selected for a case study.

1.4 Methodology and Research Design: Case Study Strategy

This study investigated the aforementioned research questions by combining the case study strategy with qualitative and correlation research strategies. For the case study research, three art museums are selected: the Yale Center for British Art (1977) in New Haven, CT designed by Louis I. Kahn; the Museum of Modern Art (the new expansion, 2004) in New York designed by Yoshio Taniguchi; and the original building of the High Museum of Art, Atlanta, (1982, 2004) in Atlanta, GA designed by Richard Meier and its extension wing designed by Renzo Piano. These three museums share morphological characteristics such as atria space and room configuration that establish visual connections and routes of navigation.

To investigate the research questions, the curatorial intent and exhibition narratives are qualitative and compiled through open-ended interviews with each museum's curatorial team, and research on the particular museum publications and other scholarly sources. The spatial descriptions of the main gallery layouts are obtained through spatial analyses of the gallery layouts using space syntax theory and methodology. The data of visitors' space-use patterns are collected through an observation study that tracks and times visitor patterns. This is because this study's interest is the observable patterns of space-use that can be used to infer visitors' spatial experience, rather than understanding visitors' quality of experience through their responses to space.

This study conducts all of these investigations individually for each museum, with the aim of understanding the capacity of each gallery layout to shape exhibition narratives and to predict space-use patterns within its morphological characteristics. The results obtained from each museum are cross compared in order to determine the continuum and variations among the case studies.

1.5 General Outline and Summary

The dissertation carries out these investigations in eight chapters: following this introductory chapter, Chapter II presents the studies in the fields of environmental behavior and architectural design that inform this dissertation, Chapter III explains the methodology utilized in this study. Chapters IV, V, and VI presents an in-depth analysis of the case study museums, Chapter VII discusses the results obtained from these analyses comparatively, and finally Chapter VIII summarizes the key results and outlines the contributions of this study in relation to the fields of architectural design and museum studies.

In particular, Chapter II reviews prior research in order to set this study within an existing context of museum layout analysis of exhibition narratives and visitor behavior. This chapter is structured in three parts. The first part presents explorations on how exhibition narratives can be shaped using spatial aspects of galleries. This part also provides a brief review of space syntax theory as theoretical and methodological background of previous research as well as for this dissertation. The second part reviews the studies that analyze influences of gallery environments on visitor behavior. The studies that analyze the effect of galleries on visitor behavior in the field of environmental psychology have confirmed that gallery spatial arrangements have an effect on visitor behavior. Other studies analyzing visitor behavior using space syntax methodology in the field of architecture have explained visitor space-use patterns in terms of syntactical properties of spatial layouts. This chapter indicates that in contrast to museum studies that focus on how layout influences behavior patterns at the gallery room level, studies using space syntax argue that it is also the global spatial characteristics that have an effect on how visitors move through museums, locate the exhibitions and grasp the exhibition content (Choi, 1991, 1999; Psarra & Grajewski, 2000; Peponis et al., 2004; Psarra, 2005; Psarra et al., 2007; Wineman & Peponis, 2009). The third part of this chapter discusses the recent studies that further spatial analysis techniques, and identifies the contributions made by the previous studies while raising issues that need further development.

Chapter III introduces the general methodology of this dissertation as a case study strategy by combining correlation and qualitative research techniques. Following a brief introduction of each museum, it explains the rationale of selecting illustrative museums for case studies, the YCBA, the MoMA and the HMA. Following this part, the chapter explains the techniques used to analyze spatial layout properties and to collect the empirical data in the case studies. Finally, the steps followed to compare and correlate spatial layout properties with the collected data are outlined and detailed. The final part of this chapter presents the methods used to evaluate the case study analysis results cross-comparatively and in relation to morphological characteristics.

Chapter IV, V and VI presents the in-depth analyses of the YCBA, the MoMA and the HMA following the methodology described in Chapter III.

Chapter IV discusses the main questions raised by this study on the basis of the research findings in the analysis of the YCBA's fourth floor galleries. This chapter argues that the YCBA's gallery layout is visually highly integrated through the main atria spaces, which establish a rich pattern of interconnections among galleries and throughout atria spaces. The strong impact of the museum's layout at a global level visibility offers opportunities for comparing displays across distance; this introduces yet another layer beyond scholarly interpretation to read these narratives across interior distances. The comparison of spatial properties with movement patterns showed a strong correlation between global spatial characteristics and movement, suggesting that visitors gravitate towards the most integrated spaces arranged around the atria. This means they are likely to notice alternative relationships among the displays through the effect of visual juxtapositions, and to make contact with the displays in the most integrated locations. The explorative movement of viewing displays and scanning the gallery space and exhibits seems to be predicted by similar elements of both global and local level visibility. Thus, explorative behavior, viewing displays and scanning behavior are synergized and to some extent determined by the gallery layout.

Chapter V discusses the findings obtained from addressing the research questions in the MoMA's fourth floor galleries. The chapter suggests that while the gallery layout is utilized to present a highly structured and scholarly narrative on the late modern and pre-contemporary art, various interconnectivities among the south galleries present contrasting and reactionary developments of the art movements. On the MoMA's fourth floor, visibility relationships are structured mostly through local level connectivity between the gallery rooms, yet fewer openings to the atrium space and limited connections between the rooms concentrates the global visibility in the south galleries rather than distributing it to the entire gallery environment. The gallery layout guides visitors through visibility of neighboring locations, which facilitates a sequential reading of complex relationships between the chronologically related art movements in the narrative. On the other hand, the absence of global visibility and popular paintings motivates the behavior of viewing displays in visually segregated galleries, although these galleries are less frequently visited. In fact, most galleries are distanced from the global structure of visibility, and thus the opportunity to obtain a large-scale view and to experience the architecture is offered by few spaces. In these spaces, visitors tend to focus on viewing the atrium rather than displays. These suggest that the MoMA's layout dissociates the explorative behavior from the behavior of viewing displays and experiencing the architecture. The dissociation between viewing displays and experiencing the architecture thus promotes the architecture of the building as an independent entity in the museum visit experience.

Chapter VI interprets the results obtained from analyzing the HMA's fourth floor (skyway) galleries on the basis of the research questions. The layout presents a narrative on American modern, self-taught and contemporary art within a structured installation. The spatial analysis suggests that the bi-partite layout of this museum concentrates the highest values of local and global visibility on the main circulation spine connecting the two gallery wings. While larger and more visually connected gallery rooms are located around the central spine, smaller and more segregated gallery rooms are located at the peripheral locations in both wings. Thus, rich opportunities of visual juxtaposition at a local level and global level are available around the central spine and thus layout provides the potential for new interpretations at that area where the display groups of American modern, self-taught and contemporary art intersect. The layout predicts explorative movement through both local and global visibility although the effect of local visibility on movement is stronger. The prediction of movement by local level visibility motivates visitors to recognize visual juxtapositions and thus the alternative connections between the display groups at the local level. The absence of global visibility information at the periphery of the gallery space motivates visitors to view displays and thus creates an opportunity to focus separately on narratives of American modern, self-taught and contemporary art. At the central locations, visitors can recognize the possible dialogues among these groups through explorative movement motivated by available global and local visibility. With these potentials, the HMA layout dissociates explorative behavior from focused viewing of displays, as this is affected by differences between central and peripheral locations in terms of availability of visual information.

Chapter VII analyzes the museum layouts comparatively and discusses the morphological characteristics that shape exhibition narratives and space-use patterns in the three museums. Accordingly, the YCBA and the MoMA gallery layouts are most distinct from each other in terms of predicting space-use patterns. In the YCBA, the centrally located and generously open atria spaces bring the potential to generate alternative readings of exhibition narrative, and explain the synergism among various space-use patterns. Whereas, MoMA's poorly connected atrium and gallery spaces, as well as local level connections between the galleries presents the highly structured narrative mostly as intended, and brings a spatial experience where displays and space are read through sequentially unfolding information; as a result space-use patterns become dissociated from each other. The MoMA and the HMA are comparable in terms of their architectural potential to dissociate the explorative behavior from viewing displays that can be explained by the absence of global visibility levels in the peripheral locations.

Chapter VIII summarizes the conclusions drawn from the comparative analysis of the case studies. Most importantly, the museum layouts are found to predict visitor spatial exploration patterns through the best available levels of visual information. Second, the layouts also motivate exploration patterns through each museum's hidden regions as well as its directly visible surfaces. This conclusion implies the role of sequentially unfolding information to modulate movement. Third, the lack of visual information in galleries creates potential for visitors to focus on displays. Additionally, the smaller gallery size plays a role in viewing displays by maintaining interest in the information beyond the visited galleries. As can be understood by these conclusions, we see that the layouts that have visually isolated and segregated galleries have a potential to dissociate patterns of exploration and viewing displays. Fourth, we show that the behavior of visually scanning the gallery environment is motivated where visual information of an entire space is available. Based on these conclusions, the final chapter argues that a key property in museum gallery layout to synergize patterns of exploration, viewing displays and scanning the gallery environment is the capacity to release visual information from central to peripheral locations. Another key property is that the room partitions allowing visitors to maintain contact with the information beyond the visited gallery rooms. The size of the gallery rooms is also considered one of the factors that may modulate visitor patterns of exploring and viewing displays through visibility at a local scale. Based on these conclusions, the final chapter discusses how the key objectives of art museum building design, such as providing good legibility and motivating focused viewing, can be enhanced through morphology. This chapter concludes with recommendations aimed at informing architectural design of museum buildings.

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CHAPTER II

STUDIES IN ARCHITECTURE AND MUSEUMS FIELDS

2.1 Chapter Overview

This chapter reviews prior research that informs this dissertation. The first part discusses studies exploring interactions between exhibition narratives and gallery environments as well as briefly reviews relevant work on space syntax theory. The second part focuses on studies in the fields of environmental psychology and architecture that analyze visitor behavior and the influence of gallery environments on that behavior. Finally, the chapter discusses recent studies that contributed to the spatial analysis techniques used in the extant study, and briefly discusses areas that need further development.

2.2 Displays and Exhibitions in Museum Gallery Layouts

In museum buildings, exhibitions interact with the physical environment of the gallery to differing extents, depending on how display groups are placed in the space and how independent this placement is from the room properties. Some of the physical properties of a gallery space are inevitably incorporated into the layout of displays. The ways in which spatial properties of gallery environments and building design influence display layout have been the focus of a number of studies in museums field. Studies of techniques for incorporating existing spatial structure of galleries with display layouts have also been undertaken in architecture. This section reviews these studies from museums and architecture fields to explore the ways in which museum gallery layouts can form exhibitions.

2.2.1 Exhibition and Display Strategies in Contemporary Museums

A number of studies in the museums literature have examined various experiments and explorations in exhibition techniques that have been implemented in twentieth century museums. A review of these studies shows that in applying exhibition techniques, curatorial teams often utilize physical properties of gallery environments, and thus shape the tone and manner through which exhibition content is presented to visitors.

Focusing on twentieth century museums, these studies suggest that display strategies introduced by modern art museums in early twentieth century, particularly by the MoMA, have marked a radical change from the display techniques used in the nineteenth century. Unlike the nineteenth century's densely arrayed displays in monumentally scaled rooms, early twentieth century museums installed exhibitions in rooms of residential scale and placed works of art spaciously and at eye level on neutrally colored walls. These strategies, which have fundamentally defined the contemporary ways in which works of art are exhibited in the gallery space (Staniszewski, 1998; Noordegraaf, 2004), were motivated by two factors derived from the nature of modern works of art. First is the belief that modern works of art can be understood independently of historical context. Second is the notion that the formal and artistic explorations in the modern works of art can be studied within their various arrangements and combinations in a gallery space. Indeed, this exhibition approach was implicit in the MoMA's original mission, stating that modern works of art can be best understood, studied and appreciated through their combinations in a "laboratory like" environment that promotes understanding contemporary art through experimenting with various arrangements of works of art [3] (Lowry, 1998; Elderfield, 2004; Lowry, 2005). With regard to presenting art independently of the context, Noordegraf and others suggest that displaying works of art against a backdrop of neutrally colored walls and in

[3] The analogy to a "laboratory" in the MoMA's original mission and Elderfield's discussion implies that the MoMA's galleries works like a laboratory environment promoting the study of contemporary art through experimenting various exhibition arrangements.

small-scale rectilinear gallery rooms de-contextualized the art from its historical and political contexts (Noordegraaf, 2004).

MoMA's approach to exhibiting art has subsequently influenced many other art museums in the early twentieth century and later periods. In addition to this influence, twentieth century experimentation with display strategies can be best understood by reviewing the broader agenda of exhibiting art. As Serota argues, art museums today (including the MoMA) no longer try to exhibit art within its interpretations based on historical classifications of school and period. He relates this phenomenon to the fact that it is neither realistic nor desirable for museums today to present an encyclopedic overview of works of art (Serota, 1997). He suggests that this is partially because the history of twentieth century art is replete with individualized styles and thus it is too complex to be presented in a gallery space. Serota further maintains that an alternative way of displaying art today involves promoting experiential qualities of the art rather than merely interpreting it within a historical analysis. He explains that grouping works of art based on artists' individual style prioritizes the experience with their art over its chronological interpretation. This is because a focus on artists' styles downplays the importance of the historical story line and thus allows visitors to appreciate the unique qualities of the art of the individual artist. Serota further remarks that displaying the works of art on the basis of experiential qualities has essentially become a norm in art museums today and thus, the didactic purpose of these museums has departed from its high minded and encyclopedic definition (Serota, 1997). A different perspective to this view is offered by MoMA's chief curator, Elderfield, who suggests that understanding and enjoying art are in fact inseparable (Elderfield, 2004). This view suggests that while knowing the historical significance of the collection may enhance the enjoyment, presenting works of art with experiential qualities can also offer an interpretation. One can argue that this phenomenon most directly applies to modern works of art because their artistic qualities are defined by explorations in form and material used to represent content, which can be read through experiencing these qualities comparatively.

As exhibitions have promoted works of art through their experiential qualities, physical properties of gallery space have gained more prominent roles in exhibiting art. To understand this better, it is worth reviewing some cases showing how physical properties of gallery environments can inform the exhibition of art. Newhouse, for example, examines how physical characteristics of gallery space may influence the meaning conveyed in the exhibitions. Through exhibition case studies, Newhouse discusses how the size and shape of the gallery rooms as well as the color, texture and length of the gallery walls can influence the perception of works of art and thus accentuate the message conveyed. In one of the examples she discussed, the exhibition message seems to have been conveyed more clearly when curators used noticeably divided and color-coded spaces to refer to that exhibition's original installation. However, a different version of the same exhibition apparently did not convey a clear message when it was installed in ambiguously divided rooms and their neutrally and homogeneously colored walls. In some other examples, Newhouse also discusses how installing artworks on the walls with a certain length and in a certain position can emphasize the key themes represented by those works. She suggests that displaying the works of art on long walls reduces their singular importance, but allows for interpretations those works in the context defined by other works on the same wall. In addition to these observations, she points out that the elongated shape of galleries is more conducive for a promenade and offers visitors a less stationary experience or reading of the exhibition (Newhouse, 2005).

Aside from the shape and geometry of the gallery rooms and walls, Newhouse also shows that other works of art displayed in a gallery can define the context where each work of art gains its meaning in the gallery space. This view relates to a point recently made by Penn et al. (2007) in their study on exhibition experiences. They suggest a work of art can be understood within the context of what has already been seen immediately before what is currently the focus of attention (Penn, Martinez, & Lemlij, 2007, p. 11). Newhouse elaborates this in her discussion by reviewing various ways that pieces of art can be combined and juxtaposed and discusses how these juxtapositions can influence the perception of each art object and thus shape the narrative. She describes how the works of art to be placed in the same gallery can be grouped on the basis of various aspects such as subject matter, chronology, and formal properties of the works of art. Newhouse suggests that chronology, the most conventional method of organization, has an advantage of putting together works of similar sensibility that tend to reinforce one another and highlight artistic developments of different periods (Newhouse, 2005). Another method of organization is to juxtapose the works on the basis of parallels in their subject matter and composition. As Newhouse clarifies, juxtaposing seemingly and conventionally unrelated works of art, such as a painted piece and a mass-produced photograph depicting similar content, may mask the insufficiencies of the collection and provide access to pieces that may otherwise not be displayed. Similarly, the works of art could be displayed on the basis of their genre, such as landscapes or portraits, which may even bring artworks from different periods together (Newhouse, 2005). Parallel to these strategies, Staniszewski describes grouping works of art on the basis of visual and formal affinities as one way of organizing displays, as in the "Timeless Aspects of Modern Art" (1949) exhibition of the MoMA, which brought together ancient artifacts and modern works of art on the basis of their affinities (Staniszewski, 1998). Yet, Staniszewski notes that in such exhibitions formal and visual affinities might look too straightforward to pinpoint the scholarly interpreted meanings of artwork.

The display strategies used in early twentieth century museums have also redefined the viewer's position in relation to exhibition content. Some have argued that modern display techniques pioneered by the MoMA have facilitated the viewer's direct contact with artwork in a "laboratory" type setting. Such display techniques consider the viewer as an active element of the display setting and as an individual who can study and appreciate the works of art in the gallery space at his/her own will (Staniszewski, 1998; Noordegraaf, 2004). As Staniszewski suggested, museums like the MoMA have experimented with various techniques, one of which is the implementation of free standing (L and T-shape) partitions in the gallery space that provide the viewer with an opportunity to explore art in a variety of paths that can be taken in the gallery space rather than following the permanent walls only. Another technique that Stanizsewski discusses is the installation of works of art on tilted and adjustable panels so that displays can be adapted to the viewers' "field of vision" (Staniszewski, 1998). Additionally, MoMA's temporary exhibitions of modern art styles have mimicked the formal and aesthetic manifestations of those styles, for example by providing adjustable devices for exhibiting Futurism and Constructivism which manifest dynamism, or by designing the gallery environment as a dream-like environment for exhibitions of Surrealist art, which focuses on subconscious mind. These examples show that in addition to considering viewers as active participants of the gallery setting, display techniques and exhibit design can also be considered as an art itself.

Other display techniques the MoMA has experimented with in the early years of its history have explored various extents to which the viewer can gain control over what to see and how to interpret the exhibition message. Stanizsewski argues that a museum's institutional political agenda can affect how it frames the viewers' experience with displays. For example, in some of the temporary exhibitions of the MoMA (installed during the World War II years) viewers were given the least control over their viewing sequence and interpretation, as these exhibitions were propagandistic in nature aiming to manifest certain ideals and messages. To convey this message these exhibitions utilized oversized panels and were placed mostly in prescribed routes for viewing sequence, and thus dominated vision and visitors' experience in the gallery space. Staniszewski, however, also points out that after World War II the MoMA's permanent exhibitions adopted a seemingly more neutral position to presenting art, where the aesthetic combinations and juxtapositions were the primary context for viewers to understand the art -- quite a departure from the museum's propagandistic style in the war period. In the post-war period and in 1970s, the MoMA installation of works of art based on purely aesthetic concerns, and within neutral and transparent conceptual frameworks, gave the works of art meaning within combinations of other work. Stanizsewski views this manner of exhibiting art as "staging institutional invisibility" where the museum has disavowed an institutional responsibility for how exhibition design functions to manifest social and political concerns (Staniszewski, 1998, p. 350).

As a part of this approach to exhibiting art in the twentieth century, some art museums, including the MoMA, have provided little contextual information on labels and kept the explanations brief to allow the art to speak to viewers. Some argue that this approach implies that museum space is more for artists and educated visitors than for novice viewers (Newhouse, 2005). However, beginning in the 1980s the museums have deviated from this approach due to their changing roles in society that required greater emphasis on educational missions of museums (Roberts, 1997). As a result of this, new emphasis museums began showing some interest in empirical studies analyzing visitor behavior and measuring exhibit effectiveness, in order to understand visitors' learning behavior and better address visitor expectations.

As the discussions of display strategies suggests, the ways in which art collections are interpreted and presented has drastically changed over the course of the twentieth century, parallel to the transformations in museums' institutional goals and missions. These changes emerged when traditional and preservation oriented display techniques were abandoned in the early twentieth century. As the interpretation and presentation of art became more based upon the aesthetic and experiential qualities of works of art, the interactions between the viewer and the artworks became more directly influenced by the ways in which works of art are installed in the gallery space. This led to the conception of gallery space as part of the viewing and experiencing of art. Therefore, the discussions of display strategies in the twentieth century provide a basis for understanding why and how the gallery space may matter in the presentation of exhibition content to visitors. Thus, these discussions reinforce the significance of this dissertation focusing on the effect of gallery layouts in shaping the exhibition narratives.

2.2.2 Space Syntax Theory and Methodology

In the field of architecture, a number of studies have examined the ways in which gallery layouts can be used to shape exhibition narratives and thus have focused on the potential provided by architectural design. These studies in architecture have, for instance, analyzed the interactions between gallery layout and the narratives from the perspective of space syntax theory, which interprets layouts in terms of spatial relationships among its units. The studies have employed space syntax methodology primarily to obtain descriptions of gallery layouts so as to trace their role in shaping the narratives. Before reviewing these studies, this section will first review space syntax theory in order to illuminate the theoretical framework.

Beginning in the 1970's, architectural research sought a new theoretical and methodological approach to the theory of architectural design. This new approach had to leave stylistic concerns aside and pursue questions concerning the interaction between people and their physical settings. One of the questions with which architectural research has been concerned is how to understand the interaction between man and the environment and to develop a definition of an environmental setting that would influence users (Hillier & Leaman, 1973). Previously, the interaction between man and the environment could not be substantially explained by philosophical and sociological theories, on which architectural theory had long relied. These older theories attempted to explain the interaction between 'man' and the 'environment' from the point of either 'man' or the 'environment.' For instance, the rationalist and the empiricist theories in philosophy proposed a profile of a 'subject' as an organism characterized by 'object inputs' gained from physical environments (Hillier, Musgove, & O'Sullivan, 1972; Hillier & Leaman, 1973) Likewise, sociological theories attempted to explain man's behavior in terms of an individual’s free will or of their positions in the society (i.e. Weber), or defined the individual as determined and positioned by the mechanism of society (i.e. Durkheim). However, neither of these views could define the relation between ‘man’ and the ‘environment’ within the pervasive complexity of individuals and their environmental context (Hillier & Leaman, 1973).

Pursuing a man and environment paradigm in the body of architectural research, Hillier and Leaman (1973) introduced a rigorous framework derived from Jean Piaget’s “interactivist” and “constructivist” approach. Piaget formulated “the riddle of how far ‘knowledge’ originates in the subject and how far in its environment” (Hillier & Leaman, 1973, pp. 508-509). He established a man and environment relation that is neither from the point of ‘man’ nor the ‘environment,’ but from the point of interactions between them, arguing that knowledge is determined by the exchanges between the two. By shifting the focus towards the interactions between man and the environment, he placed an emphasis on the subject’s constructive activity. The cognitive construction in a subject’s mind is illustrated by an analogy to how a child learns language by constructing its knowledge over time of what in fact already exists. In this analogy, language is accepted as a system that exists with its own structures and elements and environment is resembled to a language.

Another important point of the new man environment paradigm introduced by Piaget was the emancipation of the concept of space from “formal considerations” and its redefinition in terms of topological relations. Within this perspective a logical definition of space, therefore, is created by systems of signs, symbols and representations (Hillier & Leaman, 1973, p. 510). Hillier and Leaman (1973) suggested that “destroying space at a paradigmatic level” enabled architecture to be described within the methods of applied science, in particular, methods of structuralism in mathematics, such as algebra and graphs (Hillier et al., 1972; Hillier & Leaman, 1973, p. 510). Beginning from the mid-seventies, this new conception of space allowed built forms to be described quantitatively and to be represented by graphs. The graph theoretic representation was explored due to its potential as an architectural design tool that could reproduce derivations of morphology (Steadman, 1976, p. 103). These attempts provided a basis for the emergence of the space syntax methodology (Hillier, Leaman, Stansall, & Bedford, 1976), applications of which have been later modified with computational analysis techniques. Space syntax theory and applications became widely known with the publication of *Social Logic of Space* where the theoretical and methodological frameworks of space syntax were first introduced (Hillier & Leaman, 1974; Hillier et al., 1976; Hillier & Hanson, 1984).

The methodology of space syntax conceives of buildings as systems of configurations that consist of spatial units and their local and global relationships. Accordingly, buildings can be represented as configurations of nodes corresponding to spatial units and 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 networks (Figs. 2.1 and 2.2). In the graphs representing configurations in terms of nodes and links, nodes refer to spaces characterized by occupation, and links refer to permeability (or visibility) among the nodes. On the basis of its position in a configuration, a node might be in a dead-end position within an entire system of links, or on a pathway to or from other nodes, or can be linked to more than one node and thus be part of a loop (Hillier, 1996). In space syntax methodology, these topological relationships in configurations provide a means for representing patterns of use and social meaning in built environments.

Space syntax methodology proposes that topological relationships be depicted using a number of measures describing local level and global level relationships among the units. Local level relations refer to each spatial unit's relationship with its neighboring units, while global level relations refer to each spatial unit's relationship with all other units in the entire configuration. To describe local level relations, one of the most fundamental measures that space syntax methodology uses is "connectivity". This measure refers to the degree to which a spatial unit is connected to its neighborhood; in other words it describes to how many other spatial units are directly accessible from that unit. The units that are directly accessible from many other units are considered highly connected. To describe global level relations, most fundamentally space syntax uses a measure called "integration". The integration is the degree to which it is necessary to pass through intervening spaces to arrive at that particular unit (Hillier & Hanson, 1984, p. 108). The units that are accessible from other units by crossing the fewest possible numbers of spaces are considered highly integrated. Using these local and global level measures, space syntax methodology analyzes human spatial activity, and suggests that global spatial properties, such as integration property of layouts may have an impact on human spatial activity. More specifically, the studies using space syntax methodology demonstrate that patterns of human spatial activity are drawn to highly integrated locations (Hillier & Tzortzi, 2006).[4]

By analyzing human spatial activity in built environments, space syntax methodology interprets the interaction between space and human activity in two ways: (1) spatial layouts may either *reflect* existing social structures, or (2) *generate* new structures in society (Hillier & Hanson, 1984; Hillier, 1996, 2005). In the former case, a spatial layout can reflect or embody a culturally or programmatically given pattern of usage, such as layouts of vernacular houses or a courthouse. In such layouts, potential movement through spatial units is determined by existing social structures, because these structures (i.e. the pattern of interaction among social groups) are embodied in the spatial layout. For instance, in a courthouse the layout is designed to operate with the functional program, and thus the relationships between the spaces and the patterns of usage afforded by these relationships are predetermined before the spatial layout is even conceived. As a result, in such buildings 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

[4] The more technical explanation of space syntax analysis methods and the devised measures are discussed in more detail in the Methodology chapter. In addition, studies in architectural design using space syntax methodology are reviewed in the upcoming sections of Chapter II. A short introduction of the fundamental measures used in space syntax and proposed argument on how human spatial activity is predicted in layouts are provided here as a reference to terminology used in the review of space syntax studies.

configuration where the usage patterns are not predetermined by a culturally given structure or a building program. For example, office buildings may be designed for a more flexible usage, and may not impose a strict usage pattern. In such buildings, the relationships among the spaces arise from the way in which the spatial layout interprets the program. Within this framework, Hillier distinguishes settings that reflect existing social structures from settings that generate new encounters. He designates the former as a "strong program" and latter as a "weak program", which corresponds to *reproductive* versus *generative* layouts accordingly (Hillier & Penn, 1991, p. 30).

In the context of Hillier's theoretical framework, museum buildings may be considered as either a "strong program" or a "weak program" setting, depending on the degree to which their spatial layouts reflect the knowledge structure of the display content. If the spatial layout is a one to one representation of the exhibition content, and the narrative is constructed within a fixed viewing sequence, one can argue that the potential movement is determined by the program, as in a strong program setting. Conversely, if the exhibition content is presented within the potential interpretations of the content knowledge, within multiple viewing sequences, the spatial layout would be characterized as a weak program setting, and the potential movement may be predominantly predicted by the spatial layout. In such settings, the spatial layout may motivate new explorations in the narratives, and this may exemplify a spatial structure that generates new structures, as discussed Hillier's theoretical framework. Therefore, space syntax theory and, in particular, Hillier's distinction of strong and weak program (that corresponds to conservative and generative mode layouts) provide a framework for the extant study to analyze the degree to which a spatial layout can frame exhibition content and how this content is explored by visitors in architectural space.

2.2.3 Studies on the Spatial Mapping of Content and Narratives

As discussed above, exhibition content forms the museum buildings' functional program. This is because the space usage is planned around the ways in which exhibition content can be viewed and experienced. Indeed, the functional program of a building refers to the assignment of content and use. Specifically, as discussed by Markus (1987, 1993) and Pradinuk (1984), programming in architecture is most commonly performed by classifying what a space is supposed to contain and by whom it is supposed to be used (e.g. inhabitants vs. visitors). Among various building types such as prisons, libraries, and hospitals discussed by Markus, museums are a type of a built environment where a classifying notion is central to architectural programming and design. To illustrate, a museum building not only distinguishes some spaces to be used by visitors from those to be used by an administrative department, but also classifies spaces for artifact storage and artifact display. In the spaces displaying artifacts, another layer of classification can be introduced by the thematic arrangement of artifacts. The grouping of museum artifacts, as a task of dividing objects according to classes and placing them into the spatial units, can be considered a type of spatial mapping of the content that those artifacts represent. In art museums, works of art may be grouped by school, historical period, mode of production, or material origin, and then placed into separate galleries (Markus, 1987, p. 468). This task is the essential component of shaping exhibition narratives in museum space, since it implements the underlying disciplinary knowledge of exhibition content, and then structures a narrative out of this content.

Pointing to the classification of artifacts in museum layouts, Pradinuk (1986) has explained how museum layouts can provide a spatial structure that underlies a pedagogic presentation of the exhibition content by applying the concepts of "classification" and "framing" devised by Basil Bernstein. Previously, Bernstein (1975) used these concepts to analyze how an educational message is conveyed. In his analysis, the concept of "classification" refers to the identification of the themes in exhibition content. This means that when classification is strong, the themes are well insulated from each other by strong boundaries; where classification is weak, there is reduced insulation between the themes, resulting from blurred boundaries between those themes (Bernstein, 1975, p. 88). The concept of "framing", on the other hand, refers to strength of boundaries between what may and may not be transmitted. Bernstein explains this concept further by referring to a "range of options available to teacher and taught in the manner of controlling what is transmitted and received" (Bernstein, 1975, pp. 88-89). In a more concrete explanation derived from the context of classroom pedagogy, Bernstein argued, that "strong frames reduce the power of the pupil (receiver) over what, when and how he receives knowledge, and increases the teacher's power in the pedagogical relationship" (Bernstein, 1975, p. 90). From this definition, it can be understood that weak framing refers to pedagogy where the receiver has some control over what can be conveyed to him/her. The result is a kind of pedagogy that can be considered less didactic.

In Pradinuk's 1986 study, "classification" and "framing" were discussed within the spatial references that could apply to room or display arrangements as well as viewing sequences in art museum galleries. For him, physical boundaries between gallery rooms implied classification in exhibition content. Accordingly, physically and visually separated rooms provide a structure for presenting the content[5] within a strong classification, whereas the galleries with less salient boundaries, for example rooms with wider openings between them, weakly emphasize the categories assigned to those rooms (Pradinuk, 1986). In Pradinuk's thesis, "framing" in exhibition content refers to the degree to which viewing sequences are structured, in other words, the degree to which visitors may have control or choice over how the content can be read. In this understanding a gallery layout that allows only one possible sequence for viewing the works of art offers strong framing. In such layouts the interpretation of the exhibition content is limited to

[5] Here, Pradinuk considers that content might be structured within a space, instead of a narrative that might be conceptually organized independently of a space.

what the curator intended to present, and thus these gallery layouts may potentially result in a didactic presentation of the content. Layouts with more than one possible viewing sequence could present knowledge in a less structured manner by allowing for the visitors' own interpretations. In Pradinuk's terms, such layouts provide a weak framing of the exhibition content, and thus embody a less didactic approach in presenting the content.

Within this framework, Pradinuk comparatively analyzed several art gallery schemes and explored their spatial characteristics that provide varying degrees of classification and framing in presenting content. In Pradinuk's analysis, the Castelvecchio Museum (Verona, Italy) is characterized by "strong classification" and "strong framing" because the layout has a series of rooms that are clearly separated by walls (with limited openings) and the entire layout must be navigated by a single route that mandates a single viewing sequence (Fig.2.1).[6] Unlike the Castelvecchio Museum, the Pompidou Center's (Paris, France) gallery layout (Fig 2.3) represents a weak classification and weak framing, given its open plan arrangement that suggests visual connections between categories and promotes multiple navigation routes. An example of weak classification and strong framing, the Glypthothek museum layout (Munich, Germany) has a series of rooms connected with quite broad gateways on a central axis, which can be navigated only on a single route through those gateways" (Fig.2.2). Through the analysis, Pradinuk (1986) provides a thorough discussion of the spatial mannerisms that can structure exhibition narratives. Further, his discussion illuminates particularly how the spatial arrangement of gallery rooms underlies the categorical relations among the themes of a content, while establishing the pedagogic relationship between curator and visitor. In this manner, Pradinuk explores spatial templates for presenting exhibition content, irrespective of the actual content is and the nature of its conceptual structure.

[6] The Castelvecchio Museum is analyzed in several other studies where its characteristic of "strong classification" is implied in the discussion of visual experience in the galleries (Stavroulaki & Peponis, 2003; Tzortzi, 2004) .

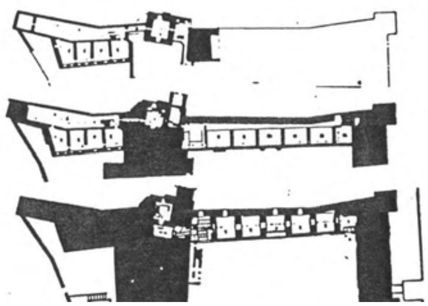


Figure 2.1 The Castelvecchio museum, Verona, Italy

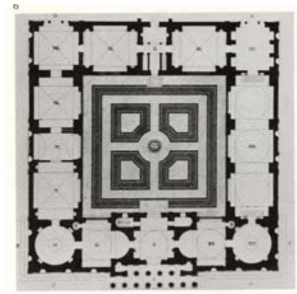


Figure 2.2 The Glypthotek, Munich, Germany

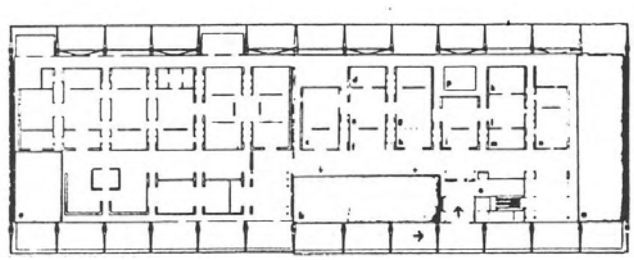


Figure 2.3 The Pompidou Center, Paris, France

Other studies apart from that of Pradinuk have explored how content that initially has different conceptual structures may be presented in spatial layouts (Peponis & Hedin, 1982; Tzortzi, 2003, 2004; Psarra, 2005; Tzortzi, 2005; Psarra et al., 2007). For instance, Peponis and Hedin (1982) and Psarra (2005) compared the gallery layouts in terms of content structure, spatial layout and potential movement. These two comparisons focus on differences in organizing and presenting two kinds of exhibition content shaped by the distinct paradigms of natural science. In their seminal study, Peponis and Hedin (1982) compared two exhibition layouts in the Natural History Museum in London, one focusing on "Bird Biology" and the other focusing on "Human Biology." The content of the Bird Biology exhibition was organized within a conventional paradigm of natural history where clear categories exist and the relationships between them are linear, whereas the knowledge of human biology was structured within the paradigm of evolution where relations between the categories are fluid and interchangeable. Correspondingly, the Bird Gallery situated display objects within categories separated from each other with clear boundaries, while the Human Biology Hall did not present a clear categorization of the themes.

As for the presentation of displays in spatial layout and potential movement patterns, the Bird Gallery displayed in locations that are accessible (or permeable) by crossing only a few spaces, in other words at more integrated points. In contrast, the Human Biology Hall situated displays in more segregated locations. As a result of this high degree of segregation, the Human Biology Hall layout split the visitor flow into smaller groups, and suggests loops in the galleries. Thus, this new structure encouraged an exploratory and individualized experience of browsing the collections Peponis and Hedin's (1982) investigations of the structural differences in the spatial layouts nicely demonstrate the reciprocal relationship between the changing paradigms of the content and the ways in which they can be presented in spatial layouts.

Similar observations of interactions between exhibitions and gallery layouts were reported in Psarra's (2005) comparison of the Natural History Museum and the Museum of Kelvingrove, both in Glasgow, Scotland. Referring to an earlier study (Yanni, 1996), Psarra (2005) contrasts the paradigms of scientific knowledge presented in the Natural History Museum with those presented in the Museum of Kelvingrove. The former museum's layout presents Richard Owen's static vision of nature.[7] The gallery rooms have a highly structured organization that allows only a fixed viewing sequence and a static view of nature. In contrast, the latter museum's layout consists of interconnected spaces that encourage multiple ways of reading the narrative and highlight various associations among the themes. As such the latter layout presents a contemporary and pragmatic understanding of nature as a resource associated with science and technology, and emphasizes nature's connections to industrial and cultural development.

Each of these two investigations by Peponis and Hedin (1982) and Psarra (2005) illustrate how conceptual organizations of the exhibition contents -- whether characterized by clear categories and a linear relationship between them or by a blurred distinction between the categories and multiple relationships between them -- is reflected in the spatial layout of each

[7] Richard Owen (1804–1892) was an English biologist, comparative anatomist and paleontologist. He is known as a driving force behind the establishment of the Natural History Museum, London.

museum. Psarra's (2005) investigation extends the discussion further to the relationship between permeability structure and exhibition narratives. This work focuses on the potential movement structured by permeability relations and the manner in which exhibition narratives can be constructed within these relations. Psarra's examinations of the two museum layouts suggest that the spatial layout of the Natural History Museum is less integrated; in other words, the exploration of the entire space depends on crossing various spaces within certain galleries. Thus, the content is presented step by step along that sequence, which she describes as a "temporal progression." Psarra (2005) argues that such a manner of presenting content is based on sequence and causality, does not allow multiple interpretations, and therefore can be called a "strong narrative." The spatial layout of the Museum in Kelvingrove, on the other hand, is more integrated, allowing the entire layout to be accessible through a number of connections among the galleries and the different parts of the narrative to be experienced synchronously. Psarra (2005) argues that this manner of presenting the content enables multiple interpretations and thus can be called a "weak narrative." This argument is consistent with Pradinuk's characterization of museum layouts as having strong or weak "framing", i.e. the degree to which the visitor may have control over how the content can be read. Both Psarra (2005) and Pradinuk (1984) show that weak narrative is associated with "spatial integration," where the different parts of the layout that contribute to the construction of the narrative have the same degree of accessibility.

Considering that exhibition narratives form the program of a museum building, Psarra's discussion of "strong narrative" and "weak narrative" can be understood in reference to the theoretical framework of "strong" and "weak" program buildings, discussed in Section 2.2.1 on space syntax methodology. Accordingly, Psarra suggests that layouts with "strong narrative" can produce movement patterns that entail a single viewing sequence. This definition accords well with the concept of buildings with "strong program" or "reproductive" mode layouts. Correspondingly, Psarra's definition of layouts with a weak narrative is consistent with the concept of buildings with a “weak program” (or generative mode) where the potential movement patterns are multiple and enable different patterns of exploration.

In addition to the analyses of the two natural science museums, Psarra (2005) also compared the layouts of two contemporary museums, the Museum of Scotland and the Burrell Museum. In this comparison, she examines the influence of visibility structure on how exhibition narratives are presented to visitors. Suggesting that the two museums have elements of both “temporal progression” and “spatial integration”, she stresses that visibility structure in both the Museum of Scotland and the Burrell Museum reveals the display walls in distant parts of the layouts and thus enables visitors to experience synchronously the displays from diverse categories (Psarra, 2005, pp. 90-92). In her view, this presents the display groups within a unified image, although the content represented may not imply such unification. In another study of the Museum of Scotland, (Psarra & Grajewski, 2000) she argues that this unified image may not correspond with the actual interpretation of the content; thus, one should distinguish between the actual content and the story told in the galleries through the spatial placement of displays (Psarra & Grajewski, 2000; Psarra, 2005).

Parallel to Psarra’s (2005) investigation, the relationship between exhibition narratives and their exposition to visitors through visibility structure has also been explored by Tzortzi (2003, 2004, 2005), and Stavroulaki and Peponis (2003). Tzortzi compares the spatial layout properties of the Sainsbury Wing of the Tate Gallery (London, UK) and the Castelvecchio Museum (Verona Italy). In this comparison, she argues that the layout of the Sainsbury Wing provides a visual structure to present a global network of themes to visitors within a unified spatial structure and thus exposes the themes within a spatial continuity. The Castelvecchio Museum’s visual structure, however, provides a series of fragmented exposures of displays along a temporal (step by step) sequence (Tzortzi, 2004). The Castelvecchio Museum was also the focus of Stavroulaki and Peponis (2003) who explored how visitors enter the field of “gaze” and make one-sided visual connections between the sculptures on display. Within this exploration, they argue that the Castelvecchio's layout invites visitors into the field of the visual structure between sculptures. For them, this effect of the spatial layout demonstrates how museums dictate the potential ways of viewing works of art. Finally, Stavroulaki and Peponis (2003) argue that museums not only convey the exhibition content but also introduce the ways of seeing the works of art, which are constitutive of it (Stavroulaki & Peponis, 2003).

In a more recent study of gallery layouts, Psarra et al. (2007) examined how the gallery layout of the new Museum of Modern Art's gallery layouts contributes to the narrative, the story of modern art through the lens of curator Alfred Barr, Jr.'s. As opposed to the MoMA's earlier gallery layouts, the new building offer alternative connections among the galleries and thus allows reinterpretation of the content through expressions of the complex relations among the art movements that were not expressed in the earlier layouts. This study also examines the visibility relationships among the galleries that contribute to the reinterpretation of the content by exposing displays in neighboring locations. This study also extends explorations of the influence of layout on the narrative through a discussion of how gallery layout may contribute to museum institutions efforts to define new ways of presenting their narratives.

In her latest study, Tzortzi examined eight museums in terms of the interaction between spatial layout and display organization. Her study defines three distinct models in which spatial layout and narrative organization can interact. One of these models establishes a correspondence between principles of spatial structure and narrative organization, which she describes as "exploiting space to enhance the impact of displays." The second one is the opposite of this model, which defines "spatial relationships through placement of display objects." The third model allows spatial layout and display organization to exist independently of each other. Her discussion of these models demonstrates the degree to which spatial layout may influence the exhibition narrative. In reference to Hillier's distinction between conservative and generative mode layouts, she argues that spatial layouts may either reflect existing relationships, or generate new relationships. Accordingly, she suggests that the museums that narrowly guide exploration and facilitate encounters with displays in a structured manner reproduce a preconceived content, while the museums that allow exploration in the layout and present the displays in an unstructured manner (with unexpected encounters) generate new interpretations of the content. Tzortzi maintains that while the first group of layouts representing conservative mode can be similar in terms of spatial properties and attributes, the second group can be highly individualized through various morphologies and display object layouts. In this regard, Tzortzi's study explores how morphological properties along with display object layout define various ways of experiencing narratives, such as spontaneous exploration and surprising encounters. Tzortzi's (2007) enlightening explorations contribute to our understanding of the potentials of geometry and morphological characteristics that shape exhibition narratives and define how they are experienced.

The studies by Psarra (2005, 2007) and Tzortzi (2003, 2004, 2005, 2007) also have touched on how experiencing exhibition narratives through visibility structure may influence potential movement patterns. These studies are further reviewed in the following sections, along with other studies that analyzed visitors' movement patterns.

2.3 Visitor Behavior in Museum Galleries

The question of how physical environments affect visitor behavior has been of central interest to environmental psychology. In particular, the influence of gallery layouts on visitor behavior has been investigated in the fields of both museums and architecture. Due to their different epistemological understandings of space and user behavior, the investigations in the fields of museums and architecture have had slightly different objectives. Based on environmental behavior research, the studies in the museums field aimed to understand visitor behavior and thus increase the effectiveness of how exhibits transmit their educational message.

Those studies have contributed to the museums field by establishing detailed observation techniques and devising measures that describe visitors' cognitive behavior associated with learning, way-finding and orientation. Other studies in architecture using space syntax methodology have investigated visitors' spatial behavior looking at the structure of spatial layouts and the way in which they relate to human activity. These studies using space syntax have examined the interactions between physical layout and visitor spatial behavior and thus aimed to explore how the spatial structure of layouts works. To describe visitor spatial behavior, studies using space syntax in architecture utilized observation techniques and measures devised by the visitor studies in the field of museums. This next section first reviews visitor studies in the field of museums and then examines studies that explore effects of spatial layouts on visitor behavior using space syntax methodology.

2.3.1 Studies in Museums Field Analyzing Visitor Behavior

Visitor behavior in museum galleries has been studied extensively in the museums field ever since visitor attendance became the main concern of museums in the post WWII decades. First studies of visitor behavior have explored museum fatigue and visitors' movement, and formed the basis of subsequent studies (Gilman, 1916; Melton, 1935).

As the educational missions of museums became more central to their work, studies on visitor behavior have focused on understanding the behavior associated with learning, such as the patterns of visitors' attraction to exhibition objects and attention to exhibition content. In addition to developing measures for describing such behaviors, these studies have focused on understanding what would predict the behavioral patterns. Among the various factors that can potentially predict behavioral patterns, physical layouts have been found the most influential (Melton, 1935; Falk, Koran, Dierking, & Dreblow, 1985). Investigations have shown that visitors' attention to exhibits neither indicates high differentiation for each exhibit; nor does it show high variance for each visitor. This finding indicates that neither exhibit properties nor visitors' individual differences play a major role in predicting their paths. However, investigations have also found that visitors' behavior shows certain differences according to depending on the characteristics of the setting, supporting the conclusion that physical setting likely predicts visitors' behavioral patterns.

The studies predicting visitor behavior have also described how visitors might use their time during their visit. First time visitors spend their first couple of minutes on orientation and way-finding, while in the subsequent 20-30 minutes they focus their attention on the exhibitions. Thereafter, visitor attention drops due to museum fatigue (Falk et al., 1985; Falk & Dierking, 1992; Falk, 1993).

In this next section the previous research that explored visitor behavior is reviewed from three perspectives: movement, stopping behavior, and interactions with gallery spaces in the form of orientation and way-finding.

Visitors' movement in museum galleries

Several studies in the museums field have focused on visitors' movement in galleries. Some of these studies have particularly been concerned with visitors' movement directed to the display objects, which is an indicator of visitors' attention to those objects. Specifically, these investigations have centered on what might predict attention to particular exhibits (Melton, 1936, 1972; Klein, 1983; Serrell, 1997). Other studies have been concerned with the direction of movement at choice points in the galleries (Melton, 1935; Bitgood, Hines, Hamberger, & Ford, 1991; Bitgood, 1994, 1995, 2006). The direction of movement at the choice points is considered critical as it may determine which exhibits receive most attention in a gallery. In a number of studies, these two patterns of visitor movement, attention to exhibits and direction of movement at choice points are discussed together.

One of the earliest studies that analyzed the direction of movement at choice points is that by Melton. Melton (1935) found that visitors tend to move toward the right hand side at the gallery entrances and follow the right side in the galleries. His study also shows that during their exploration of galleries, visitors are attracted to exit doors and tend to leave the gallery room as soon as they see the exit door. This means that the display objects on the left hand side and those in proximity of exit doors get the least attention, considering that visitors are distracted by the exit before possibly seeing the displays near the exit (Melton, 1935). Similar to these findings, later studies also report some evidence that the location of display objects in the galleries might predict visitors' attention to these objects. One of the earlier studies in this field shows that among the display objects in a crowded hall, the isolated objects are given more attention than the rest (Melton, 1972). A more recent study by Serrell's 1997 found that display objects located near entrances often get more attention than those near exits. Her other findings are also somewhat consistent with Melton's conclusion that visitors follow the right periphery of a room; she also finds that the display objects in the middle are rarely visited (Serrell, 1997). Other studies exploring visitors' movement in terms of attention to display objects discuss how the objects themselves may affect visitors' movement; for example, an object that has a character different from the rest of the display objects (in terms of size, color, kinetics) may attract attention, although that object is located on the left side of the room (Yoshioka, 1942) or, in proximity to an exit (Melton, 1936; Klein, 1983; Bitgood et al., 1991). These results suggest that exhibition arrangement in a layout is a major factor that motivates visitor's attention, unless the display objects have a distinctive character that attracts visitors.

Other factors that might predict visitors' movement besides the preference for the right hand side direction and the objects' location have been explored in more recent studies focusing on visitor behavior. These studies have adopted a broader understanding of gallery conditions and have investigated the direction of movement at the choice points in the context of more complex settings; for example, choice points other than gallery entrances are also taken into consideration. Bitgood (1995) and Bitgood and Lankford (1995) have discussed various factors that might predict visitors' movement. They note that visitors could be goal oriented and thus tend to move towards a particular destination in their mind. Bitgood (1995) also suggests that if this tendency is neutralized, the 'landmark' objects in galleries may attract visitor movement (Parsons & Loomis, 1973); if the objects are not distinctive enough, an exit or open door will attract visitors' movement; and if all these conditions are indistinct, visitors will maintain the direction that was initially chosen. Thus, Bitgood (1995) and Serrell (1997) propose that only when these other factors are insignificant, the right turn preference might be observed in visitors' patterns. To support this conclusion, Bitgood (2006) reviewed the findings of the research focusing on visitor movement and summarized the factors that might predict visitors' direction of movement reported in the research. His review suggests the following factors in order of significance in predicting visitors' behavior, (1) visitors' intended destination; (2) attraction of objects/exhibits, (3) attraction to exit/gateway (an open door); (4) maintaining the initial direction[8]; and (5) right turn. This suggests that Melton's early finding of the right turn tendency might be accurate in limited circumstances; in other words, as Bitgood argues, this tendency occurs in the absence of other factors (Bitgood, 2006).

Another explanation to the right turn tendency was proposed by Bitgood and Dukes (2006) in their most recent study. Their investigation of shopping malls suggests that people walking on the right hand side of a hallway almost always turn right at choice points due to the economy of steps; that is, it is unlikely for them to turn left as they will have to take more steps. Bitgood (2006) has also argued that visitors' movement patterns, including the ones directed to exhibitions, can be predicted on the same basis of cost-benefit justification in space use. This means visitors move towards a display object if it seems worthwhile to take the extra steps. Bitgood's (2006) argument differs somewhat from the earlier studies in its approach to explaining

[8] This third factor is explained by Bitgood as the tendency of walking in the direction that visitors have at the beginning; for example if a visitor enters a gallery along a left-hand wall, he/she continues walking along this wall, unless any other force is operating.

the prediction of movement. In his approach, the visitors' perception of which direction of movement requires least effort to move is the central factor, although how visitors might perceive cost and benefit of space use, or how the layout properties might effect this perception remained unexplored.

It has thus far been discussed that the tendency of right turn may be related to the distribution of movement patterns in the entire layout in a certain way. Referring to Weiss and Boutourline (1963), Bitgood and Dukes (2006) have noted that the right turn tendency might be related to people's tendency to circulate in a counterclockwise direction, depending on the design of exhibits and the design of the entire hall. Although this result promises that certain characteristics of an exhibition and a gallery layout might influence the right turn pattern in the entire layout, what these characteristics may be remains open to debate (Weiss & Boutourline, 1963; Bitgood & Dukes, 2006).

All these findings nevertheless provide good evidence that physical layout may have an effect on visitors' movement patterns. In particular, these studies suggest that visitor movement shows some underlying characteristics indicating that it may be influenced by layout characteristics and the placement of exhibits in room layouts. Despite this contribution, the findings of these studies seem limited in terms of identifying which properties and architectural characteristics of spatial layouts may predict movement patterns.

Visitors' Stopping to View Displays

In addition to visitors' movement, visitor behavior research has also been concerned with the distribution of visitors' stops. A number of studies have looked at the distribution of stops in relation to movement patterns and exhibition arrangement. For example, Melton (1935) noted that when visitors move in a direction opposite to the suggested route, they tend to stop to view displays increasingly selectively, which means they stop at only few displays and thus have a weaker understanding what the entire exhibition is about. In another study, Falk (1993) compared the stop patterns in two distinct layouts containing the same display objects, which provided a linear sequence and a non-linear sequence to visitors. He found that in the layout allowing alternative routes visitors stopped at a higher number of elements than in the structured viewing sequence where all visitors had to follow an identical route. This result suggests that layouts offering choice seem to encourage visitors to explore the display to a greater extent in comparison to linear sequences.

Visitors' patterns of stopping to view exhibitions have been analyzed to gain an understanding of the kinds of display objects that attract visitors. To this end, a number of measures have been used. One of these measures is the number of stops at display locations (Screven, 1976). This measure has been used to investigate what kind of display objects might attract visitors so as to identify display objects that have high degree of "power of attraction." Later studies investigated visitors' stops associated with viewing displays in relation to the total time visitors spend in the galleries. On such study, Serrell (1995, 1997) devised a number of measures that can indicate where these stops occur (distribution of stops) and whether the majority of display objects (at least 51%) in an exhibition are visited. For both the distribution of stops and the number of stops, she had to establish what should count as a "stop." Accordingly, in Serrell's study a "stop" equals the position where both feet of a visitor come to a full halt for 2-3 seconds while the person's body or head is oriented towards the display (Serrell, 1995).[9] Serrell applied "the distribution and the amount of stops in an exhibition" measures to comparative analyses of various exhibitions. In these comparisons, these measures are used to examine how extensively and in depth the exhibitions are explored. Her findings suggest that the visitors who spend more time in an entire exhibition are usually those who stop at more elements and become more aware of what the exhibition has to offer overall. This means that visitors who take time to

[9] As indicated in Serrell's study, this rule is established to describe a stop to view a variety of "exhibit elements" which may vary in size and type (e.g. a panel, a case, a diorama, a set of artifacts, a video theater, a computer, an interactive device etc). It can be suggested that works of art are objects that require less involvement to understand them, therefore, a pause in a shorter time can be considered as a "stop."

explore an exhibition usually distribute their time by stopping at as many elements as possible, instead of spending more time viewing fewer elements (Serrell, 1997).

The studies discussed above have established the measures that can describe stop patterns in relation to visitors' contact with exhibitions. One drawback, however, is that these studies have not explored whether the physical locations of display objects predict visitors' stop patterns. This may be partially due to the limitations in the methodology these studies used to relate location of display objects to visitors' stops in the layouts. With the limitation in mind, the same measures have nonetheless been adopted in this dissertation to describe visitors' patterns of contact with exhibitions.

Visitors' Interactions with Gallery Space: Orientation and Way-finding

A small number of studies analyzing visitors' movement have also examined the behavior of maintaining orientation and way-finding in museum settings. This behavior is discussed in relation to potential confusion that may arise during the course of a visit, which may arise due to the provision of directions and obstacles as visitors move in the layout. Some of these studies have investigated the physical layout properties that can eliminate way-finding problems. For example, Bitgood (2003) examined casino and shopping mall layouts in terms of orientation. Drawing from data on casino and shopping mall layouts, Bitgood (2003) argues that fewer choice points and intersections of pathways with 90-degree angles would support visitors' way-finding in museum layouts. He maintains that in museum layouts visual access to main circulation areas and reference points such as information desks (which are atypical for casino layouts) would help visitors retain their orientation and guide them to their destinations (Bitgood, 2003). These observations suggest that maintaining visual access to reference points and direct visibility of available routes are crucial for eliminating way-finding problems.

A number of studies have discussed orientation and way-finding behavior in relation to the entire museum visit experience. These studies have suggested that these problems could be the main cause of an unsatisfactory experience (Cohen, Winkel, Olsen, & Wheeler, 1977; Wright, 1989; Falk & Dierking, 1992; S. Kaplan, Bardwell, & Slakter, 1993). In particular, Kaplan, Bardwell and Slakter (1993) have considered way-finding and orientation problems detrimental to the "restorative experience" art museums can provide.[10] Further, Kaplan's 1993 study indicated that being able to find the way around dramatically impacts the quality of a museum visit, as it reflects the restorative potential of the museums (Walsh, 1991; S. Kaplan et al., 1993). His study showed that visitors who reported a high level of confusion and a sense of feeling lost scored significantly lower in the category of feeling "Restored" and higher in the categories of feeling "Harried" and "Tired" than others. In Kaplan et al.'s 1993 study, the visitors who reported understanding the plan well enough so as they could tell someone else where to locate displays had a "restorative experience" in their museum visit. These results indicate that the museum layouts that do not have orientation and way-finding problems provide a more satisfactory and restorative experience for visitors. Along with the other studies analyzing orientation and way-finding, Kaplan et al.'s (1993) explorations can serve to highlight the importance of a legible environment for a restorative museum visit experience. The issues related to legible environments are further explored in studies using space syntax in architecture, which are discussed in the upcoming sections of this study.

The ways in which museum settings can facilitate restorative pauses for visitors can be understood by Rachel Kaplan's explorations of the effect of having windows in building interiors. Her discussion centers on the positive effects of windows on psychological well being of the occupants in certain building interiors, such as offices, hospitals, and homes. She convincingly argues that windows have a special role for building interiors as views out the window potentially draw occupants' attention. Attention to the views may lead to very brief interludes that can

[10] In Kaplan's theoretical framework, "restoration" is a restful state of mind evoked by involuntary attention to a source. This state provides a mental break from a prolonged effort that requires voluntary attention. Kaplan considers art museum setting as a restorative environment because it fulfills elements of restorative experience: being away from daily routines, feeling of extent, fascination, compatibility and aesthetic element (R. Kaplan and S. Kaplan, 1989).

provide a respite from immediate tasks and demands, thus providing a micro-restorative experience (R. Kaplan, 2001, p. 509). These explorations concerning the effect of windows on visitors' interactions with gallery space help understand other factors that may predict the behavioral patterns other than moving and stopping to view displays. The explorations on behavior of gaining orientation and stopping for restorative breaks imply that stopping to scan the gallery might be motivated by visitors' need to retain orientation, such as pauses for looking around and looking through atria openings.

The gallery settings that can influence visitors' behavior concerning way-finding and orientation can be understood with the light of the "environmental preference" model introduced by Stephen Kaplan and others (Herzog, Kaplan, & Kaplan, 1982; S. Kaplan, 1987; Herzog, 1988; S. Kaplan, 1992). Through empirical studies assessing user responses to natural and urban setting pictures, Kaplan and others identified certain aspects of environmental information that can be utilized by humans in way-finding. They argue that for humans certain aspects can make an environment easier to understand while some others may evoke a desire to explore that environment further, or create a particular joy in exploration; thus these aspects can create "environmental preference" (S. Kaplan, 1992). Kaplan and others argue that "mystery" is one of the spatial attributes that make an environment preferable due to creating motivation for further exploration. Mystery refers to "those features of an environment that promise more would be seen if one would travel deeper into that environment"; thus it is described as the property that creates some glimpses and hints about the scene that is gradually unfolding (Herzog et al., 1982; Herzog, 1988). Although "mystery" and its link to environmental preference was initially understood focusing on natural environments; later studies reported that mystery is also a predictor of preference in interior settings (Scott, 1990). Later, Kaplan and others further elaborated the environmental preference model, and grouped the attributes of a preferred environment according to the degree of information processing necessary to draw inferences about a setting. In this model, Kaplan placed mystery as an attribute that required further information processing along with another attribute, "legibility," which refers to how well one could find one's way within a setting. To Kaplan, mystery is considered a motivator of "exploration" while legibility contributes to "understanding" (S. Kaplan, 1992). While Kaplan's environmental preference model and its attributes concerning way-finding are promising, it is not entirely clear which spatial elements constitute or contribute to these preferred environmental attributes. Nevertheless, the explorations of environmental preference attributes help identify visual and spatial aspects of an environment that can attract visitors and that can make navigation easier and desirable; and thus certainly inform the investigations of this dissertation concerning way-finding and orientation.

2.3.2 Studies Comparing Layout Properties with Space Use Patterns

The potential link between museum gallery layouts and visitor behavior has been investigated further in a body of architectural research using space syntax methodology. Space syntax provides spatial analysis techniques for analyzing layouts and comparing them to the patterns of movement and use. These analysis techniques have enabled researchers to describe the spatial layout properties in terms of quantitative and graphical representations, and to compare them with the visitors' space use patterns, and thus to investigate the link between them. Some of the studies in this group have focused on the permeability structure (Choi, 1991, 1999; Psarra, 2005) to predict visitors' space use patterns; while others have explored visibility characteristics of layouts in conjunction with analyzing permeability (Choi, 1991, 1999; Psarra & Grajewski, 2000; Stavroulaki & Peponis, 2003; Tzortzi, 2003; Peponis et al., 2004; Tzortzi, 2004, 2005; Psarra et al., 2007; Wineman & Peponis, 2009).

Visitors' Movement Patterns and Spatial Layout Properties

Studies investigating the potential link between permeability structure and visitors' movement reported significant results (Hillier et al., 1996; Choi, 1999; Psarra, 2005). For example, in his comprehensive study of eight art museums, Choi examined visitor patterns of movement by tracking the visitors' paths selected floor plans. He compared syntactical measures gallery rooms, integration and connectivity with the number of paths and the number of visitors crossing each gallery room. This comparison revealed that the number of visitors moving through the gallery spaces is linked to the "integration" of those spaces; in addition the number of paths of each gallery space is strongly correlated to "connectivity." These results indicate that visitors' movement patterns, both as denoted by the counts of paths and the counts of visitors crossing the galleries, may be predicted by the spatial properties of the layout. Similar results are found by Psarra (2005) in her study examining four museums: the Art Gallery and Museum in Kelvingrove, the Natural History Museum in London (an example of Victorian era architecture), The Burrell Museum and the Museum of Scotland (examples of contemporary architecture). Examining these museums, Psarra (2005) compared the average number of visitors observed in the galleries with the integration values of those spaces. In her analysis, the average number of visitors in the galleries roughly represents the rate of visitor movement attracted to the galleries. Psarra's analysis found correlations between the average number of visitors and the integration values of the spaces. However, the correlations were not homogeneous in the four museums. First of all, a stronger correlation was obtained in the Kelvingrove and the Burrell museums when the service spaces operate as strong attractors (i.e. restaurants, shops and temporary exhibitions) are excluded from the analysis. Second, the correlation in the Natural History Museum was poor and only improved when neighboring spaces were combined in the analysis. The results obtained in the Natural History Museum still showed that some popular galleries (i.e. the Dinosaur gallery), attracted higher number of visitors than other spaces did. These results suggest that although spatial layout properties may influence the visitors' use patterns, they alone cannot determine how visitors will use space; some particular exhibitions may play a role in visitors' choices in movement. In this respect, both Choi's (1999) and Psarra's (2005) studies show that spatial layout may predict the visitors' movement patterns. However, Psarra's investigation brings a perspective to the understanding of the role that spatial layout properties might play in predicting visitors' use patterns in conjunction with other factors.

Along with exploring the prediction of movement patterns by gallery layouts, both Psarra (2005) and Choi (1999) demonstrated that the gallery layouts have different spatial manners of shaping the movement due to their morphological characteristics. For example, as indicated in Psarra's study (2005) the Natural History Museum guides visitors through the main circulation areas in a formal and hierarchical manner, whereas the Kelvingrove and the Burrell museums guide visitors through gallery rooms in an informal and relaxed way. In a similar investigation, Choi (1999) comparatively examined how movement patterns are distributed in eight museum settings he chosen for a case study. The layouts he analyzes represent variations in configuration, such as layouts with clearly defined rooms versus free plan organizations, and those with rooms organized within a sequence or a network of connections. Choi's analysis of the eight floor plans reveals the relationships between the morphology of the layouts and the structure of the movement patterns. Specifically, it shows that as museum layouts become increasingly subdivided and thus have more segregated spaces, visitors move more selectively; in contrast, in the more integrated and more intelligible layouts, visitors' movement paths are more evenly distributed. Unlike the studies in the field of museum focusing on behavior only, both Choi's (1999) and Psarra's (2005) explorations provide an in-depth analysis of the spatial characteristics of museum layout and their relationship with visitor behavior.

In addition to Choi's (1999) and Psarra's (2005) investigations of the influence of permeability structure, the potential influence of visibility structure on movement patterns was also explored by Psarra (2005), Psarra et al. (2007), and Tzortzi (2003, 2004, 2005 and 2007) among others. Psarra (2005) and Tzortzi (2005) examined how movement patterns in gallery spaces may be shaped by how the layouts' spatial manner exposes the display groups to visitors. Psarra (2005) examines movement path data to understand how the display groups are experienced. She observes that in museum layouts with a higher degree of integration, movement paths exploring the displays are shaped in circuits. This also confirms that the integration property that can be explained by the “ringy” structure of the layout predicting the movement patterns. However, in the layouts with a lower degree of integration Psarra observes that the movement paths for exploring the displays are shaped more linearly. Tzortzi’s (2005, 2007) analysis of eight European museums includes a discussion of the contrast between the Kroller-Muller Museum (the Netherlands) and the Louisiana Museum of Modern Art (Denmark) in terms of the manner in which movement is predicted by their layouts. Within its axial geometry and segregated spatial structure, the Kroller-Muller Museum provides fewer choices in circulation and thus monopolizes the visitors’ exploration. In contrast, the Louisiana Museum of Modern Art offers more choices in circulation and exposes the displays through surprising encounters and intrigues visitors who then hope to see something new along the navigational route. Finding that both museums predict movement, she concludes that the Kroller-Muller Museum illustrates that when movement is more uniformly distributed in a layout, the effect of integration is weaker (Tzortzi, 2005).

In a more recent study, Psarra et al. (2007) examined how visibility structure may influence the variation in the distribution of movement paths in the fifth and fourth floor layouts of the new Museum of Modern Art (New York). This study found that the movement paths (measured by the sequence of rooms visited by visitors) on the fourth floor is less uniformly distributed, and this can be explained by low visual integration, which implies a difficulty in understanding the layout. Psarra et al. (2007) argue that the fifth floor, which is visually more intelligible, distributes movement paths more evenly, creating a more varied itinerary that offers more choices in circulation; on the other hand, the low degree of intelligibility on the fourth floor may have resulted in visitors moving in a less exploratory manner. Psarra’s (2005, 2007) and Tzortzi’s (2005, 2007) explorations provide detailed observations on how spatial properties of gallery layouts influence movement distribution in relation to the type of experience the layout offers to visitors, such as spatial exploration through surprising encounters or directed routes.

Visitors' Contact with Displays

In addition to the explorations of movement patterns, a number of studies have been concerned with how visitors' stops for contact with displays might be linked to spatial layout properties. Peponis, et al. (2004), and Wineman and Peponis (2009) investigated this question in the context of science exhibition settings. As discussed in their study, the layouts of science exhibitions differ from those of art museums. Most importantly, science exhibitions layouts are usually shaped by a free placement of exhibit objects in a non-partitioned gallery that creates spatial layout properties, i.e. permeability and visibility relations. Two science exhibitions with different installations in two different galleries were studied in order to examine both exhibitions in the same and different gallery settings. The focus was on whether visitors' stop counts at the exhibits can be predicted by the degree of permeability and visibility of the exhibit locations.

Peponis et al. (2004), and Wineman and Peponis (2009) took stop counts at the exhibits as a measure that denotes visitors' contact with the exhibits. Depending on the duration recorded in the stops, they also assigned two other measures, the short "stay" denoting momentary contact and the "long stay" denoting the engagement with exhibits. The authors compared these measures derived from stop counts with the relative permeability and visibility values at each exhibit location. The results of their comparison show the following. First, the location of the exhibits in the permeability structure of the layout has a powerful effect on the distribution of places where visitors stop, irrespective of short stay and long stay. Second, the patterns of visitors' stop for short stays (contact) are linked to the partial visibility of exhibit objects; in other words, exhibits that are partially visible from other exhibits attract more visitors for short stays. On the other hand, exhibits fully visible from every other exhibit are correlated to the counts of long stays. Interestingly, this correlation is stronger than the correlation between visibility and short stays.

The results of this study indicate that the spatial placement of the exhibit objects influences the way in which the exhibitions are visited. Moreover, the establishment of a link between direct permeability of exhibits and stop counts is particularly significant for understanding how spatial layout properties may predict the rate of visit that each exhibit receives. Further, the findings are indicative of how active engagement with exhibits may be predicted by the visibility of those exhibits from other exhibit locations.

Psarra et al.'s study (2007) examining the fifth and fourth floors of the MoMA (New York) reports that the paintings with the highest viewing rates are usually on the main sequence and in integrated locations. However, an exception to this link between viewing rates and integrated locations appears on the fourth floor, pointing to the effect of popular displays.

These explorations concerning visitors' contact with displays show that spatial layout properties may motivate visitors contact with the exhibition content and thus may play a role in conveying the exhibition content. Yet, more extensive and detailed investigations are needed to understand this relationship more thoroughly.

Visitors' Contact with Architecture and Gallery Layout

The studies discussed above relate visitors' stops with the patterns of contacting exhibitions. The extant study is also interested in exploring how stopping behavior is associated by other factors such as regaining the sense of orientation or a restorative break from intensive viewing of the displays. In the body of architectural research, a small number of studies explore how spatial properties enable visitors to retain their orientation or to grasp the gallery layout. These explorations address the issues related to retaining orientation or grasping the layout in relation to spatial properties and geometry (Psarra, 1997; Psarra & Grajewski, 2000).

In their study analyzing the Museum of Scotland, Psarra and Grajewski (2000) investigated how the visual information obtained sequentially through movement contributes to visitors grasping the total picture of architecture and display content. The central aim of their investigation was to explore how the architectural geometry of museums might be revealed to visitors through movement. Based on their findings, Psarra and Grajewski (2000) suggested that the atrium void in the Museum of Scotland visually connects the galleries at the periphery of the building, while the interplay of wall surfaces potentially enables observers to grasp the relationship between the center and the periphery. Psarra and Grajewski concluded that visitors retain information on the spatial geometry through the atria space while exploring peripheral locations. With these observations in mind, the authors examined the visual information revealed along a representative route of the potential movement. To this end, they utilized point isovists generated from selected vantage points and examined together to determine the sum of all isovist polygons. This examination shows that the entire layout is exposed along the potential movement route so that visitors retain constant visual access to the reference points in the layout, and thus grasp the entire layout with reference to the atrium (Psarra & Grajewski, 2000, pp. 132-133). The results of Psarra and Grajewski's (2000) analysis support the notion that in museums with an atrium, the atrium provides a strategic point that visitors can use to retain orientation and grasp the total picture of the building during their exploration. This finding indicates that it may be worthwhile to investigate whether spatial layout predicts where visitors stop to obtain orientation and restorative breaks. Thus, this dissertation can extend Psarra's and Grajewski's study in terms of how an atrium informs spatial exploration and attracts visitors to stop in order to have a restorative break.

2.4 Methods and Contribution

2.4.1 Further Explorations in Methods of Spatial Analysis

In the body of space syntax research, the studies analyzing museum layouts present interesting findings on the potential link between visibility relations and space use patterns of visitors (Psarra & Grajewski, 2000; Stavroulaki & Peponis, 2003; Tzortzi, 2003, 2004, 2005; Psarra et al., 2007; Wineman & Peponis, 2009). These findings have improved our understanding of how layout morphologies may work in predicting space use patterns. However, these studies are limited in that they appear to be based on aggregate descriptions of space use patterns and top-down characterization of space.

A number of studies in architectural research have extended the analysis of visibility relationships to finer grain descriptions of visibility structure and investigate visibility within geometric shape and movement. In an earlier study before the development of space syntax methodology, Thiel (1970) focused on developing techniques for noting and measuring the experiences of an observer moving along a path or channel. Archea's (1977) and Thiel's (1970) investigations refer to two ways of experiencing visibility relations in physical settings: static viewing and viewing through explorative movement (Thiel, 1970; Archea, 1977, 1984). Similarly, a group of recent studies drawing upon space syntax methodology are concerned with relating spatial analysis methods to the geometric shape and experience of grasping the visual information of that shape (Peponis, Wineman, Rashid, Kim, & Bafna, 1997; Peponis, Wineman, Rashid, Bafna, & Kim, 1998; Psarra & Grajewski, 2001; Psarra, 2003, 2005; Psarra et al., 2007). Among these studies Psarra and Grajewski (2001) describe shape on the basis of the syntactic properties of its perimeter. Their exploration emphasizes the analysis of the perimeter on the basis of visibility relations among surfaces. This approach shows that shape can be analyzed beyond the conventional methods of examining geometric order. Informed by Psarra and Grajewski's explorations, another application has now been included in *Depthmap* to generate visibility graphs on the basis of the points along the perimeter of the assigned area.

Indeed Psarra and Grajewski's investigations are concerned with the description of a peripatetic observer's actual experience of exploring spatial layout properties, and seek to integrate this description to the spatial analysis methods (Psarra & Grajewski, 2001; Psarra, 2003). Psarra and Grajewski argue that the spatial analysis methods of space syntax abstractly describe the hypothetical ways in which spatial layout is experienced by an observer.

Acknowledging that the observer can absorb a limited amount of visual information along the places where she/he moves, Psarra and Grajewski point out that the research questions concerning how layout is grasped through exploratory movement should also consider a "bottom-up" characterization of space and spatial experience (Psarra & Grajewski, 2000, p. 132).

Studies seeking a bottom-up description of experiencing layouts have explored interesting aspects of the relationship between movement and shape properties (Peponis et al., 1997; Peponis et al., 1998; Psarra & Grajewski, 2001). Peponis et al. (1997), for example, concentrated on exploring how shape is exposed to a peripatetic viewer along movement. Referring to the conceptual relationship between movement and visual information, Peponis et al. (1997) consider movement as a pattern of changing perspectives of a space (Frankl, 1914; Cassirer, 1953; Gibson, 1979). They argue that this movement can be described in terms of two kinds of differentiation in visual information. One is changing perspectives along movement within a constant set of spatial elements (i.e. a room), and the other is changing visual information in transition from one space to another that unfolds different sets of spatial elements. Peponis et al. suggest that these two kinds of differentiation in visual information of spatial layout can be registered by thresholds in space and that these thresholds can be represented by theoretical partitions in the layout plans. In this respect, Peponis et al. (1997) devised a technique of drafting theoretical lines marking thresholds where visual information of geometrical shape changes in a viewer's experience.

In another study, Peponis et al. (1998) extended their 1997 study to examine the relationship between shape and visual information of spatial elements. They investigate how geometric shapes influence the visibility of wall surfaces in two ways: (1) from the point of each individual wall surface and (2) from the point of an observer occupying the spaces surrounded by the surfaces. Peponis et al. carried out this investigation using examples of three distinct plan types: a cellular plan, a free plan, and an open plan (See Fig. 2.4 for further explanation). Peponis et al. (1998) first characterize these plans according to the degree to which the wall surfaces are co-visible with each other, and analyze how the surface characterization in terms of mutual visibility differs among the three floor types.

The authors' analysis of the visibility of surfaces used two key measures of spatial analysis: visual connectivity and visual integration. Visual connectivity of surfaces refers to the degree to which a surface is directly visible from the neighboring surfaces; visual integration describes the degree to which each surface is visible from all other surfaces. The analysis carried out by Peponis et al. show that surfaces in the cellular plan layouts have higher visual connectivity than those of open and free plans, indicating that surfaces are more likely to sustain a mutual visibility relationship with other surfaces in cellular plans than in either the open or free plans. In addition, free plans are the least advantageous in sustaining co-visibility relationships among the walls compared to the other plans. The reason for this is that free placement of walls decreases the possibility of surfaces being completely visible to each other. With regard to sustaining co-visibility with all other surfaces in the layouts (visual integration), cellular plans

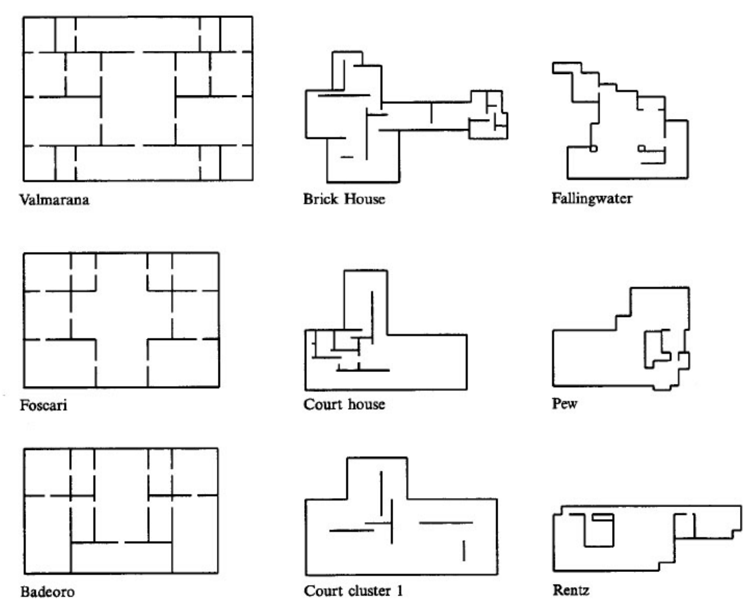


Figure 2.4 A sample of the plans analyzed by Peponis et. al.,(1998): first column on the left shows the samples for 'cellular plan', the middle column shows the examples of 'free plans' and the third column (on the right) shows the 'open plan'.

Source: Peponis et al. (1998).

and free plans are significantly less advantageous than open plans (Peponis et al., 1998, pp. 697-699). While museum layouts with a shape might be more advantageous to establish a visual link between the displays on the surfaces within a room (local level), open plan layouts allow the visually linking of displays on a surface with all other surfaces in the layout.

The explorations of Peponis et al. 1998 pointed to some potential for future studies analyzing spatial geometry and visibility structures that emerge from this geometry. Such investigations can be extended to art gallery settings to illuminate how the interaction between spatial geometry and the visual structures along with the potentials of visibility structure provide a setting to establish exhibition narratives and reveal the displays to visitors. These studies can help reveal which kind of museum gallery layout may provide stronger visibility relationships between the walls and provide a potential for stronger dialogues among the displays. This understanding could then inform interpretations of the results of case studies in relation to morphology shaped with the position of gallery walls.

2.4.2 Defining the Contributions Aimed at this Study

The studies discussed above provide the research background of this study, and present the findings informing the objectives of our research. Although much has done to clarify our understanding of how gallery rooms influence visitor behavior and the experience created by exhibition narratives, further attention must be paid to how gradually unfolding information of gallery environments can further explain the interactions among the gallery layouts, exhibition narratives and space-use patterns. To understand these interactions in detail, this study first investigates how museum gallery layouts shape exhibition narratives, and second to what extend layouts influence visitors' space use patterns, and carry outs these investigations taking the viewers' gradual exploration of gallery space into account. This study evaluates the results from these investigations in relation to morphological characteristics so as to identify the role that these characteristics play in a gallery layout's shaping of exhibition narratives and space-use patterns.

Previous studies relevant to the first stage investigations are those that discuss the models of the interaction between exhibition narratives and spatial layouts. These studies address a number of aspects of this interaction. Most fundamentally, a few discussed how museum gallery layouts provide spatial templates to convey the educational message (Bernstein, 1975; Pradinuk, 1986). Other studies focused on the parallels between the conceptual structure of various kinds of content and the spatial structure of the layout; in addition, they discussed how a concept is presented through the expression of thematic relationships in terms of the permeability structure (Peponis & Hedin, 1982). Some looked at how spatial layout properties shape the extent to which visitors are given control over reading the narratives (Tzortzi, 2004; Psarra, 2005; Tzortzi, 2005, 2007). Among these studies, Psarra's (2005) explorations distinguished two kinds of layouts. One type presents narratives with a sequence and causality (a strong narrative) with the potential of low integration. The other type presents the narrative through interchangeable routes and interconnectedness between rooms allowing multiple interpretations (a weak narrative) with the potential of high level integration. Her analysis suggests that less integrated layouts offer a more rigid exploration path, and convey the narratives more didactically (Psarra, 2005). In further explorations she reveals how visibility relationships across space provide another layer of connecting narrative themes, although connections at that level may present the narrative in a different manner than its conceptual structure suggests (Psarra & Grajewski, 2000; Psarra, 2005). Tzortzi organized her explorations on the basis of Hillier's model of conservative and generative mode layouts. Accordingly, she distinguished museum layouts that guide the viewing sequence and provide less control over visitors' explorations of narratives from those that allow alternative viewing sequences and generate new conceptual relationships. Tzortzi maintained that layouts in the second group can considerably vary in morphologies and display object layouts, and those tend to offer spontaneous exploration and surprising encounters. Thus, Tzortzi's study explored how morphological properties along with display object layouts would have an impact on defining various ways of experiencing narratives (Tzortzi, 2007).

In the analysis exploring the interactions of museum gallery layouts with exhibition narratives , this study examines the relations between gallery layouts and exhibition narratives on the basis of a detailed investigation of spatial relationships defined at both the global and local levels. Based upon Hillier's framework of conservative and generative mode layouts, this investigation aims to identify the potential of a layout to shape a conservative versus generative narrative at a global and a local level, and explores which morphological characteristics play a role in reproducing the preconceived narrative or generating new narratives at different scales. This investigation will contribute to the understanding of how morphology can determine whether narratives are presented in a didactic manner at a global or a local level, and thus clarify how visitors' control over exploring narratives varies at different scales of the morphology.

Previous explorations relevant to the second part of this study's investigation are those in the fields of behavioral studies in context of museums field and architectural design that examine the extent to which space-use patterns are predicted by layout. The behavioral studies have explained the potential effects of physical environments on visitor behavior in terms of gallery room and exhibit location characteristics, in addition to other possible factors such as the right turn tendency, planned destinations and the exhibit characteristics (Melton, 1935, 1936; Yoshioka, 1942; Melton, 1972; Parsons & Loomis, 1973; Serrell, 1997). With regard to visitors' stopping behavior associated with viewing display objects, the studies in the museums field have established a methodological basis for describing the stopping behavior using visitors' stop count data, and have analyzed stopping behavior to determine the extent to which visitors are attracted to certain exhibits (Screven, 1976; Serrell, 1995, 1997). Those studies have focused on the characteristics of exhibits that might attract visitors rather than exploring the effects of physical setting on the stopping behavior (Melton, 1935, 1972; Serrell, 1997). With regard to another pattern of space use this study examines, previous studies in the museums field have established an understanding of a visitor's potential need to retain orientation and motivation for restorative pauses (Melton, 1936, 1972; R. Kaplan & Kaplan, 1989; S. Kaplan, 1992; S. Kaplan et al., 1993; Bitgood, 2003). On the other hand, studies in architectural design have used space syntax methodology, and thus extended the explorations of the studies in museums field to the spatial properties of the entire gallery layout. The studies in architectural design research have found strong evidence for layouts' ability to predict visitor movement through spatial relations in the entire layout (Choi, 1991, 1999; Tzortzi, 2003, 2004; Psarra, 2005; Tzortzi, 2005; Psarra et al., 2007; Tzortzi, 2007; Wineman & Peponis, 2009). In addition to exploring the prediction of movement by layout, a group of studies has provided some concrete evidence for the ability to predict stopping behavior to view exhibits. The investigations of a number of science exhibit layouts have shown that permeability and visibility relations are influential in predicting stopping to contact exhibits (Peponis, Dalton, Wineman, & Dalton, 2003; Peponis et al., 2004).

Using space syntax methodology, previous studies in architecture concerning the effect of layouts on visitors' space-use patterns explored visitors' movement and stopping patterns in terms of their aggregate distributions throughout the entire layout. In addition, these studies focused on investigating effect of layout through their global level and structural properties (i.e. integration). These explorations, however, do not take into consideration the sequences in which spaces are visited and the ways in which local and global spatial characteristics impact the choices made by visitors gradually moving inside the layout. In order to achieve more accurate and detailed understanding of layouts' influence on the space-use, this study analyzes to what extent visibility properties at local and global levels may predict visitors' choices in movement, stopping to view displays and stopping to grasp the layout, and uses detailed descriptions of these space-use patterns. Therefore, this dissertation investigates the effects of museum gallery layouts on visitors' space use patterns based on both "top-down" and "bottom-up" characterizations of space. "Bottom up characterization" of space refers to the morphological characteristics and spatial layout properties that can be described at the level where it is experienced by visitors.

Top-down characterizations, on the other hand, refer to global properties that describe the layout as a configuration, and exploring their effects on space-use patterns help understand how layouts work as a system. As a part of the explorations on the basis of a bottom-up characterization, this study examines how visitors make choices in the movement direction within the effect of visibility available at the spaces offering choice. This study also compares movement lines with visibility at the grid cell level, the space around individual visitors. With those explorations in addition to examining the links between aggregate space-use patterns and spatial structures at the global level, this study intends to provide a clear and more detailed understanding of how morphology influences the way in which visitors use museum gallery layouts.

After analyzing case study museums to investigate how museum gallery layouts relate to exhibition narratives and visitors' space-use patterns, this study looks at how the distribution of space use patterns within visitors' choices in movement, stopping displays and stopping for restorative pauses can be explained within the synergistic effect of exhibition design as shaped by the layouts. In addition, the transmission of exhibition narratives can be better understood by examining which viewing sequences are likely visited due to the impact of layout on movement. Therefore, this study describes the possible interactions among gallery spatial layout, space-use and exhibition narratives, and is thus able to characterize the resulting museum visit experience.

CHAPTER III

METHODOLOGY

3.1 Chapter Overview

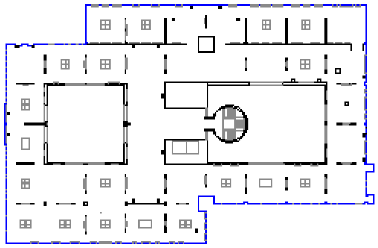
This chapter outlines the methodology of this study. The first part discusses the research strategies, while the second part describes the specific methods of data collection. Finally, the third part outlines the techniques used to analyze the data.

3.2 Research Strategy: Case Study with Correlation and Qualitative Research

As described earlier, the aim of this study is to identify how art museum gallery layouts shape the message of an exhibition as well as the spatial experience of a visitor. With this goal in mind the primary question explored here is how art museum gallery layouts interact with exhibition narratives and visitors' space use patterns. To explore this interaction, the following series of related questions are examined: (1) how can visibility properties shape the presentation of exhibition narrative, specifically in terms of whether the content is didactically presented and (2) to what extent can visibility properties predict space-use patterns. Because an investigation of these questions in real-life settings offers most applied results, research has adopted a case study approach for selected museums to address these questions. The research questions of this study entail finding relations between gallery layout properties and exhibition narratives, as well as visitors' space use patterns. Therefore, the data representing gallery layout properties, exhibition narratives and visitors' space use patterns were collected from the case studies and were compared and correlated utilizing qualitative and correlation research strategies. In this way, the methodology of this study employs a combined approach integrating case study, qualitative research techniques and correlation research techniques. The specific techniques investigations are explained in detail in the upcoming sections.

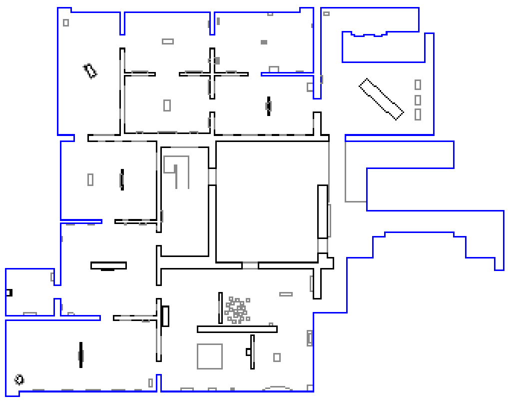
3.2.1 Selection of the Three Museums for the Case Study

Three museums are the foundation for the case study: the Yale Center for British Art (1977) in New Haven, CT designed by Louis I. Kahn; the Museum of Modern Art (the new building, 2004) in New York designed by Yoshio Taniguchi; and the High Museum of Art, Atlanta, (1982, 2004) in Atlanta, GA the original building of which was designed by Richard Meier, and the extension wing of which was designed by Renzo Piano (Fig. 3.1). These museums were chosen because they fulfill a number of criteria necessary to address the research questions within the scope of art museums. Accordingly, since the focus of this study is on current museum layouts, the selected art museums had to be from a contemporary museum context and thus potentially represent the contemporary understanding of presenting art collections. Indeed, in this regard all three museum buildings had been opened (with expansion wings) within past three decades and thus reflect a contemporary understanding of exhibiting art defined by a visitor-oriented approach to planning exhibitions and gallery space. Second, the museums had to have gallery layouts allowing interchangeable routes for exploration, while providing visual continuity in space linking galleries across distance. This was necessary so that the study could identify the effects of spatial layout on visitor behavior. Third, in order to minimize the differing levels of interference by display objects on museum visit experience the museums had to have comparable collections and displays; in this regard, each of the three museums exhibit painting and sculpture collections from various periods. Finally, to allow the data collection and analysis the museums had to have an institutional interest in this study. Since the YCBA, the MoMA new building, and the HMA with the new extension wing fulfilled these criteria, these three museums are the focus of this study. Layouts of these museums are presented in Fig 3.1.



(a) The Yale Center for British Art (YCBA), fourth floor gallery

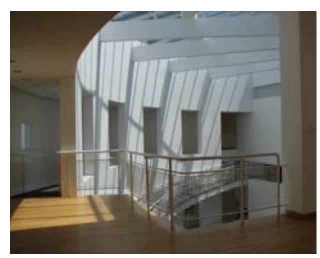
(b) The YCBA's main atrium



(c) The 'New' Museum of Modern Art (MoMA), fourth floor gallery

(d) The MoMA's atrium

(e) The High Museum of Art, skywalk (uppermost) floor of Wieland (left) and Stent (right) wings



(f) The HMA's atrium at the Stent wing

Figure 3.1 Floor plans and interior views of the museums selected for the case study

3.2.2 The Case Study Museums

The Yale Center for British Art (YCBA) in New Haven, Connecticut houses a collection of British paintings and sculpture, watercolors, drawings, prints, rare books and manuscripts dating from the sixteenth century to the mid-nineteenth century. The center is housed in a modern style building designed by Louis I. Kahn and opened to public in 1977. The building is constructed on a structural grid, the gallery spaces are organized around two atria, and the gallery rooms are defined with movable partitions. The YCBA building underwent a major renovation in 1998 to improve the building's material condition. This renovation increased the gallery space on the fourth floor by opening to visitors the *Long Galleries*, which had originally been reserved for scholarly research displays. This floor primarily exhibits the museum's permanent collection of British painting and sculpture dated from sixteenth to mid-nineteenth century and is the focus of the case study in this dissertation.

The Museum of Modern Art (MoMA) in Manhattan, New York is known as a leading institution for collecting and presenting of pieces of modern art. Since the inauguration of its first building in 1939, the MoMA's collection has continuously grown as the pieces of art have been acquired. The growing collection as well as the increasing number of visitors motivated several renovations and extensions of museum galleries. The six major building commissions over its sixty five year history have provided larger circulation spaces, display and storage areas, at the same time redefining the museum's spatial relationship with its visitors. The last extension wing was designed by Yoshiko Taniguchi and opened to visitors in 2004. The wing is a five storey gallery block, which also re-organizes the museum's entrance and circulation. This study analyzes the fourth floor galleries of this wing, which exhibit late modern and pre-contemporary painting and sculpture collections.

The High Museum of Art in Atlanta, Georgia was founded in 1905 as the Atlanta Art Association, and in time expanded its services as a museum. The museum's first official building was designed by Richard Meier and opened to the public in 1982. Meier's design offered a space in an L-shaped gallery block organized around a quarter-circle-shaped atrium. The original interior of the building was designed to display a decorative arts collection from the nineteenth century (Brenneman, 2006). As the collection has grown with the addition of artwork in various forms, the interior organization has undergone revisions over the years. Another motivation for revision was that the museum's recent policy promoting the inclusion of contemporary works of art necessitated the addition of exhibition and circulation spaces to the original Meier building, (later named the Stent wing). As a result, the museum galleries have been recently expanded with the addition of two wings, the Wieland and Cox wings, using designs by architect Renzo Piano. The museum re-opened to public in 2005 with the extension wings. This study focuses on the skyway fourth floor galleries of the Stent wing (designer by Meier) and the Wieland wing (designed by Piano), which are connected by a hallway.

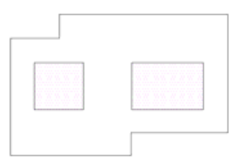
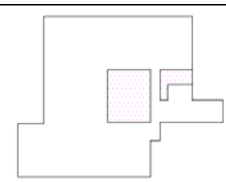
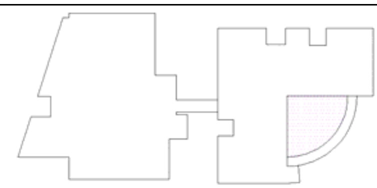
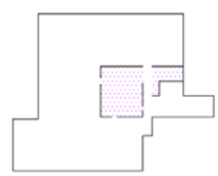
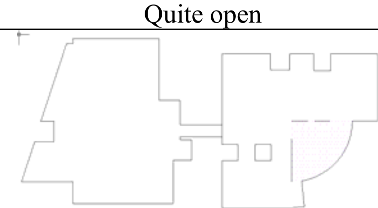
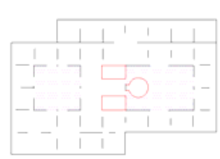
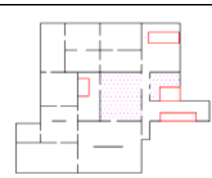
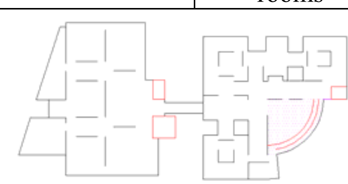
This investigation concentrates on three museums' main gallery layouts that are reserved for displaying the permanent collections. These gallery layouts are of interest to this study due to their spatial attributes that show the galleries' relationship with spaces of architectural expression including atria voids in those museums.

The case study museum layouts have similar spatial attributes that are determined by a configuration of partitions and atria voids: all three museums have atria voids with openings to the gallery spaces and these spaces can be navigated in multiple ways. The similarity of the spatial attributes of these museums allows for an interesting comparison of how their layouts shape narratives and visitor behavior through these attributes (Table 3.1). At the same time, however, their morphologies are not identical; there is variation in how the atria voids and gallery partitions are situated. As can be seen in Table 3.2, the YCBA has two atria voids that are located at the longitudinal axis and widely open to the galleries. In the MoMA's new building, despite being located at the center of the gallery floor the atrium has few openings to the gallery rooms. In contrast, the atrium in the High Museum of Art is off the center and opened to gallery spaces only in one wing, and has no direct relationship with the expansion wing designed by Piano. These variations, therefore, allow for an examination of their effects on visitors' space use patterns and exhibition narratives.

Table 3.1 Characteristics that the three museum gallery layouts share

Spatial Attributes	YCBA	MoMA	HMA
Atrium	√	√	√
Visual reference through atrium void	√	√	√
Allowing interchangeable routes	√	√	√
Atrium position in the layout	Bifocal	Central	De-central

Table 3.2 Variations in the morphologies of the three museums' gallery layouts analyzed

<table>
<tr><th></th><th>YCBA 4th Floor</th><th>MoMA 4TH</th><th colspan="2">HMA</th></tr>
<tr><td rowspan="2">1. Atrium shape</td><td>Four sided</td><td>Three sided</td><td colspan="2">Two sided</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="2">2. Atrium and galleries</td><td>Largely open</td><td>Few openings</td><td colspan="2">Quite open</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="2">3. Gallery room organization</td><td>Linear circulation, room to room organization</td><td>Linear circulation, matrix of rooms</td><td>Linear circulation, matrix of rooms</td><td>Linear-cyclic circulation, rooms within rooms</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td>4. Gallery partitions and building circulation</td><td>Partitions at center, circulation at sides</td><td>Partitions at sides, circulation through the central axes.</td><td>Partitions at center, circulation at sides</td><td>Partitions at center, circulation at sides</td></tr>
</table>

3.3 Data Collection and Obtaining Descriptions of Spatial Properties

The research questions of this study entail comparing and correlating gallery layout properties (permeability and visibility relationships) with exhibition narratives and visitors' space use patterns. To this end, three groups of data were collected from the selected case study museum gallery layouts using several techniques. First, to understand the curatorial intention and exhibition narratives, (a) open ended interviews were conducted with the museum curators and (b) printed sources related to the exhibitions were reviewed. Second, to describe permeability and visibility relationships, spatial analysis of the gallery floor plans was undertaken. Third, empirical data on visitors' space use patterns were obtained by recording visitors' behavior of explorative movement, viewing displays and stops for scanning the gallery environment through detailed observation studies conducted in the galleries.

The data was collected through fieldwork in the museums, as well as subsequent research on the museum's publications, and other art historical sources. The scope of the fieldwork and research was identical for each of the three museums, although the time frame and sequence of the data collection varied slightly for each museum. Data collection at the YCBA was completed during a three month internship in summer 2005 that was a curricular requirement of the University of Michigan Museum Studies Certificate Program fulfilled by the author. The fieldwork at the MoMA and a subsequent investigation on the spatial layout properties and the exhibition narratives were part of a research project supervised by Sophia Psarra in the Doctoral Studies in Architecture at the University of Michigan. As this project was part of the Doctoral Studies, the fieldwork and the research on spatial layout properties of the MoMA was completed with departmental support in November 2005. Some of the findings of this research were disseminated in conference paper presentations (Psarra, 2006; Psarra et al., 2007). The data collection at the High Museum of Art was a part of fieldwork and research conducted as an independent study by the author in June 2006.

3.3.1 Compiling Curatorial Intent to Understand Exhibition Narratives

To begin to comprehend an exhibition narrative it is useful to understand the underlying curatorial intent. Curatorial intent in art museums concerns the task of drawing particular interpretations from content represented by collections. To delineate these interpretations and convey an educational message, curators establish a conceptual structure where particular themes represented by display groups are interrelated. Based on this conceptual structure, display groups are organized and then placed in galleries by curators and exhibit designers. This placement gives a final shape to the exhibition narratives and conveys the exhibition message. Even though this process is carried out by curatorial teams on the basis of curatorial intent, some decisions may be made during the organization and placement of displays in galleries.

As a first step toward comprehending the exhibition narratives, open-ended interviews were conducted with curatorial teams to understand their intents. Also collected were the museums' printed statements on their exhibition programs, comments from special exhibition tours (recorded in the form of notes), as well as research on the museums' scholarly publications and other art historical sources discussing the collection pieces. This compiled information provided a basis for understanding the exhibition narratives in relation to placement and organization of displays in layouts.

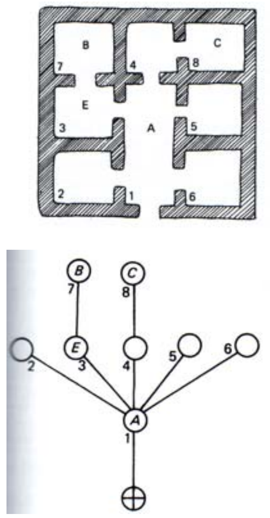
3.3.2 Method of Obtaining Spatial Descriptions of the Layouts

As discussed earlier, the spatial structure of the gallery layouts can be described by looking at permeability and visibility relationships. Permeability relationships refer to the network of spaces through which one can move, whereas visibility relationships refer to the network of spaces through which spaces visually relate to each other. In order to describe the permeability and visibility relationships of each gallery layout, this study uses syntactic analysis techniques developed in space syntax methodology. Specifically, the permeability relationships of the gallery layouts were captured through convex map analysis, justified graphs, and axial line map analysis.

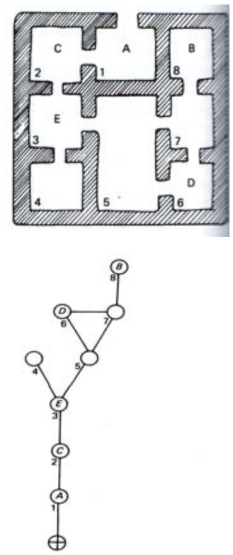
Using justified graphs, space syntax methodology describes built environments in terms of topological relations, rather than using the size of spaces and distance between them as is done conventional formal analysis. Justified graphs in space syntax methodology describe spatial units as nodes and the relations between those as links. Thus, justified graphs provide convenient schemes to graphically represent the built environments based upon topological relations described by permeability. In its general definition, permeability refers to where one can go (or walk through) in the spatial layout (Hanson, 1998). The degree of permeability can be described for each unit and for a configuration itself. Within the permeability of a configuration, topologically how "far" spatial units are from every other spatial unit is captured by the measure of "integration." The integration measure is the degree to which it is necessary to pass through intervening spaces to arrive at a particular unit (Hillier & Hanson, 1984, p. 108). Accordingly, a space that is accessed by crossing the highest number of spaces in a configuration is considered the least integrated (or, topologically the farthest) from the rest of the configuration. Since the integration measure is concerned with describing the relationship of each spatial unit to the whole configuration, it is considered a global measure. The integration measure can also be used to describe how shallow or deep a configuration is depending on integration property of all spatial units.

In addition to integration, space syntax methodology suggests that spatial units can also be analyzed in terms of permeability from their adjacent units, which describes a local relationship between the units. The permeability of one spatial unit in regard to adjacent units is measured by the connectivity measure. Connectivity describes the number of many units directly linking spatial unit and thus measures degree to which a spatial unit is reciprocally permeable from each neighbor of that unit.

In addition to graphs, space syntax methodology uses other techniques to represent and analyze permeability relationships, namely the *convex map* and the *axial line map* (Hillier and Hanson, 1984). In its mathematical definition, *a convex space* refers to a space where any two points can be joined by a line that does not cross the boundary of the space (Hillier & Hanson, 1984, pp. 97-98). Therefore, a convex polygon is created by examining where the largest possible circle can be drawn and delineating the regions in the space. A convex polygon shows a region in



a)



b)

Figure 3.2 a) A sample layout with its justified graph with illustrating a “tree like” configuration **b)** A sample layout with its justified graph with illustrating a “chain like” configuration.

<u>Source</u>: B. Hillier and J. Hanson (1984), *The Social Logic of Space*; pp.150-151.

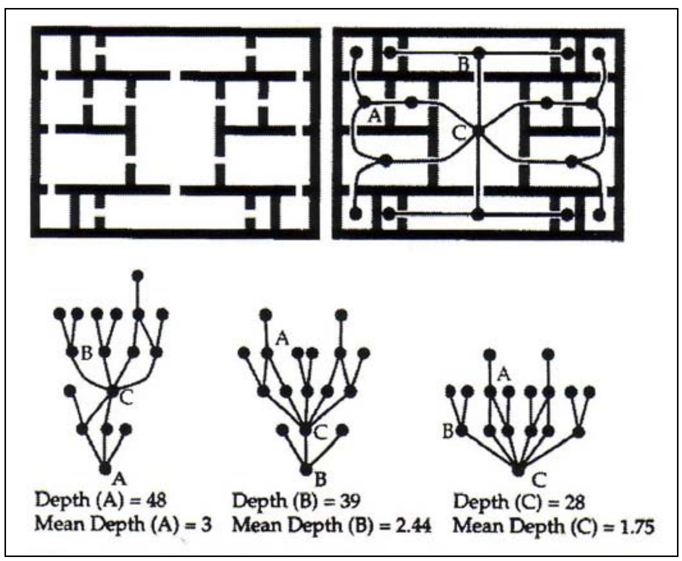


Figure 3.3 A sample plan represented as a graph of connections. The graph is rearranged as seen from three positions within the plan.

<u>Source</u>: J. Peponis and J. Wineman (2002), Spatial Structure of Environment and Behavior, p.273

which any pair of points is mutually visible to each other. A *convex map* consists of a set of convex polygons in a configuration and captures how visually contiguous spaces are distributed in a layout and these spaces are permeable from each other (Fig.3.4). In this way, convex map captures characteristics of a layout based on visually contiguous spaces and permeability among them. Another technique used to capture permeability relations layouts is axial line map. In order to capture the potential movement in layouts, space syntax methodology uses axial lines. An axial line is the longest straight line that passes through a permeable threshold between two adjacent convex spaces. An axial line is an abstraction of movement from one space to another, which depicts the possible directions that potential movement can take in an abstract sense. An axial map of a layout is drawn by finding the longest straight line that can be drawn and then second longest and so on until all convex spaces are crossed and all axial lines that can be linked to other axial lines without repetition are so linked (Hillier & Hanson, 1984, p. 99). By connecting each of these lines, an axial map, therefore, captures the structure of the potential movement allowed through connections between and among convex spaces (Fig.3.5). Both *convex map* and *axial line map* representations of a configuration can be further analyzed by using the syntactic measures of "integration" (global measure) and "connectivity" (local measure). In both convex map and axial line maps, the analysis based on integration and connectivity measures identify each unit's (a convex space or an axial line) value in terms of how integrated it is to the entire configuration or locally connected it is to the other units.

Space syntax theory suggests that highly integrated units identify the locations or segments where potential movement is generated by a configuration. Space syntax theory also suggests that the degree of accessibility from the adjacent units may influence the degree of accessibility from every other unit in the whole configuration. This relationship between local and global level accessibility can be analyzed using the correlation between the connectivity and integration values of the spatial units of a configuration. The degree to which these values are correlated indicates the intelligibility of that configuration. The concept of intelligibility, which describes by how many spaces a unit is connected to other units of a configuration that can be seen by an observer, is a good guide to the integration of each space into the system as a whole (which cannot be seen by an observer all at once) (Hillier, 1996, p. 129). Put more simply, spatial *intelligibility* refers to the degree to which an observer can grasp global spatial properties (described by integration measure) can be grasped on the basis of local spatial properties (Hillier & Tzortzi, 2006).

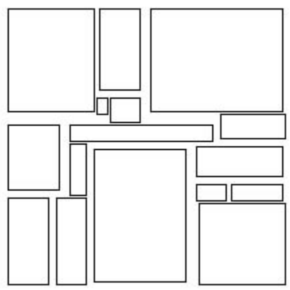


Figure 3.4 Sample convex space map

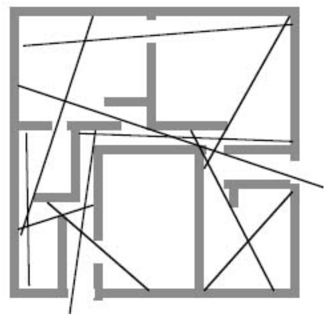


Figure 3.5 Sample axial line analysis.

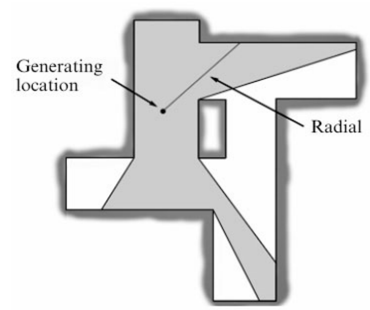


Figure 3.6 A sample visual field

The convex space and axial line map techniques can be used to analyze not only permeability in space but also an observer's experience of space through visibility. This experience through visibility can be analyzed, for example, by using axial lines to represent the lines of sight. This technique alone, however, may not be sufficient to capture the visibility relations in space, because visibility as a dynamic property can be more accurately described in reference to an observer's vantage point. For this reason, space syntax methodology applies a visibility polygon, known as an "isovist" and introduced by Michael Benedikt, to the spatial analysis methods, resulting in a finer grain measure of visibility.

According to Benedikt, an isovist is a polygon that defines a visible area from a vantage point of 360 degrees; in other words, the boundaries of isovist are descriptive of the region where the radials of sight project from the vantage point can permeate until they meet physical boundaries (Fig.3.6). Generated from a single vantage point, this technique is also referred to as *point isovist*. Within a point isovist, visual information can be described using the characteristics of its polygon, denoted by various measures such as the "area" and "perimeter" of the visible polygon (Benedikt, 1979, p. 50). Benedikt's point isovist captures the extent of local visual information obtained at the designated vantage points. In order to describe visibility relationships globally in a configuration, point isovist (visual field) technique has also been applied to points of a designated grid in a layout using computational applications. These applications generate isovists from the grid points (such as those on a floor plan), and calculate visual fields overlapping throughout the space, (Dalton, 2001; A. Turner, Doxa, O'Sullivan, & Penn, 2001). Using various algorithms to calculate overlapping and mutual visibility among the points, computer applications, such as *Depthmap* and *Syntax 2D,* derive syntactical measures of visibility relationships (A. Turner, 2003, 2004; J. Turner, Wineman, Psarra, Jung, & Senske, 2006). The resulting graphs can demonstrate the "visibility structure" in the floor plans a configuration through color rendered representations and quantified measures (Fig.3.7). These computer applications thus enable comparisons of visibility structure on the basis of spatial units incorporating potential movement and other human spatial activity in built environments.

In this study, the visibility relationships of the selected gallery floors were captured using the computational applications *Depthmap* and *Syntax 2D*[11], both of which calculate visibility relationships among grid points on the basis of syntactical measures. As the latest versions *Syntax 2D* with its complete features became available only recently, this study used *Depthmap* to generate most of the visibility graphs of the layouts. *Syntax 2D* was used to generate representations of point isovists, because this application is able to capture all point isovist measures and provide a complete information of extent of visibility at local level.

For museum galleries, visual access is a meaningful attribute as it indicates the degree to which an observer has direct interaction with works of art. Thus, among the different syntactic measures, a number are particularly meaningful to examine the visibility structure of gallery spaces. A local measure, visual connectivity is derived from the connectivity measure that

[11] '*Syntax 2D*' licensed by Turner, J., Wineman, J., Psarra, S., Jung, S. K., and N. Senske, University of Michigan, 2006.

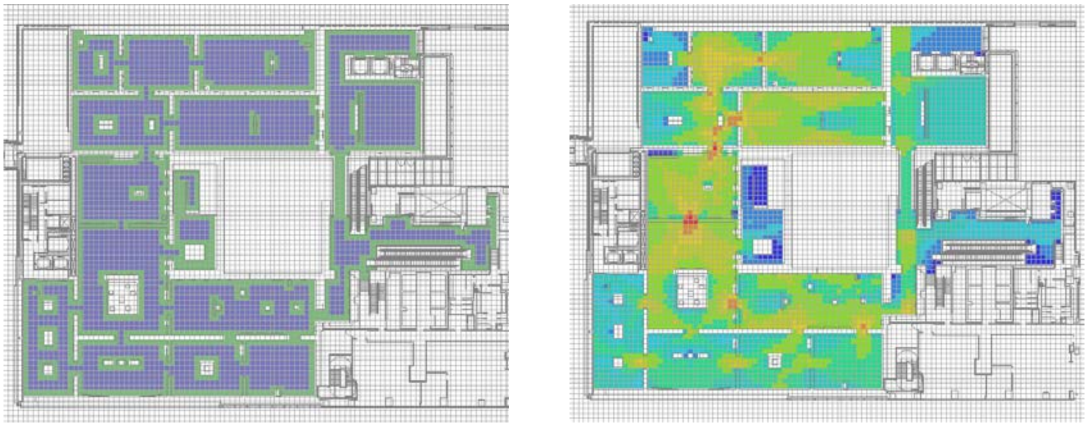


Figure 3.7 Steps of generating visibility graph analysis in *Depthmap*; setting the grid and selecting the paces where the graph will be generated (*left*); and visual connectivity graph (*right*).

describes the degree to which a spatial unit is visually accessible from its neighbor units (Hillier & Hanson, 1984). Parallel to this definition, visual connectivity describes the degree to which the analyzed spaces can be mutually seen from their neighbor locations. In visibility graphs, regions that have a higher degree of mutual visibility are considered advantageous areas in terms of visual access. As Archea (1977) described earlier, visual access in layouts refers to the information obtained at a particular vantage point location.

Another local measure that is useful to this study is visual control. In space syntax methodology, control value denotes the degree to which a spatial unit is visually connected to spaces that are connected to few spaces in their neighborhood (Hillier & Hanson, 1984). Extending this definition, the measure of visual control explains the extent to which one space have visual access to others with limited visual access to their neighborhood (i.e. rooms are located in dead-end locations) (A. Turner, 2004, p. 16). In gallery layouts, for instance, a doorway threshold between two rooms is likely to have high visual control, if the spaces at two sides have limited visual access to other rooms. When an observer is in a high control space, this may lead to the opportunity of being aware of the spaces that are mostly isolated from other spaces. This condition that can be captured by the measure of visual control is valuable for comparing visitors' patterns of stopping to visually scan the gallery space.

One global measure employed for visibility analysis in space syntax methodology is visual integration. As explained earlier, *integration* denotes the degree to which it is necessary to pass through intervening spaces to arrive at a particular unit (Hillier & Hanson, 1984, p. 108). Consistent with this definition, visual integration of a configuration indicates how many visual fields one must move through to see the whole layout from each point within that layout it. More specifically, when grid points in a visual graph are highly integrated, this indicates that the points are visually accessible using the fewest number of steps (or the shortest path) from every other grid point (Hillier, 1996; Hillier & Tzortzi, 2006). In museum layouts, the property of visual integration is significant since it can indicate the areas through which an observer might with minimum effort comprehend the entire exhibition and spatial layout. According to space syntax research, an observer seeking to comprehend a layout would minimize her/his effort, maximize the visual information, and then would move through the areas which maintain visual accessibility.

Given their potential importance in understanding visitor movement as discussed above, the visibility properties of the gallery layouts are examined by looking at the measures of visual connectivity along with the measures of control and integration.

In addition to analyzing visibility on the basis of the syntactic measures described above, this study also utilizes non-syntactic visibility measures, captured by point isovists (visual fields) and grid isovist graphs. As explained earlier in this section, point isovist polygon defines the visible area from a 360-degree vantage point. In this study, single point visual fields (isovists) generated from particular vantage points are used to examine the character of visibility in the spaces offering a navigation choice. The point isovitsts in those spaces were obtained by using, *Syntax 2D*, which can calculate the measures of the visual field (i.e. area, perimeter and occlusivity) introduced in Benedikt's (1979) original isovist concept. In addition to single point isovist graphs, this study uses flood-fill analysis (grid-isovists) of visual field graphs. The grid isovist graphs show isovist values from every grid point in a space, and aid in analyzing the general capacity of that space to provide visual information.

3.3.3 Collecting the Data of Visitors' Space-Use Patterns

In this study, data of visitors' space use patterns was collected through detailed observation studies at the selected museum galleries. The observation studies involved unobtrusively tracking the movement and stopping behavior of randomly selected visitors. Specifically, these observations recorded visitors' paths of movement, the places visitors stopped to view displays, and the places they visually scanned the gallery space. Visitors were recorded as stopped when they slowed down and paused for at least 1 second by bringing their two feet to a full halt and orienting their body or head towards the display in the confines of the gallery room.[12] If a visitor only glanced at a piece of art that was located in another gallery room or did not slow down, this did not count as a stop. If a visitor stopped multiple times to view the same piece of art, each of these was recorded as a separate stop. These multiple or recurring stops are relevant because they indicate the amount of attention that the piece of art received, which is a part of display viewing behavior. Visitors were recorded as stopping to scan the gallery environment when they slowed down and their both feet came to a full halt for at least 1 second to look around the gallery environment.

The collected data included the tracking records of individuals visiting the museum alone or in groups for the entire tour of the layout completed in the first twenty minutes of their visit. The twenty minute time frame was chosen because the previous research shows that first time visitors focus on the exhibition in the first 20-30 minutes of their visit, after which visitor attention drops due to museum fatigue (Falk et al., 1985; Falk & Dierking, 1992; Falk, 1993). The decision to collect data on space use within an entire selected gallery tour was made because the

[12] This criteria is based upon Serrell's (1995) study, which suggests, visitors 2-3 second pauses in front of a various exhibit objects including panel, a case, diorama, a computer screen and interactive device could be considered stop.

pilot observation studies in the three museums revealed that most visitors completely navigated each of the three gallery layouts within 20 minutes. Data was collected for 34 visitors at the YCBA, 33 visitors at the MoMA and 25 visitors at the HMA. The data were then were analyzed to identify the following: (1) patterns of spatial exploration, (2) patterns of viewing displays, and (3) patterns of visually scanning the layout. The patterns of spatial exploration were determined by looking at the paths of movement from the moment of entering the gallery rooms through the meandering in the galleries to visit works of art. The patterns of viewing displays and patterns of visually scanning the layout were identified by analyzing the stop counts recorded using the previously given definitions of a 'stop' for these two stopping behaviors. Although described by analyzing stop counts, visitors' patterns of visually scanning the layout vary widely including such aspects scanning the gallery space, looking at the spaces of architectural expression (atria or courtyards, for instance), and looking out of the windows. These stops not directly connected to the viewing of the works of art might have occurred for a number of motivations, such as a way-finding and orientation in the layout (scanning and looking at atria) or needed for taking restorative breaks from displays (looking outside windows). Although the precise reasons for these stops was not obtained, they were, nonetheless, considered as a part of visitors' patterns of space-use in the art museum galleries, since they may represent visitors need to get cognizance of gallery space and exhibits. For the sake of brevity, these stops are called "scanning stops" in the analysis.

3.4 Case Study Analysis

This part outlines the techniques of analyzing the collected data and comparing them with the spatial layout properties in each case study.

3.4.1 Exhibition Narratives and Gallery Layouts

This section describes the analysis conducted to comprehend the exhibition narratives and compare them with gallery layout properties in each case study.

Analysis of the Curatorial Intent and Installations

As explained in the previous section on data collection, information on the curatorial intent was obtained from the open-ended interviews with curators, from the museums' statements on their exhibition programs, and from the notes taken in the special exhibition tours, as well as research on the museums' scholarly publications and other art historical sources discussing the collection pieces. The analysis of this information helps clarify what content the different museum collections actually represent in art history, and which messages are drawn from the different content by the curatorial teams. In relation to the sources that provide detail on the curatorial intent (i.e. Alfred Barr, Jr.'s modern art interpretation), this analysis discusses the complete conceptual structure of the exhibition message that the museums intended to present. This analysis of the compiled information on the curatorial intent serves to reveal the conceptual relationships that are established among the major themes of the exhibition content and the organizational logic that brings display groups together (e.g. chronology or a focus on individual artists). In doing so, the underlying structure of the different exhibition narratives can be explicated, which then provides a foundation for comparing the exhibition narratives to spatial layout properties.

Analysis of Spatial Layout Properties: Permeability and Visibility

Section 3.3.2 briefly explains the techniques used to obtain spatial descriptions of the gallery layouts. This section also outlines how these techniques and involved measures were used to analyze the spatial layout properties of each gallery layout.

As explained earlier, justified graphs, convex map techniques and axial map techniques were used to obtain the permeability properties of each gallery layout. The first step of analyzing permeability in the gallery layouts involved the use of justified graphs of each gallery layout to identify *rings* in their configurations. This step is necessary because in space syntax methodology, *rings* denote the parts where potential movement is distributed into various directions; the nodes where a *ring* is formed would be connected to the entire configuration through a number of links higher than that related to other nodes. The nodes where *rings* are formed potentially represent the spaces where movement is distributed in more than one direction. These spaces can then be treated as spaces that offer choices in potential movement, an important factor in this study that allows for an analysis of the distribution of movement into various directions. To identify the capacity of a node to distribute movement into various directions, the topological position of the node was examined in the configuration. The relationship of a node with the links in configuration defines a topological type. For example, nodes that are in a dead-end position in the configuration (a-type space in Figure 3.8) are distinguished from other nodes that are on the way to and from other nodes (b and c-type), and again from nodes that provide a link to more than one node. As can be seen from the figure, a-type nodes do not permit movement to other spaces, while d-type can be part of more than one ring, and thus be exposed to movement from several other nodes. For the extant study, this characterization is useful to distinguish spaces in a configuration on the basis of their permeability relationships. As can be seen in Fig. 3.8 c-type and d-type nodes represent spaces offering choice, while a-type clearly does not. Thus, this methodology was used to examine justified graphs of the layouts so as to locate nodes offering choice within the ring and the distribution of movement in the layouts.

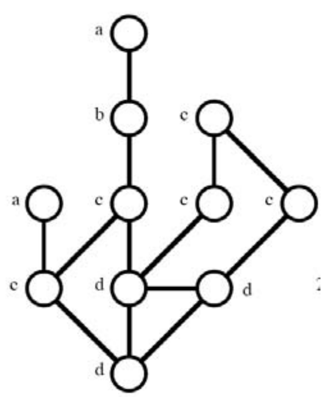


Figure 3.8 The sample justified graph showing Hillier's classification of nodes on the basis of topology. Source: Hillier, B. (1996) *Space is the Machine*, p.319.

Another step in examining permeability relationships, analyzed axial line maps using computational tools (*Depthmap*). These computational tools created the previously drafted axial lines according to their integration and connectivity values in each configuration. The distribution of highly integrated and connected axial lines shows where potential movement can be predicted by the gallery layouts. This distribution informs later steps of the analysis that examine which viewing sequences (among the gallery rooms) are likely predict visitors' movement.

As discussed in the section on the techniques used to obtain the descriptions of spatial properties, visibility relationships in the gallery layouts can be understood on the basis of visibility graphs generated by *Depthmap* using the key measures of connectivity, control and integration. In this study, visibility graphs of these measures were generated at both knee level and eye level sections of the floor plans. The aim in doing so was to compare those graphs and examine how visibility through non-permeable voids influences the overall visibility in the layouts. The eye level graphs include the areas that visitors could see through but could not step into, such as atria voids and all display areas which did not block their vision; thus, the eye level graphs render a distribution of visibility relationships as experienced at that level. The graphs generated at knee level exclude the regions that visitors could not occupy, such as box displays and sculptures, but includes the location of furniture, as it was considered that visitors can potentially occupy those areas; thus the knee-level graphs represent distribution of visibility relationships at the level where visitors' movement and occupation take place. The eye-level and knee-level graphs were compared with each other on the basis of key visibility measures in order to determine to what extent the permeable and visible spaces overlap, and whether atria voids differentiate permeability and visibility structures from each other.

In the eye level graphs, the highest degree of visual connectivity indicates the spaces where visitors would have visual access to the largest possible area in the layout. This information is significant for the current study since displays in the visible areas can be visually compared by visitors, and also directly accessible visual information of neighboring spaces may motivate visitors to move towards those spaces. Thus, visual connectivity graphs are used in the analysis comparing spatial layout properties with space-usage patterns, and with the narratives. The visual control measure as measured by the eye level graphs demonstrates in which spaces visitors can see areas that are less directly connected to other spaces. The parts of the layout designated as having highest degree of visual control are those that are advantageous in providing visual access to spaces with lesser degree of connectivity. This information has significance for this study as it shows where visitors can potentially be aware of the information around them, although that information is not accessible from every location. Thus, visual control graph is used only in the analysis comparing spatial layout properties with space-usage patterns, not in the comparison of the narratives. Visual integration as measured in the eye level visibility graphs aids in understanding how visually accessible the spaces are within the fewest number of visual steps (or the shortest lines of sight) from every other space in the layout. In these graphs, the spaces with the highest visual integration values are those that are visually close to every other point in the layout. This property of gallery spaces is important when examining how visitors can capture the visual information of the entire layout through their spatial exploration. In addition, the visual relationships of individual spaces to every other space in the layouts may create opportunities for visitors to visually compare display groups in space. Therefore, this study uses the visual integration measure in the analysis comparing spatial layout properties with exhibition narratives and space use patterns.

In addition to the eye-level graphs generated from the measures of syntactic visibility, this study uses graphs of non-syntactic visibility, namely grid-isovist graphs providing flood-fill analysis of visual field. These graphs are not generated for individual analysis but to correlate these measures with the space-use patterns.

Examining Exhibition Installations in Gallery Layouts

This part of analysis examines how the three gallery layouts of the case study museums relate to the conceptual structure of the exhibitions they presented. This is accomplished through a comparison of the spatial and formal properties of each gallery with the conceptual organization of its respective exhibition. The aim of this is to see how the formal and spatial properties of the gallery layouts are utilized to express conceptual relationships among display groups that are installed. Given that the installation of displays completes the shaping of the exhibition narratives and that formal properties of the gallery layout are often utilized by curatorial teams to install the display groups, this analysis was conducted to understand in depth exhibition narratives as they are established through the placement of displays in a space.

In this analysis, the conceptual organization of the exhibition is compared with the gallery layout on the basis of two key aspects of the displays. The first is the curators' placement of displays in layouts and the incorporation of their associated formal and geometric properties with this placement; and the second is the ways that gallery layouts expose the displays to visitors. As a key task of curatorship, placement of display objects in the gallery layout serves to impose an interpretation to those displays in relation to each other and thus expresses a conceptual relationship among display groups. In most cases, a curator's placement of display groups aims to maintain their interpreted meaning in the art historical context; however, in some other cases this placement may reflect a curator's own interpretation. For both cases, a comparison of the conceptual organization of an exhibition (as understood by curatorial intent) with formal spatial properties of the layout can help explain to what extent there is a correspondence between an exhibition and its spatial organization. Indeed, the installation of displays also entails planning visitors' viewing sequences, in other words, envisioning the order in which display groups will be viewed. However, as suggested earlier, curators may have less ability to determine viewing sequences through placement since the gallery layout may allow visitors to view displays in sequences other than those envisioned.

Within this framework, the first step of this aspect of the extant study focuses on how display objects are placed in a room in terms of its geometry and organization. Next, each of the gallery layouts and exhibitions were examined to determine how exhibitions may be viewed by visitors. In this regard, the analysis of how the layouts expose displays to visitors lead to the investigation into the layouts' potentials to generate further meaning.

Comparing the Exhibition Narratives with the Syntactic Properties of the Layouts

This part of the study is a comparison of the syntactic properties of the gallery layouts and the exhibition narratives established in the galleries. To accomplish this, narrative organization of the exhibition in each museum is compared to the visibility graphs of connectivity and the integration measures. These comparisons reveal how visibility structure may facilitate visitors' ability to relate different narrative themes through visibility between spaces. Given that displays are experienced by visitors at eye level, this comparison is based on visibility graphs that are generated at eye level. Theoretically speaking, displays in visually integrated areas can be seen from all other locations within fewest visual steps and the themes of such displays could potentially be the center of the narrative organization. Therefore, a comparison of narrative organization with visual integration graphs can reveal the narrative themes on which the gallery layout places an emphasis.

The goal of the investigations described above is to see how the gallery layouts are utilized to express the exhibition content as interpreted by the curatorial intent, and as well as to determine how the layout generates new and alternative interpretations of the content.

3.4.2 Space-Use Patterns and Their Correlations with Visibility Properties

Prior to the in-depth analysis of the space use patterns, the sample data on visitors was examined to identify how gallery rooms are visited by visitors during the course of tracking. Given that some visitors move faster and visit many rooms while others are slower and visit fewer rooms, the purpose of this examination is to understand whether the sample included a random distribution of fast-moving and slow moving visitors. To this end, the distribution of the rooms visited in each layout was captured by histograms. Histogram values that are on the right side of the graph aligned with higher number of rooms side indicate that the number of rooms visited within the course of tracking is quite high and, the visitor sample constitutes mostly fast moving visitors. Since the visitor data was collected by tracking randomly picked individuals, the distribution of fast-moving and slow-moving visitors is expected be random and the histogram showing how many rooms were visited and by how many visitors should approximate a random distribution.[13] By establishing whether the data sample has a normal distribution of the number of rooms visited, the histogram analysis aims to determine that the data sample was not affected by the selection of individuals.

Following the examination of the histogram, this next part of the analysis examined the distribution of space use patterns obtained from the data on visitors completing an entire tour within the course of tracking in each gallery layout. This part first examined the space use patterns descriptively through the measures retrieved from the visitor data. The purpose of this examination was to identify how visitors' space use patterns are distributed throughout the gallery floor. Second, the analysis compared these measures with syntactical and non-syntactical visibility properties in order to investigate their potential for prediction.

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[13] The normal distribution is pattern for the distribution of a set of data which follows a bell shaped curve. The more closely a set of data approximates to a (symmetric) bell shaped curve, the more likely that the variable in the data is randomly (without being influenced by other factors) distributed.

Patterns of Spatial Exploration

This study describes the visitors' patterns of exploration as revealed by the movement path data. The patterns of explorations were captured in two ways. The first involved looking at the number of movement paths that crossed each gallery room in relation to the number of visitors counted entering each gallery room. This number straightforwardly describes the degree to which each room was visited by the sample population. The other measure of pattern exploration is the number of movement lines that cross each room. This number was obtained by counting movement lines entering each room and denotes how many times each room is visited. Looking at the number of movement lines that cross each room as opposed to number of visitors entering each room can explain the extent to which visitors visited rooms by crossing them many times or returning these rooms to explore further. To understand how the usage in the gallery layouts varied in terms of these two measures, the rates of number of visitors and number of movement lines for each gallery were compared for each of the layouts using diagrams created by color-rendering the found rates (Fig.3.9). This comparison helps clarify which parts of the layout were visited more frequently. As the number of movement lines crossing each gallery room captures the explorative behavior by including further explorations on the basis of return visits, this measure could be used to compare to visibility properties, as described in greater detail later in this section.

Figure 3.9 Sample diagrams showing the percentage of visitors crossing galleries (left) and number of movement lines entering galleries (right)

The second method of describing exploration emphasized the number of paths that are directed towards different directions in spaces offering choice. Each of the case study gallery layouts includes a number of spaces offering choice. For the purpose of descriptive analysis, spaces offering choice at the beginning of viewing sequences were used to examine the distribution of movement in various directions. This was done because these spaces may influence overall distribution of movement in the layouts. In these locations, the distribution of movement into available directions was examined by counting the movement lines that crossed the gallery the first time (representing a visitor's first arrival on the gallery floor). The results obtained from this analysis demonstrate the percentage of first time visitors' movement lines distributed among the available directions.

The measures capturing explorative behavior described above were compared with the visibility properties. In the first step of this comparison, the frequency of visits to each gallery room, a pattern of exploration described by the number of movement lines entering each gallery, were correlated with the visibility properties of the gallery rooms. The visibility properties of each room are represented by visibility graph measures obtained by taking average values of visual connectivity, control and integration measures on the grid cells in each room. The correlation of these visibility measures with counts of movement lines serves to establish the association of the visibility structure with explorative movement. In addition to this, the number of movement lines were also correlated with the average values of the non-syntactic visibility measures, in particular a number of isovist measures described in section 2.4.1. Among these, the isovist perimeter measure of a single point isovist denotes the length of the boundary of the visible polygon region. Occlusivity measures the total length of occluding boundary, in other words the edges of hidden regions in the visual field. The isovist maximum radial denotes the longest line of sight in a visual field. These measures can be obtained as average values from all grid points in a gallery room (grid-isovist measures). Averages of the perimeter and occlusivity measures of the grid points in a room indicate boundary the characteristics of a view available at any point in that room. The aim of correlating movement lines with these grid isovist measures is to investigate whether these aspects of local visibility play role in predicting exploratory movement.

The second part of this investigation examined the relationship between movement lines and visibility properties using finer grain spatial unit that were determined in the grid cells of visibility graphs generated with *Syntax 2D*. Using the "path-count" feature of *Syntax 2D* movement lines entering each cell of a designated grid can be counted; using this same feature, the grid isovist and VGA values of each grid cell are also be calculated. The number of movement lines crossing the grid cells was correlated against the grid isovist and VGA values of those cells. The aim of this investigation is to reveal whether exploratory movement described in the designated grid cell is linked to visibility properties described at those points.

The third aspect of this investigation focuses on other techniques capturing exploratory behavior described by the paths distributed into various directions at the spaces offering choice. This step investigated the extent to which local non-syntactic visibility properties may predict visitors' choices to move towards the available directions. In this regard this particular investigation explores which directions visitors take based on the gradually unfolding visual information as they move in the layout. It has been hypothesized that permeability is most likely to shape visitors' choices in movement direction (Wineman & Peponis). To explore this possibility, the ratios of movement lines distributed into each direction were noted and compared with the non-syntactic local visibility at those directions. For this analysis, single point isovists were generated in knee level graphs of *Syntax 2D* from the spaces offering choice, in order to measure the extent of visibility at the level visitors could move. In order to describe the visibility at the available directions, visual field polygons were generated from. At each of these spaces, the center point of that space is accepted as a vantage point of the point isovist (visual field). Also as discussed earlier, within a visual field, extent of visibility can be described in various ways through visual field polygon measures such as *area*, *perimeter*, *occlusivity*, and *compactness*. Using *Syntax 2D's* isovist division feature that was developed along with the methodology of this research, the visual fields were divided into radial portions corresponding to the available directions (Figs. 3.10 and 3.11). The partial values of the visual field measures (area, perimeter, occlusivity, drift, compactness, and circularity) retrieved from those divisions were calculated as percentages within the entire visual field measure obtained at the knee level isovist graph. On the other hand, to explore how movement is distributed to available directions offered at choice points, the movement lines leaving to each of the available directions were counted separately to quantify their percentage in relation to the all movement lines leaving those spaces. These movement line ratios of each direction were correlated with for visual field measures at the corresponding directions.

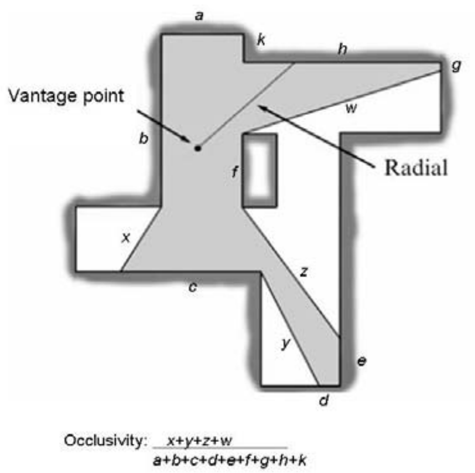


Figure 3.10 Visual field polygon and occlusivity measure

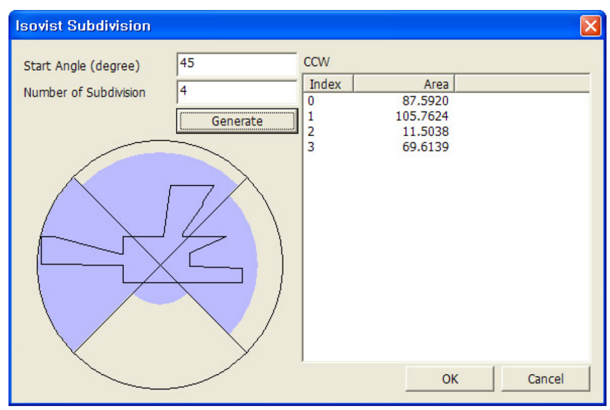


Figure 3.11 A sample application by Syntax 2D, point isovist dissected into angles of permeable directions.

Patterns of Contact with Displays

Visitors' patterns of contact with displays were analyzed using data for stops to view displays. To describe patterns of contact, the stop counts were examined using two measures. First, the stops to view displays in each room were examined to determine how many displays were visited in relation to the number of displays in each room. The proportion of the displays visited was calculated for each room and these proportions were examined throughout the layout to identify the rooms where all displays were viewed. Second, to understand the frequency of stops to view displays, stops recorded at each display are examined. In order to understand approximate frequency that displays were viewed in every room, the total number of stops recorded in each room was divided by the number of displays visited in those rooms. This calculation normalizes the counts of stops recorded in each room and indicates the approximate amount of attention each display received. The distribution of this measure throughout the layout is presented in a color shaded floor plan diagram so that it is easy to identify the gallery displays that were visited most frequently.

The descriptive examinations described above provide the basis for investigating the effect of gallery layout on patterns of contact with displays. These measures obtained in each room were then correlated with visibility properties, as explained below.

To compare the patterns of contacting displays with spatial layout properties, this study isolated a number of measures that define the behavior of stopping to view displays and compared these measures with the following syntactic and non-syntactic visibility properties: (1) the gross number of stops to view displays, (2) the number of the stops normalized by room sizes, and (3) the number of stops normalized by the number of available displays in each room. The first measure describes the behavior of stopping to view displays irrespective of any other factor like room size or displays. The second measure, the number of stops normalized by room size, describes the stopping behavior by eliminating the room size factor, which may influence the frequency of stopping. Similarly, the third measure, the number of stops normalized by the number of available displays in each room, describes the behavior of stopping to view displays by normalizing the various number of displays that might affect the frequency of stopping in each room. Although not examined descriptively, these measures are directly compared with syntactic and non-syntactic visibility properties. The correlation with syntactic visibility measures, visual connectivity, and control helps to clarify how stopping behavior might be linked to the visual information of adjacent locations, while the correlation with average and maximum values of visual integration contributes to understanding whether the stopping behavior might be associated with the rooms' capacity to capture the visibility of all other locations in the layout. The measures describing the behavior of stopping to view displays were also correlated with non-syntactic visibility properties obtained from grid isovist measures. The aim of this correlation is to explore which aspects of local visibility may affect stopping behavior.

To explore the link between gallery layout properties and rates of visit displays, this analysis correlated two measures: the visibility properties of the rooms (both syntactic and non-syntactic) and the percentage of displays visited plus the average frequency of visits per display in each room. Correlating the percentage of displays visited in each room with average values of syntactic visibility measures (visual connectivity, control, and integration) contributes to understanding whether the visibility capacities of the rooms influences the extent to which the content is read in each room. The correlation with non-syntactic properties explores which aspects of local visibility may influence the extent to which display content is read. These correlation investigations were repeated for the average frequency of visit per display in each room, to investigate the link between frequency and syntactic and non-syntactic visibility measures.

Last part of these correlation investigations explored whether the stopping frequency for each display object is linked to visibility properties of display location. Here, the aim is to understand whether the stopping behavior is motivated by visibility of individual displays. To this end, the number of stop counts for each display object was directly correlated with the visibility of the display location.

Patterns of Contact with Layout

Visitors' patterns of contact with the layout were examined using the "scanning stops" recorded. Visitors' pauses analyzed in this part were not those recorded while visitors viewing of particular displays; instead the pauses that were recorded while visitors scanning the layout, looking at the spaces of architectural expression and looking out the windows. For the purpose of descriptive analysis, the data of scanning stops were examined on the floor plan diagrams to identify the parts of the gallery floor that seem to be used for scanning and looking at the atrium, or looking outside. The scanning stops data were analyzed using a number of measures that describe behavior of stopping for reasons other than viewing displays. First, this behavior is described in relation to stopping behavior in general. To this end, scanning stops were counted for each room, and examined as a proportion of all stops noted in each room. While the total number of scanning stops simply describes the frequency of stopping for something other than viewing displays, the proportion of scanning stops among all stops in each room denotes the significance of visitors' stopping for other reasons within their general stopping behavior. The obtained proportions were recorded as percentage ratios on the floor plan diagrams.

The extant study investigated the potential influence of gallery layouts on visitor's contact with those layouts by correlating the measures derived from the scanning stop counts with the visibility measures. First step of this particular investigation was undertaken to understand the effect of layout on the general behavior of stopping for reasons other than viewing displays. To describe this behavior at the scale of a gallery room, scanning stops were recorded in each gallery room, and two measures were devised: (1) the gross number of scanning stops in each room, (2) the number of scanning stops normalized by room area. The first measure denotes the frequency of stopping for other reasons, irrespective of any other factor, while the second measure denotes this frequency when controlling for the room size.

In order to investigate the link between the frequency of scanning stops at the room level and visibility properties, these measures were directly correlated with syntactic and non-syntactic visibility properties. The correlations of the syntactic visibility properties (visual connectivity, control and integration) with the gross as well as the normalized counts of scanning stops in each room can show whether the potential of those rooms to reveal adjacent and all other locations would influence the frequency of stopping for other reasons. In addition, percentages of scanning stops within total stop counts were also correlated with average syntactic and non-syntactic measures obtained for each room. The comparison of the percentage ratios with syntactic properties serves to reveal if the visitors' behavior of stopping for other reasons is more significant in the gallery rooms that have certain visibility properties. The comparison of all these measures with non-syntactic visibility measures also helps to clarify whether certain aspects of local visual information plays role in the prediction of scanning stops.

Relationship between Movement and Stopping

In addition to examining separately patterns of exploration, patterns of contact with displays, and patterns of contact with the layouts, the relationship between patterns of exploration and contact was investigated by comparing the distribution of movement lines and stops counts. This comparison is made by calculating ratios between movement line counts and stop counts in each room and correlating these measures with each other. The correlations between movement lines and stop counts demonstrate how the rates of movement and stopping in rooms co-vary throughout the layout. The calculation of ratios between movement lines and stop counts reveals whether visitors stopped in the locations where they were moving, or they meandered without stopping. A ratio of moving to stopping equal to 1 represents a usage in which visitors stopped each time they entered a gallery room; and ratios greater than 1 indicate that visitors stopped less frequently along their movement.

In order to analyze how visitors' explorative behavior is related to behavior of stopping to view displays in the layouts, the ratios between movement lines and stop counts for viewing displays in each gallery room were indicated by color shades on the floor plan diagrams. These diagrams demonstrate how the calculated ratios of movement lines to stop counts vary throughout the gallery floors and reveal a number of characteristics of the space-use patterns. First, the diagrams illustrate whether the ratios between movement and stop counts might be affected by room size, for example if larger rooms have facilitated frequent stopping within a movement rate comparable to the other rooms'. If rooms of similar size have different movement-stop count ratios, there might be other factors that motivates frequent stopping such as number of available displays. Second, the diagrams showing the movement line and stop count ratios demonstrate whether some spaces motivate visitor exploration rather than display-viewing. For instance, a higher movement-line to stop count ratio indicates space-use based on exploration rather than viewing.

Following these examinations, the relationship between exploratory behavior and stopping behavior were investigated by establishing correlations between the counts of movement and stop recorded in each room. To accomplish this, the number of movement lines was separately correlated with stops viewing displays and with scanning stops. This study therefore can identify to what extent exploratory behavior can be linked to the behavior of stopping to view displays, and the behavior of scanning, individually. In the first step of this investigation, the movement lines were directly correlated with stop counts for viewing displays and for scanning stops in order to demonstrate how exploratory behavior roughly co-varies with display viewing and scanning behavior. In order to investigate these relationships more accurately and by considering the effects of room size and displays available in each room, the correlation investigation used a partial correlation procedure. Partial correlations are used to investigate the link between the two variables when there might be a third or additional variables that interfere with this link. The partial correlations procedure computes partial correlation coefficients that describe the linear relationship between two variables while controlling for the effects of one or more additional variables. By controlling for the effects of those additional variables, partial correlation procedure virtually eliminates the effect of the additional variables. In this procedure, room size and the number of displays available are assigned as controlling variables in the consecutive steps of investigating the links between explorative movement and stopping behavior. The obtained correlation values were examined to see if the relationship of movement lines with either group of stop counts (viewing displays or scanning stops) would be stronger when either room size or the number of displays are controlled.

All of these correlation investigations were repeated to exclude the entrance galleries where movement line- stop count ratios can be much higher than those for the rest of the layout. By excluding the entrance galleries, it was possible to investigate the relationship between exploratory movement and stopping behavior only in the spaces whose function is for visitors to view displays.

In addition to investigating the links between exploratory movement and stopping behavior, the analysis also looked at whether gallery layout has an effect on this link. To investigate this, movement-stop count proportions (both normalized and gross values) obtained for each room were directly compared with the syntactic and non-syntactic visibility properties of those rooms. As movement-stop count proportion expresses the rate of movement in relation to stopping, the comparison of this proportion with visibility reveals whether visibility may motivate visitors predominantly to move in the galleries instead of stopping to view displays more often, or visibility facilitates visitors' stopping in the spaces where they move.

3.5 Cross-Comparative Analysis of the Case Study Museums

Following the in-depth analysis of the case study gallery layouts through the various investigations outlined above, the results obtained from case study museums were comparatively evaluated. The first part of this evaluation involves a cross comparative examination of the spatial properties of the case study layouts (both permeability and visibility relations) with respect to their morphological characteristics. In this part, the gallery layouts are also comparatively analyzed in terms of their level of visual intelligibility. Visual intelligibility of a layout refers to the degree to which visual connectivity of individual spaces reveals the visual integration of the entire layout. As suggested in the space syntax methodology, visual intelligibility of a layout can be obtained by correlating visual integration and connectivity values. The visual intelligibility analysis is included only in this comparative analysis part, instead of individual analysis of the museums because the intelligibility values obtained from the three museums can best evaluated in comparison to each other and in conjunction to their morphological characteristics. In this comparative discussion of the spatial layout properties and visual intelligibility values, the aim is to establish a framework where results obtained from individual case studies can be evaluated in relation to morphologies of the three museums.

In the second part of this evaluation, the results obtained from investigating the gallery layouts effect on exhibition narratives were examined cross-comparatively. For this part, the degrees of structure in narrative and in spatial organization of the three layouts were comparatively analyzed. To compare the degree of structure in the three museum layout's narrative organization, the curatorial intent and the logic of narrative organization observed in the three layouts were examined. To compare the degree of spatial structured-ness, the average values of visual integration and connectivity measures of the layout were comparatively examined. In this examination, high mean values for both properties demonstrated two conditions in the distribution of these properties. For example, a high value of mean connectivity (or integration) value denotes either many quite connected (or integrated) spaces, or a few highly connected (or integrated) spaces in the layout. These two conditions were further understood by looking at standard deviation of the mean connectivity and integration values.[14] A higher standard deviation in the property of connectivity implies that few parts of the layout are connected to many other spaces in their neighborhood while some other parts may be much less connected. Similarly, a higher standard deviation in visual integration implies a spatial hierarchy, as few spaces can be visually close to all other spaces whereas other spaces would be highly isolated. These conditions in the spatial structure, such as spatial hierarchy whereas evenly distributed visual integration, would indicate how narratives might be presented within a generative mode. With regards to display viewing, if there is a spatial hierarchy facilitated by few highly integrated spaces as opposed to other isolated spaces, the displays in the highly integrated areas would be read in relation to many other displays in the layout. This means, the themes represented in the integrated areas are explicitly emphasized and the rest of the narrative is read from the lens of these themes. Or else, if visual integration is more evenly distributed throughout the layout, more display groups can be read in relation to others and the focus of the narrative is dispersed to multiple themes. The aim of this part is to identify how the morphological characteristics play a role on presenting the exhibition content as prescribed in curatorial intent or by generating new narratives.

The third part of this comparative evaluation examines the results related to the prediction of space use patterns for each layout. This part aims to identify the morphological characteristics that might be responsible to predict certain space use patterns.

[14] The standard deviation denotes the degree to which maximum and minimum values are differentiated from the mean value. If a standard deviation is smaller, the values (including maximum and minimum ones) are closer to the mean value, if a standard deviation is larger, the values are highly varied and there are values in much higher and lower than the mean value. In case of spatial properties such as connectivity and integration, the standard deviation shows to what extend a layout's local and global spatial interconnectedness is evenly distributed.

CHAPTER IV

CASE STUDY 1:
THE YALE CENTER FOR BRITISH ART

4.1 Chapter Overview

This chapter presents an in-depth analysis of the fourth floor gallery at the Yale Center for British Art, investigating how the gallery layout shapes the narratives and to what extent it predicts the space use patterns. Following an introductory description of the museum's collection and the museum building design characteristics, this chapter describes two analyses. The first examines the exhibition content in terms of its organization in the gallery layout and compares the exhibition narratives to the spatial layout properties; the second part analyzes visitors' space use patterns and correlates those patterns with the spatial layout properties.

4.2 The Yale Center for British Art's Collection and Museum Building

The Yale Center for British Art (YCBA) was founded in 1966 when Paul Mellon (American philanthropist and a Yale University alumnus) donated the greater part of his British art collection to the university (Robinson, 1985). The collection consists of paintings, sculptures, watercolors, drawings, prints, rare books and manuscripts that date from the sixteenth century to the mid-nineteenth century. Since the foundation of the center, the collection has grown as a result of gifts of Paul Mellon, the Yale alumni and other British Art collectors. With few exceptions, the acquired pieces were confined to the works of artists who were born before1850, thus, the collection is characterized by works dating from the1650s to the 1850s (Robinson, 1985). In contrast to its narrow focus on this time period, the collection rather broadly defines what is considered British Art. In addition to the works of British artists produced on British soil, the collection includes pieces from foreign artists who went to the United Kingdom and painted for British patrons, as well as works of British artists painted abroad, and works of other foreign artists who were influenced by British Art. Today, the collection is known for being the largest collection of British Art outside the United Kingdom.

The mission of the YCBA has been determined by the museum's commitment to presenting Paul Mellon's private collection and representing British art and cultural legacy (Meyers, 2007). To this end, the mission of the museum has several goals, of which, honoring of Paul Mellon' collecting interests has been central within the considerations of the YCBA's exhibition programs (Meyers, September-December 2005). To fulfill its mission and the museum program, the YCBA is planned as a place where the collection is presented "in such a manner that the significance of British art may be fully appreciated by all those concerned with the study and viewing of works of art" (Prown, 1977, p. 15). Further, according to the museum program, an additional aim is that the collection should be available for a broad range of British studies, serving as a resource for the understanding of Anglo-American civilization and working "as a model for developing a total view of the interrelationships of art, literature and society" (Prown, 1977, p. 15) Consistent with these stated objectives, the goal for interpreting the collection is to present the works of art and the archival material to reflect "the development of British art, life, and thought from the Elizabethan period onward" (Meyers, 2007). The interpretive goal extends the YCBA's function beyond being a place displaying art, but a center for studying British art and culture where the galleries work as a laboratory for researchers and British art enthusiasts.

Working within these interpretive goals, the building was commissioned with a program that includes exhibition space for the collection, research libraries, a photographic archive, a print room; conservation laboratories for paintings and paper, a lecture hall, seminar rooms, offices and work areas (Prown, 1977, p. 15). Along with such spaces, the planning committee also wanted

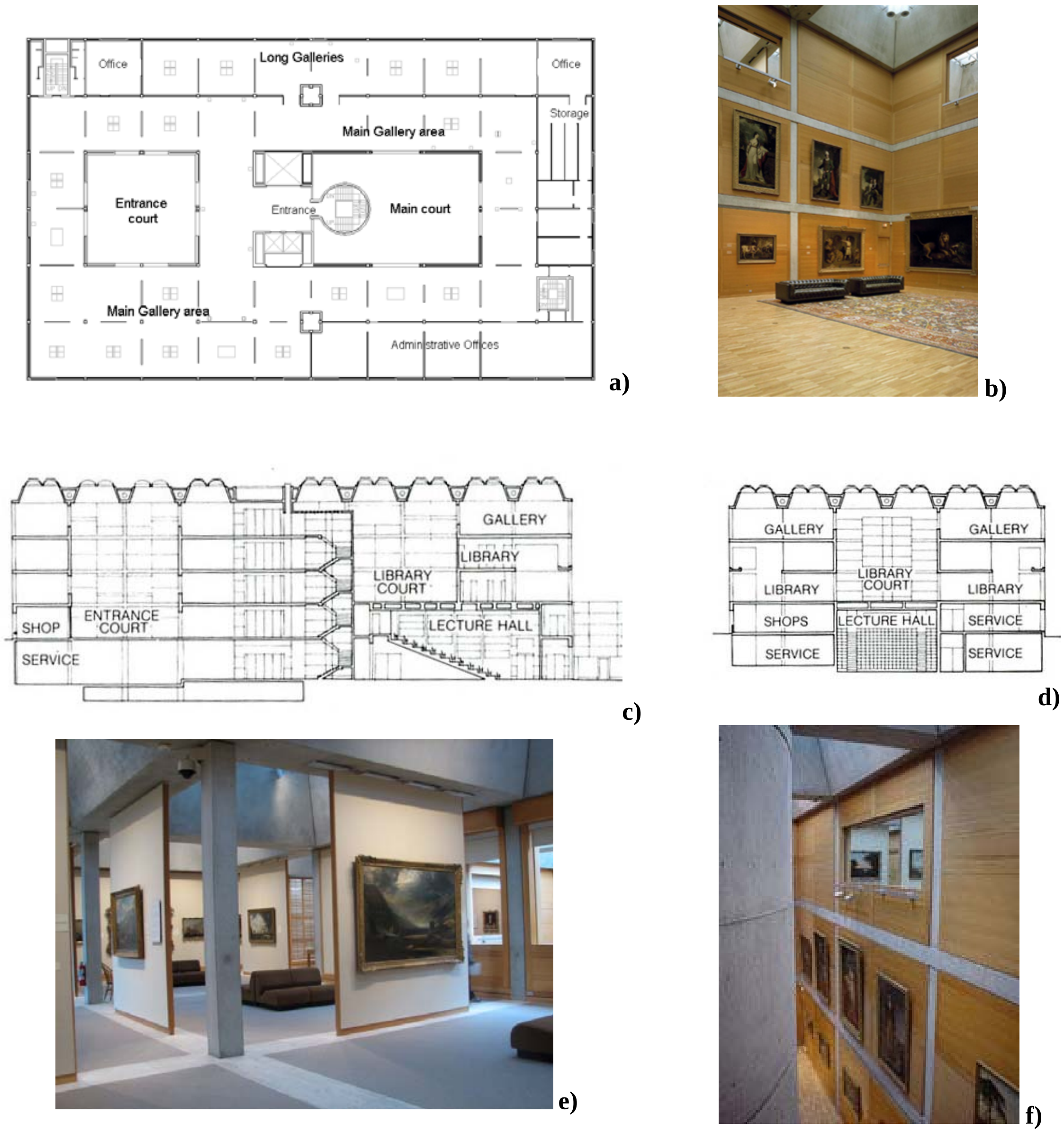


Figure 4.1 The Yale Center for British Art **(a)** 4th floor gallery, **(b)** main court, view from second floor (photo: Richard Caspole, YCBA, **(c)** longitudinal section, **(d)** transverse section, **(e)** view from the main gallery area, fourth floor **(f)** main court views from the 4th floor entrance area.

the building design to establish a comfortable relationship with its visitors. To achieve this, the planning committee requested that the museum building contain variety in scale and views through the combination of "large and small spaces, high and low ceiling heights, private and public spaces." The committee also noted that "the organization of spaces should provide legibility [and] choices in navigation" and "evoke interest and curiosity," in order to prevent "museum fatigue" during the visit (Prown, 1977, pp. 13-14). After some deliberations, the planning committee awarded Louis I. Kahn the commission for the building, which was opened to visitors in 1977.

The YCBA is housed within Kahn's modernist rectangular volume constructed on a structural grid. The grid introduces square shaped bays as a spatial unit, six of which are positioned in the transverse direction and ten in the longitudinal direction of the rectangular volume. The museum's exhibition galleries are composed of these bay units, which are located on the second, third and fourth floors of the building. The fourth floor galleries are the highlight of the building because of the large exhibition space reserved for the permanent collection of painting and sculpture, and the connection to the two atria of the building. The connections to the atria on this floor provide an opportunity to experience the entire building through the atria voids (Figs. 4.1 a to f).

4.3 The YCBA's Fourth Floor Layout and the Exhibition Narratives

4.3.1 Exhibition Content: British Art in the 16th and 19th Centuries

As a first step of understanding the exhibition narratives presented on the YCBA's fourth floor, this section focuses on reviewing the major themes represented by the display groups in the museum's collection. The information on the exhibition in the fourth floor galleries was compiled in summer 2005 during and after the installation of the exhibition. The compiled information includes curators' comments recorded during open-ended interviews, the published statements of the curatorial team in printed sources for visitors. Additionally, to more deeply understand the exhibition content this analysis is informed by YBCA publications discussing the interpretations of the works of art as well as other scholarly sources on British Art.

As indicated in the museums' publications advertising the 4th floor exhibition, the YCBA holds more then two thousand pieces of British painting and sculpture, only around three hundred pieces of which can be displayed in the fourth floor galleries at a time. Given this constraint, the pieces on display are rotated at certain intervals to allow for explorations of different dialogues among the works of art (Meyers, May-August 2005). The significance of the 2005 exhibition analyzed in this study can best understood within a brief review of the museums' exhibition history. As discussed in the sources, the museum had recently acknowledged the fact that the ways of exhibiting art have changed in recent decades. Thus, in a move away from a one-person (historian) story conveyed through constrained sequences with direct references to historic periods of British Empire, since 1998 the museum's curatorial team has been exploring new approaches to telling the story of British art. To explore alternative ways of displaying, the museum's curators reclassified the paintings and pieces of sculpture into various thematic groups other than historic periods (Fellman, 1999, pp. 45-46). These groups referred to such aspects as genre, style, individual artist and subject matter through which the British Art (between 16th-mid 19th centuries) could be newly studied and understood. Although the new approach was first visible in the narrative structure of the 1998 exhibition, that exhibition still included a suggested viewing sequence. In contrast, as indicated by several sources in the museum, the permanent exhibition installed in 2005 uses only implicit references to historical periods and offers alternative viewing sequences without a prescribed route, thus illustrating the museums' most contemporary approach to exhibiting and understanding the British art. The most distinctive feature of this exhibition in comparison to earlier approaches is the curator's intuitive acknowledgement of the potential of the gallery layout, one that realizes the appropriateness of the symmetric organization of the layout for providing choices in navigation rather than dictating a prescribed route (Trumble, 2005b).

The open-ended interview with the curator revealed some of display strategies and principles underlying the installation. As the curator confirmed, the primary intent of the 2005 installation is to place the works of art in a manner that creates an aesthetic experience where British art is enjoyed and appreciated, while affording some continuities and contrasts between the narrative themes (Trumble, 2005a). In particular, he combined the works of art on the basis of the subject matter and individual artists so that they would be appreciated within their aesthetic and experiential qualities. To achieve this, he combined some of the least-known pieces with the masterpieces which provided accessibility to the least-known pieces in the collection and explored the possible dialogues of those items with other masterpieces. As a general principle, he avoided any suggestion that the spatial relationships of the display groups offer one-to-one correspondence to the thematic relationships between these groups interpreted by his curatorial understanding and art historical sources. In his view, looking for directly corresponding expressions of the content would be too straightforward to understand and appreciate the British art. Rather, he suggests, the exhibition offers "gentle transitions" between the display themes within the placement of displays based on implicitly chronological sequences (Trumble, 2005a). Despite these statements, when scholarly interpretations display groups and particular pieces in the YCBA are researched in publications and other scholarly sources, the exhibition themes presented in the YCBA didn't seem to have deviated from the scholarly understanding of the British painting and sculpture. The display groups make the most sense if one knows the historical development of British art in relation to the political periods of the British Empire.

As indicated by the curatorial team, the exhibition installed in 2005 displays in two groups selected paintings and pieces of sculpture from the collection: works dated from the 16th to 17h century and works dated from 18th to mid-19th centuries. The works of art in the first group include predominantly portraits; while the group of later period includes marine and natural scenery paintings, which flourished in the early eighteenth century as the artists explored these subjects more extensively in the later periods. Therefore, YCBA fourth floor gallery layout presents the content pertaining to these groups, portraiture and landscape, characterizing the British art in those consecutive time periods.

Among the portraiture selected from the 16th and 17th centuries, the earliest dated pieces are Elizabethan and Jacobean portraits that were painted in the Queen Elizabeth I and King James

I periods. As interpreted in scholarly sources, given the secular imagery of these portraits depicting sitters from the British aristocracy are characteristics of British art, which reflected separation of the Church of England from the Roman Catholic Church in the Reformation period (Butlin, 2001). As suggested by the curatorial team, another group of paintings from 16^{th} and 17^{th} period, known as House Painting, depicts English courthouses from a bird's-eye view and illustrates decorated yards designed in an orderly manner that bears a resemblance to the decorated clothes of the figures in Elizabethan and Jacobean portraits. Within the same period,

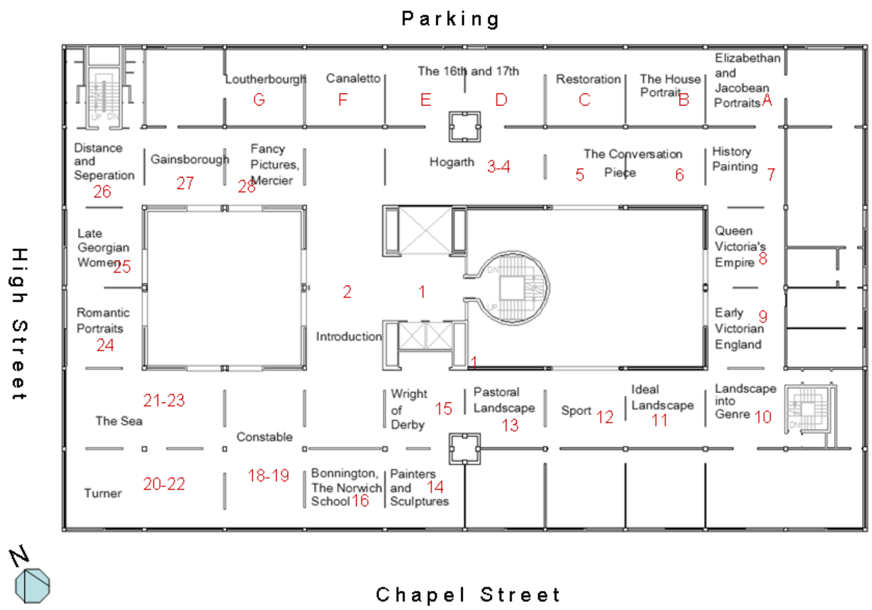


Figure 4.2 Map showing the placement of the exhibition themes on the fourth floor of the Yale Center for British Art.

Figure 4.3 Display of Elizabethan and Jacobean portraits in Bay A, in the Long Gallery section

a group of portraits painted by foreign artists, Lely, Dobson and Cornelius, depict females “in court” and thus picture beauties of the Restoration period (Trumble & Albinson, 2005).

The works of art from the 18th and 19th centuries are predominantly those of British artists both abroad and on British soil. The themes of this group include both portraiture and landscape paintings. As discussed in scholarly sources, British portraiture reached its high status as a result of commissions from the British aristocracy, bourgeoisie, city merchants and institutions (Waterhouse, 1962; Butlin, 2001). In addition, British portraiture was strongly influenced by Dutch portrait painter Van Dyck during his long residence in England (Gombrich, 1989; Butlin, 2001; Trumble & Albinson, 2005). Such influence from foreign artists was common among the most notable British portrait painters as they developed their own artistic styles.

Within the 18th and 19th British portraiture, a significant display group selected from the YCBA collection represents a genre called Conversation Piece, which was originated by British painters. In this genre, the word “conversation” is used to characterize informal group portraits as well as imaginary views of daily life. In British portraiture, the subjects of conversation pieces are families or friends engaged in everyday activities such as hunts, meals, or music parties. As discussed in the curatorial sources, conversation pieces depict the lifestyle of the prosperous middle class (merchants, industrialists, and colonial landowners), which emerged as Britain’s colonial empire expanded and its Industrial Revolution began ("NGA: British Conversation Pieces and Portraits of the 1700s," 2008). As indicated in the literature, conversation pieces became fashionable in eighteenth century with the influence of William Hogarth, the English painter who brought a “moral subject” and satire to his portrait compositions (Mullins, 1983; Trumble, 2005a). Among notable British conversation pieces, works of Arthur Davis are characterized by informal compositions of small size figures painted with detail and charm of the middle-class in their domestic settings (Alexander, 1998a). Within various artistic interpretations of conversation piece paintings imparted by British painters, some in the second half the eighteenth century were characterized by the Romantic vision of the painters. Within this group, French painter Phillip Mercier's Fancy pictures typically portray emotional gestures and vibrant expressions (Warner, 1998b). Similarly, the works of Gainsborough, are recognized by their delicacy and poetic sensibility that reflected his anti-classicist tradition as well as his stylistic inventions (Bindman, 1985b; Gombrich, 1989). Gainsborough's work embodies the era of Romanticism, which emphasized sincerity, originality, individuality, imagination, spontaneity, emotionalism, and self-expression (Mautner, 1996, p. 488).

Benjamin West, an American-born painter who painted commissioned conversation pieces, was also inspired by subjects and events derived from classical literature and mythology, but became better known with his "History paintings". History Painting is also one of the display groups associated with British portraiture in the YCBA's collection. This group of paintings is considered highly influenced by classical idealism and characterized by allegorical compositions whose subjects were selected from mythological stories and given meaning through the poetic use of color and idealized scenery ("NGA: British and American History Paintings of the 1700s," 2008).

The second group of the YCBA's 2005 installation is British natural scene painting. Unlike British portraiture, British natural scene (landscape) painting emerged later in the 1700s and without much motivation of patrons.[15] As discussed in the literature, the British landscape painting was elevated to a status higher that that of portraiture and introduced as a "genre" through the individual efforts of artists as well as some influences from Dutch and Flemish marine painting (Bindman, 1985a). As understood from the curatorial interpretation of this group, the exhibition represents the British landscape painting through display groups characterized by artistic styles visioning nature and atmospheric light conditions. These display groups depict a range of themes in terms of subject matter, including such themes as rural and urban scenery,

[15] In wide definition of landscape architecture, a small group were commissioned for documenting patron's animals and sports activities

seascapes and marine life, as well as scenes of sport, hunting and animals. In the visions portrayed in these scenes, the transforming quality of light on natural and man made objects as well as man's relationship with untamed nature are the important elements of the narratives.

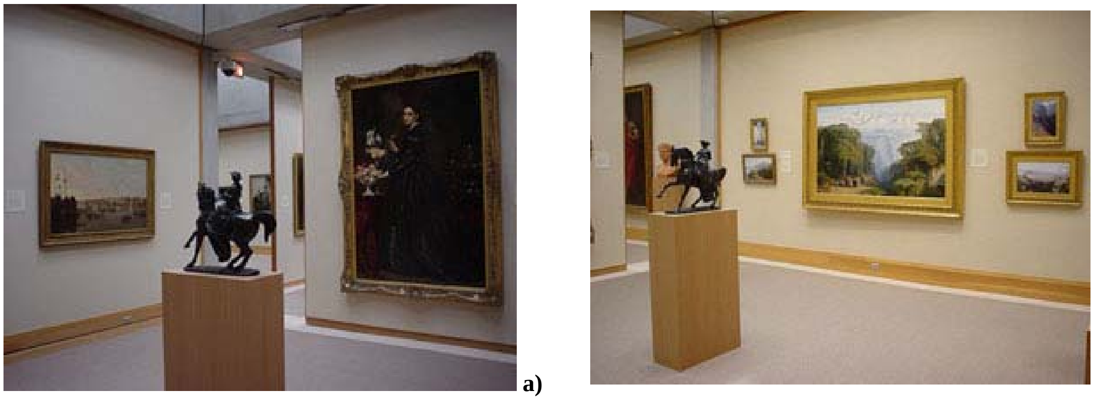
One of the display groups representing natural scene painting is placed under a notable British painter Joseph Wright (also known as Wright of Derby). He is known for his depiction of various light conditions on figures and objects. In the curatorial interpretation of the British landscape painting, Wright's works are placed in a sequence with other natural scenery paintings due his experimentation with natural light. In the literature, his paintings of scenes rendered with sharp shades of moonlight or candlelight are considered a reflection of realism in the Industrial Revolution as well as of Romanticism as applied to industry and science (Alexander, 1998b). Other works of British landscape placed in sequence with the works of Wright are classified under Pastoral Landscape, Sports, Ideal Landscape and Landscape into Genre themes. The Ideal Landscape group includes Wright's earlier works where he painted night time scenes of Italy, with dramatic representations of eruptions of Mount Vesuvius reflecting various colors in the sky, and moonlight scenes in Derby characterized by sharp tones and effect of lights on the subjects which imply his scientific vision (Egerton, 1990). As the curator of the exhibition suggested, the themes Pastoral Landscape, Sports, Ideal Landscape and Landscape into Genre themes provide convenient divisions that convey discrete and sometimes contrasting purposes of English landscape painting in the eighteenth century (Trumble, 2005a). Within these themes Landscape into Genre in fact refers to all attempts that contributed to the emergence of landscape painting as a genre.

According to the YCBA's curatorial interpretations, the Romantic Revolution in British landscape paintings marked a changing relationship between nature and observer (painter), as a result of the "transformation of the natural world" in the age of the Industrial Revolution. Thus, among the landscapes painted in the Romantic style, those by Richard Bonington and the

Norwich school of artists are characterized by their depictions of urban scenes, such as city monuments and commercial waterfronts (Noon, 1985). The culminating influence of the Romantic vision is seen in the art of John Constable and James W. Turner. Their works are displayed in the YCBA with a focus on their individual styles. While Constable is known for rustic rural landscapes, Turner, having been influenced by Dutch painters, associated with marine scenes (Hemingway, 1985; Noon, 1985). The Romantic vision in their paintings is realized through their untamed vision of nature. In both Turner's and Constable's works, nature appears as essentially volatile and changeable (McCaughey, 1998, pp. 16-17).

A significant theme represented with display groups of both British landscape and portraiture is associated with Queen Victoria's reign. As described in the literature, in the age of Queen Victoria the British art thrived on a sophisticated artistic taste reflecting the material values of British Empire's strongest political reign (Waterhouse, 1962; Mullins, 1983). In the YCBA's exhibition, this period of art is represented by two display groups called Early Victorian England and Queen Victorian Empire. The works grouped under the Early Victorian England theme were painted on British soil, and reflect the moral values influencing British society in that period. The pieces grouped under The Queen Victorian's Empire, on the other hand, are those painted by British artists traveling abroad and thus represent the great expansion of the British Empire during Queen Victoria's reign and its subsequent influence on the British Art (Figs 4.4a and b).

As can be concluded from this review, the display themes representing British Art between 16th and 19th centuries have various conceptual focuses, ranging from people and natural scenes as subject matter to art in certain political periods and the artistic styles of particular artists. This thematic variety may be due to the fact that the British art can be understood within the depth and complexity of the history of the British Empire, as well as experiential and artistic



a) b)

Figure 4.4 Views from the Queen Victoria's Empire: **a)** the full-scale portrait of a women, and an urban scene from abroad with Queen Victoria's sculpture **b)** a landscape from foreign countries with Queen Victoria's sculpture

qualities of the works. The political developments in the British Empire have direct and indirect influences on the artistic production and the subject matter painted. As for the subject matter, the works of British portraiture depict mannerisms and social status of sitters from the British aristocracy and bourgeoisie, while British landscape reflects independent artistic inspirations from nature and other aesthetic values shaped by the world view of their era. Acknowledging this complexity and depth of themes, the curator intends to structure an implicit narrative that conveys the "British-ness" of the collection most explicitly through subject matter and artistic endeavor (Trumble, 2005a, 2005b; Trumble & Albinson, 2005); this is because he believes it would be impossible to convey a complete narrative of British art within its one to one historical interpretation. Of many aspects that may connect the display themes to each other, those that allow the exhibition to be better understood can be elaborated in a discussion exploring how the content organization is expressed using the formal properties of the gallery.

Having reviewed the contents presented in the YCBA's 2005 installation, the next section will examine layout characteristics and spatial properties of the gallery layout using spatial analysis techniques of space syntax.

4.3.2 Layout Characteristics and Spatial Properties

The spatial organization of the fourth floor galleries gained its current shape with a major renovation in 1998. In this renovation, the Long Gallery section on the northern side, which was originally open to scholars only, was opened to public, thus enlarging the gallery area for display. In its current shape, the fourth floor main gallery area is composed of gallery bays arrayed around two atria. The atrium on the west side is called the entrance court and the other atrium on the east side is called the main court. The gallery bays around these atria are partitioned by "pogo" walls that were specially designed to create changeable divisions for various exhibition layouts. The resulting gallery rooms are composed of a single or a number of bays, determined by the position of the partitions. Regardless of the room size, the structural grid is reflected on the floor and walls through an exposed concrete frame and other materials. Because the gallery rooms are visually divided into the square bays, this pre-conditions the manner of classifying the display objects.

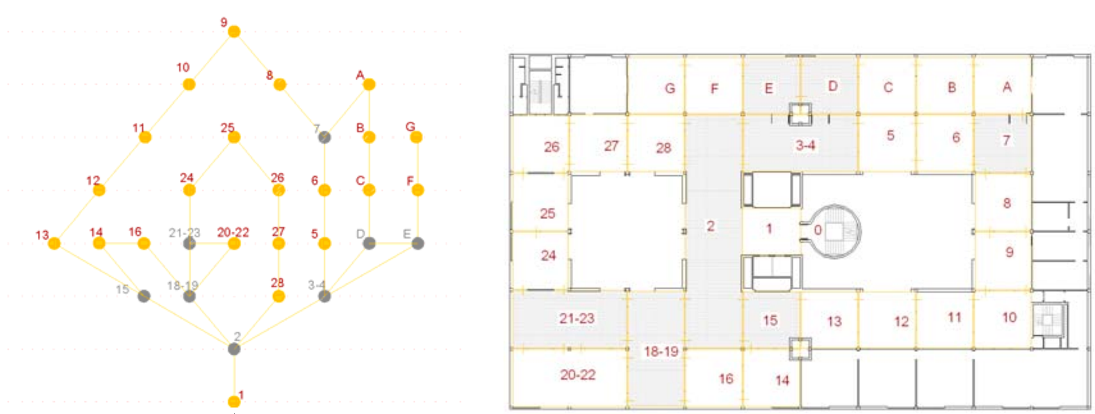
The spatial qualities of the gallery layout were shaped within Kahn's conception of how British Art could be displayed in a museum. He conceived of a museum as a "library" where "art objects would be read [page by page] and studied as well as enjoyed" (Prown, 1977, p. 17). His design ideas for the building were derived from the concept of English country houses, where hallways and corridors served not just passageways, but as spaces "where the work of art was hung and people browsed them, sat down and talked" (Prown, 1977, p. 17). This characterization of the gallery space as being a passageway as well as a room was achieved by positioning the partitions in the middle of the gallery span defining gateways at the two sides of the partitions.

Beyond these layout characteristics, the spatial properties of the YCBA's fourth floor are analyzed here by examining the gallery layout's permeability and visibility relationships. The permeability relationships are examined using justified graph, convex map, and axial analysis techniques of the space syntax methodology.

Permeability Relations

The justified graph of the layout shows that the permeability relationships in the YCBA's fourth floor are characterized by a number of *rings*. Two of these rings are formed around the two atria, one from bays 2 through 9 which are located around the main court, and one from bays 2 through 25 located around the entrance court. Another ring is formed between the long galleries (bays A through D) and bays 7 through 3*4. Smaller rings are seen at two sides of bay 18*19, one seen through bay 14 and the other through 20*22. As can be seen in the graph, the nodes where a ring is formed have a higher number of links to spaces than do the other nodes in the configuration. According to space syntax methodology, nodes can be distinguished on the basis of their topological location in a configuration, and the nodes where the rings are formed (called d-type node, as explained in Chapter III) can be regarded as the places where movement is distributed into various directions. As discussed in the methodology, these nodes represent the spaces where visitors can make a choice as to the direction they will proceed. Figure 4.5a depicts YCBA's fourth floor gallery layout as justified graph and the spaces that can be considered d-type node are denoted with darker color.

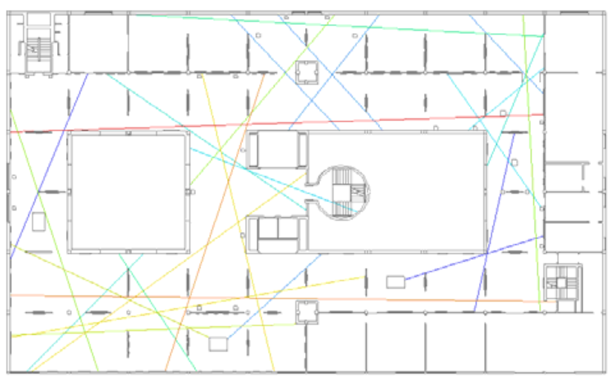
An examination of the fourth floor gallery's axial line maps reveals that the gallery bays sequenced in the longitudinal direction provide uninterrupted permeability along the gallery floor.



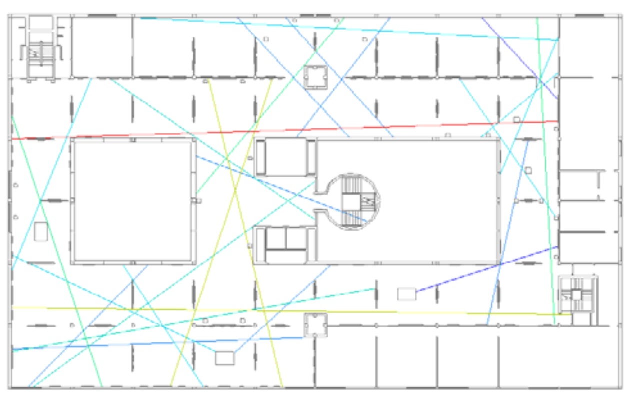
a) b)

Figure 4.5: Permeability structure of the YCBA's fourth floor. Nodes of path-choice are with darker color **a)** Justified graph, **b)** Convex space map

The axial line analyses generated to measure connectivity and integration values illustrate that the axial lines with the highest integration and connectivity values are through the room sequence at the northern side of the atria (Figs. 4.6a and b). This indicates that potential movement is most likely to be attracted at both the global and local levels along this sequence. However, the longitudinal axial line through the southern side has medium strength in terms of connectivity and integration. The connectivity value of this axial line is approximately the same as that of the line through the "Introduction" bay (the room between the two atria) and the bays located at the south-west corner of the gallery. This shows that movement at the south side of the atria core and south-west corner is more likely to be predicted by layout at the local level. These results suggest that the movement paths will be attracted to the longitudinal side of the atria core, but with more strength at the north side of the atria core.



a)



b)

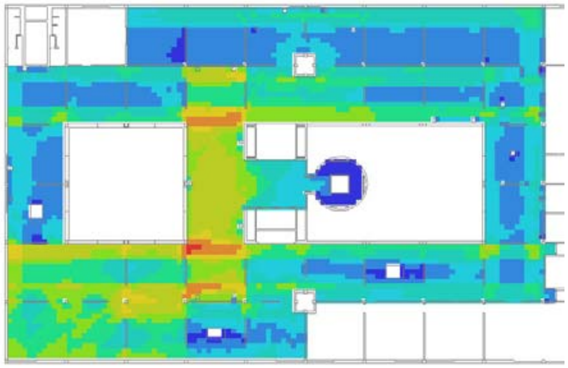
Figure 4.6 Axial line maps of the YCBA's fourth floor: **a)** degree of connectivity. **b)** degree of integration.

Visibility Relations

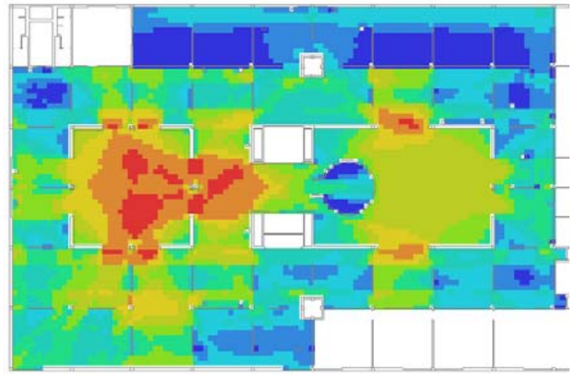
The visibility relations in the YCBA's fourth floor were examined through integration, connectivity and control graphs generated by *Depthmap.* The visual connectivity graph generated at eye level (Fig. 4.7a) shows that the highest degree of visual connectivity is located at the central parts of the Introduction gallery (the gallery in between the two atria) and at the main atria's openings facing north. Thus, observers situated at the Introduction gallery and at the atrium openings would see the largest possible area of the gallery compared to anywhere else in the layout. In contrast, low connectivity values are found for the Long Gallery bays and the bays at the north-western and north-eastern corners (bays 26 and 7) and are the least connected areas. This suggests that observers situated in these spaces will see smaller portion of the other gallery bays than they would in other bays. For visual connectivity graph generated at knee level, the high connectivity values are limited to small areas of the inner corners of Introduction gallery, while the lowest connectivity values are more evenly located in the middle regions of the gallery rooms.

The visual control graph of the YCBA generated at eye level (Fig. 4.7e) shows that the north and south side openings of the main atrium, south side openings of the entrance court and the gateways in the Long Galleries have the highest control values. When this is compared to the visual connectivity graph, the doorway threshold in the Long Galleries clearly have high control values. Therefore, observers situated at those points would have visual access to the bays at either side, although these bays would not be visible from other spaces in the layout.

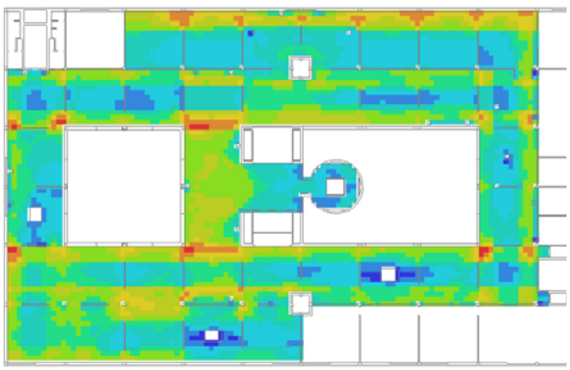
As can be seen in the visual integration graph generated at eye level (Fig. 4.7g), the most integrated areas extend from the entrance court (the western atrium) through the Introduction gallery and towards its northeastern corner going through gallery bay 3*4. The atria openings on the north and south sides also have high integration values. While medium level integration values are located at the gateways (at both sides of the pogo walls) in the sequence from the



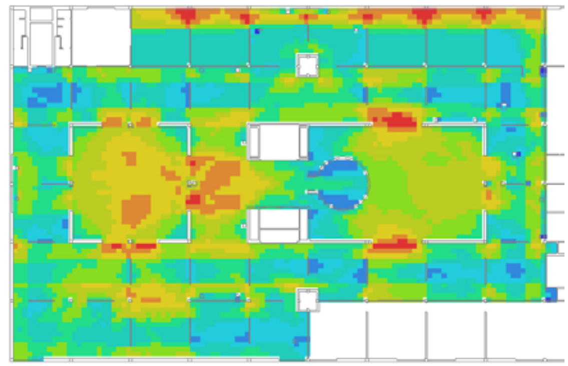
a) Visual connectivity graph at knee level



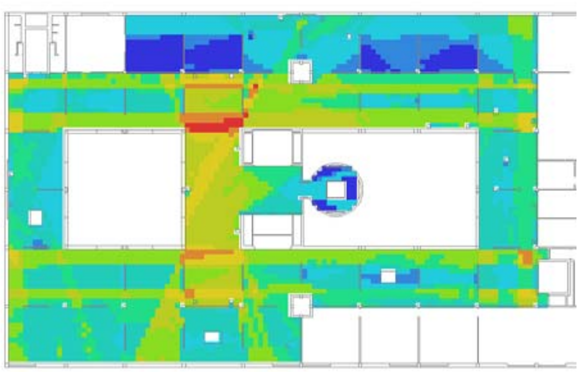
d) Visual Connectivity at eye level



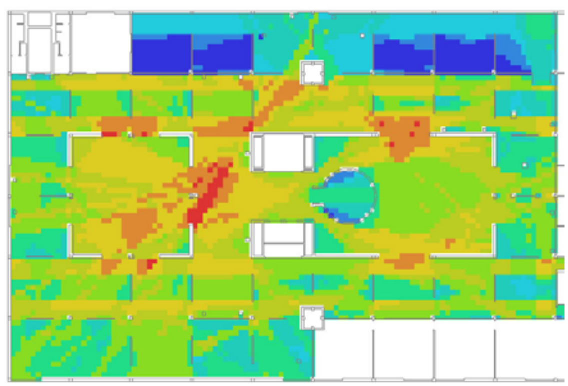
b) Visual Control at knee level



e) Visual control at eye level



f) Visual Integration at knee level



g) Visual integration at eye level

Figure 4.7 Visual Graph Analysis of the YCBA's fourth floor

eastern to the western end, the least integrated, in other words visually the most segregated places are bays G, F, and C, B, and partially A in the Long Galleries section. A comparison of these results with those of the graph generated at knee level reveals that presence of the two atria enhances visual integration in the diagonal axis from the southwestern corner towards the northeast. This enhancement of the integration is due to the fact that the aria openings visually connect spaces in both the orthogonal and diagonal directions.

4.3.3 Organization of the Exhibition Content in the YCBA's Layout

This section discusses how the spatial layout of the YCBA's fourth floor relates to the presentation of the exhibition content. To this end, it explores how the formal characteristics of the gallery layout are utilized to express thematic relationships among the display groups. Before examining the relationship between the formal characteristics of the gallery layout and the exhibition content, it is useful to summarize the curatorial team's statements explaining some of their intentions in the installation.[16]

The exhibition viewing sequence starts in the Introduction gallery with highlights of seventeenth and eighteenth century British Art. The gallery is situated between the two atria and is the place which visitor is directed to start viewing the displays in various sequences. Having the size of four structural-grid units, the Introduction gallery is left undivided by curators in order to provide visitors a wide open space upon their entrance to the gallery floor (Trumble, 2005a). The Introduction gallery space exhibits a selected group of portraiture and landscape paintings. The landscape paintings are placed on the permanent walls of the atrium and the Main Gallery space, whereas the portraits are placed on the pogo walls which are situated in symmetrical positions in the rectangular gallery.[17] The various portraits are works of four key artists who played significant role in the history of seventeenth to nineteenth century British art: Sir Anthony Van Dyck, Sir Joshua Reynolds, Thomas Gainsborough, and Sir Thomas Lawrence (Fig.4.8). Among these, Dutch painter Van Dyck is known as an influential artist who facilitated "art in Britain" to be "British art" by setting the agenda for young artists. As stated by the curators, these pieces contribute to the narrative through their subject matter, the painted subjects. The figures

[16] These statements are most explicitly found in the exhibition brochure.
[17] The pogo wall at the southern end is designated as full-closure to mimic the permanent wall at the opposite end, as stated by the curators.

depicted in full-length portrait form by each of these key artists represent the British ruling elite of the Stuart, Hanoverian and Regency periods (Trumble & Albinson, 2005). When this placement is examined more closely in reference to other art historical sources, what becomes evident is that the placement of the four portraits at the corners elicits contrasts and comparisons among the four portrait artists. Gainsborough's work is placed in parallel to Reynolds's; and this recalls Gainsborough's well-known artistic rivalry with him.[18] Similarly, the portraitures painted by Reynolds and Van Dyck are placed on the walls opposite each other, and this establishes a dialogue between the two works which belong to different centuries: Reynolds' work of a military man with a black slave painted in late eighteenth century is considered as a tribute to a painting by a previous century's portraiture master, Van Dyck (Alexander, 1998c). Combined with these pieces of portraiture, the works of landscape placed in this gallery are painted by Richard Wilson and Sawrey Gilpin, and are placed utilizing the symmetrical organization. A pair of landscapes painted by Wilson is hung at either end of the gallery (Figs. 4.8, 4.9a and b). Within this arrangement of portrait and landscape, the bust sculptures depicting the significant figures of the British aristocracy and the Royal academy are punctuated through this symmetry. Among these figures, the portrait bust of the English satirist, poet and scholar Alexander Pope, sculpted by Louis-Francois Roubiliac, is placed in between the atrium openings, right across the gallery floor entry (Fig. 4.9.a). As discussed by the curators, this placement is meant to be the "fulcrum" of the display, representing the influence of Pope in the world of English letters, as well as of Roubiliac in the community of English sculptors (Trumble & Albinson, 2005). Overall, in the introduction gallery the curators' aimed at providing a synoptic statement of development of art in Britain with reference to the political context that influenced artistic production between 17th and 19th centuries, while interpreting the significant associations between artists and their schools.

[18] It is suggested that Reynolds invented a labored style of how to paint "gesture" that reflects the character and temperament, while "Gainsborough wanted to paint straightforwardly unconventional portraits in which he could display his brilliant brushwork and his sure eye" (Gombrich, 1989, pp. 369-371)

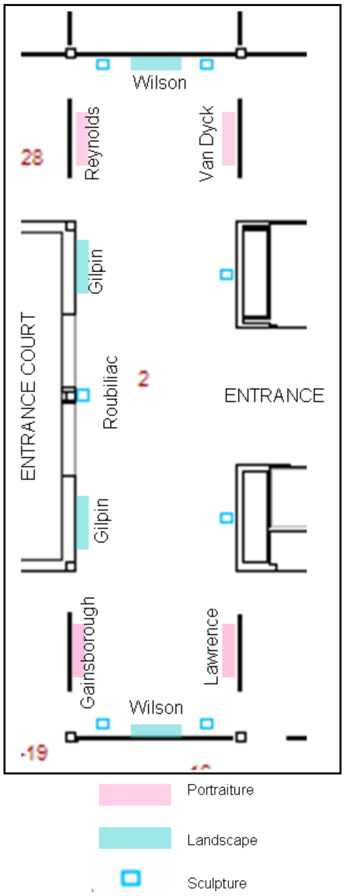


Figure 4.8 Diagram showing the placement of pieces in the Introduction gallery

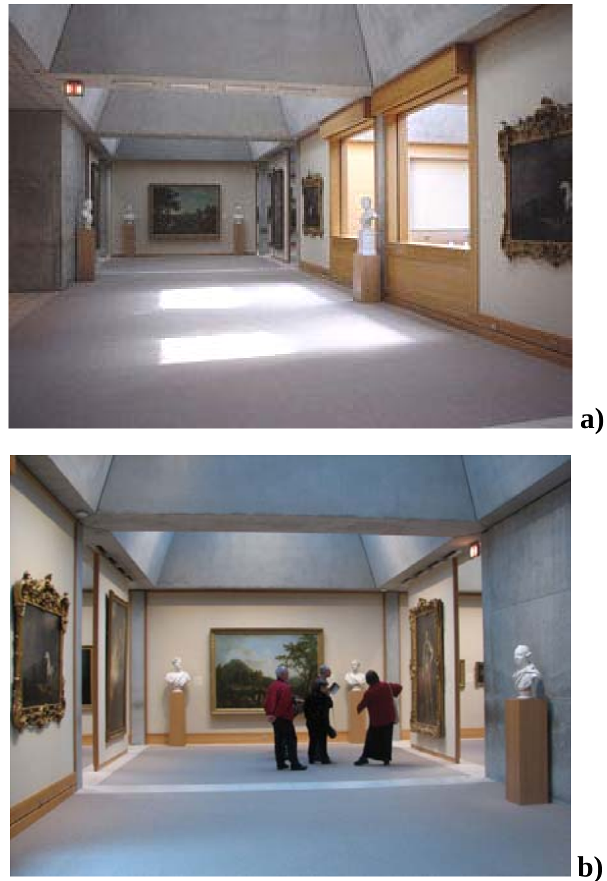


Figure 4.9 Views in the Introduction gallery. **a)** *(top)* towards the southern end, **b)** *(bottom)* towards the northern end; with frontal view of Wilson's work

As stated by the curators, the north side of the Main Gallery concentrates on the history of British portraiture, in particular the development of the unique British invention, the Conversation Piece genre paintings and other portraits from the Regency period. The south side of the gallery is largely focused on the history of landscape in eighteenth century Britain. The two bays in the southwestern corner are devoted to John Constable and J.M.W. Turner. As can be seen from the display theme names, and confirmed by the curators, the east end of the building contains mostly early Victorian paintings and sculpture, while most of the Long Gallery displays the works of the sixteenth to seventeenth centuries, which are the earliest dated pieces in the collection.

Organization and placement of displays using the YCBA's layout characteristics:

When the formal characteristics and gallery layout are compared to exhibition content beyond the intentions curators revealed, the spatial logic of the exhibition installation can be understood in the next level. At the most local scale, this logic can be first described in terms of mapping exhibition themes to gallery rooms. As discussed in the previous sections, the content of the 16^{th} and 19^{th} century British exhibition art rests on a complex conceptual structure. In contrast to this complexity, the gallery layout has a strict geometry and spatial organization, characterized by enfilade rooms and their sequences on the structural grid. Within this geometry, the thematic display groups are assigned to the gallery rooms that are composed of 20-feet square bay units. The assignment of thematic display groups into the gallery rooms, composed of one or number of (mostly two) bay units, brings a clear definition to the themes along with physicality of pogo partitions. The partitions vary in standardized dimensions with increments of 3ft (6ft, 9ft, 12 ft, and 18 ft). These minor size increments are utilized to represent subtle differences in the degree to which the themes are distinguished from each other. As observed in the gallery, the themes that have relatively closer associations, for example the pairs of The Conversation Piece - Hogarth, Queen Victoria's Empire - Early Victorian England, Ideal Landscape - Sport, and Wright of Derby - Painters-Sculptors are separated with the smallest size pogo partitions. The smallest size partitions are also used to separate the bays of the same theme, for example The Conversation Piece. Those partitions express the subtle difference in the artistic styles represented at each side, while providing additional display surface. Similarly, the pogo partitions that are attached to the side walls instead of situated in the middle of the gallery span bring a sense of continuity between the two sides of the partitions, as in between The Late Georgian Women in bay 25 and The Romantic Portraits in bay 24 (Fig. 4.10).

When the exhibition content is compared to the formal characteristics of the layout at the larger scale, spatial logic of the YCBA's 2005 installation can be characterized in three points.

First, the major themes of the complex content are mapped on to the gallery layout in accordance with the division between the Main Gallery and the Long Gallery, and the room promenades within these sections. The works of art placed in the two major gallery sections based on the historical periods: the works from the 16th and 17th centuries are placed in the Long Gallery section, and the works from the 18th and 19th centuries are displayed in the Main Galleries. Second, when the Main Galleries and Long Galleries are examined together, there are three gallery room sequences parallel to each other in the longitudinal direction and these imply a chronological order also from north to south. The first sequence, British art in the 16th and 17th centuries (in the Long Galleries) presents British formal portraits and depicts mostly individual sitters from British aristocracy within some references to historic context. The second sequence, on the northern side of the atria core, presents Conversation pieces, (a genre of portraiture) and other formal portraits, which depicts British middle class in their daily activities and casual manners in early 18th century. The third sequence at the southern side of the atria core presents British natural scene painting, depicting rural places, marine scenes and imaginary natural settings, and represents the ways of seeing the nature within the changing paradigms of understanding the physical world, which appeared in late 18th and early 19th centuries (Fig.4.11).

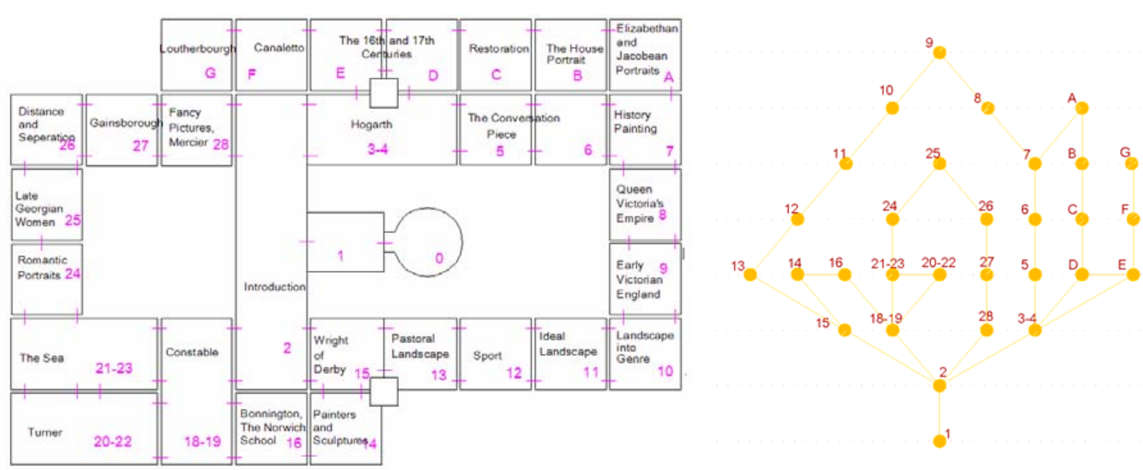


Figure 4.10 Layout of the exhibition themes on the convex space map *(left)*; justified graph of the YCBA's fourth floor gallery *(right)*

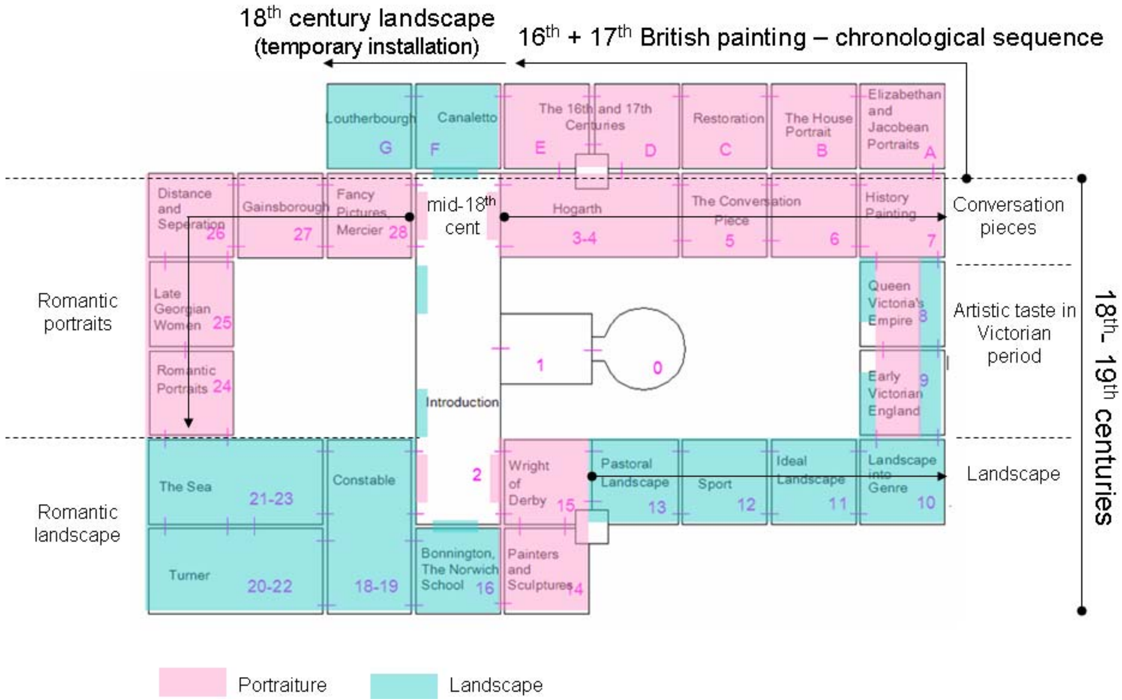


Figure 4.11 The exhibition narrative organization on the fourth floor gallery of the YCBA

Third, these sequences of portraits and landscapes include more implicit categorizations delineated by the location of the Introduction gallery separating the western and eastern portions of the sequences. The western portions of both landscape and portrait sequences are devoted to works influenced by the Romantic vision. Within the landscape sequence, the culminating works of Romantic natural scene painting by Constable and Turner are placed in the southwestern end. At the east side of the entire layout, the display groups of conversation piece and landscape painting are arranged on the basis of an implicit chronology towards eastern end. At the north side of the atria core is a sequence of “conversation pieces” that reveals evolving artistic styles, (from compositions with satire and reference to literature, and to other artists’ skills in observation and attention to detail). On the other hand, the room sequence presenting the natural scene painting on the south expresses the development of landscape painting from more scientific observation and detail reflected in animal paintings and depictions of imaginary natural scenes.

Another characteristic of this installation is related to the sequences on the transverse axes, those at the western and eastern ends of the layout. The display groups in these galleries seem to conceptually connect the themes associated with portraiture and landscape on the north and south corners. At the eastern end, the displays associated with the Victorian era are adjacent to a chronologically earlier display group, Landscape into Genre (bay 10) on the south. A close examination of these works reveals that this sequence also affords an implicit continuity in the artistic styles and themes represented. For example, the paintings from Early Victorian England (bay 9) represent certain values such as innocence, morality and descriptive truthfulness, -- which influenced the artistic production in the period -- through compositions of animals and children. The Early Victorian paintings in this bay have an affinity with the works of Gainsborough in Landscape into Genre, depicting natural scenes with a native and unpretentious style. The other works representing art from the Queen Victoria period (bay 8) are painted by artists traveling abroad. Some of those pieces capture landscapes of foreign countries, but one is a composition of middle-eastern women in an oriental setting. These pieces represent the influence of the period artists towards depicting "beauty" (Treuherz, 1993, p. 12; Warner, 1998a). These works have an affinity with History Painting in the next bay, which is characterized with appearance of allegoric and decorative compositions. Given those affinities, the two bays associated with the Queen Victoria period art bridge the Landscape into Genre to History Painting and the Elizabethan and Jacobean Portraits in the neighboring bays (Fig.'s 4.10a. and 10b). This sequence from galleries 10 to A completes the narrative around the main atrium by creating a sequence connecting to two significant historical periods, the reigns of Queen Victoria and Queen Elizabeth-I.

At the western end of the main gallery, the room sequences around the entrance court (west-side atrium) are devoted to themes of portraiture and landscape influenced by the Romantic vision. The sequence at the north side of the entry court (bays 28 and 27) displays conversation pieces and portraits painted by Mercier and Gainsborough. This sequence continues with woks grouped under the Distance and Separation theme (bays 26) which depicts individual sitters' emotions internalized within their body gestures. Bay 25 (Late Georgian Women), and 24 (Romantic Portraits) groups the portraits of individual sitters on the basis of their professions. While bay 25 displays ladies who worked as servants and housewives, bay 24 presents male figures from governmental and military positions. Through the portraitures of admirals in bay 24, these two groups bridge the portraiture displayed in the north side to the pictures of naval battles displayed in rooms 21*23.

A close examination of the transition within the longitudinal room sequences shows that in addition to chronology these sequences (like those in the transverse direction) also afford implicit transitions and contrasts between the themes. The themes of portraiture and natural scenery painting are presented in single-directional promenades where the theme rooms are physically connected to each other in the same manner (through same kind of openings offering direct transition). For example, the sequence of conversation piece starting with Hogarth presents a somewhat smooth progression from his compositions, merging a group of Conversation pieces to another group of the same style. In this sequence, the transition to History Painting makes a leap that has to be interpreted on the basis of a similar physical connection between the rooms. On the other side, the sequence of natural scene painting starting with the Wright of Derby to Landscape into Genre includes not only continuums but also contrasts. This means these physical connections (or direct transitions) do not always correspond to continuity in a particular development. These observations suggest that, the rooms sequenced linearly do not always express direct conceptual connection between the themes represented except for chronological continuity, and thus the linear room sequences reduce the intricate relationships between the themes into implicit chronologies.

At the southwestern corner of the layout where the room sequence is less linear, the geometric location of bays 18*19 and 20*22 in respect to each other elicits contrasts between the

Romantic portraits painted by Constable and Turner, while the parallel position of 20*22 and 21*23 suggests a comparison in terms of subject matter between Turner's marine painting and pictures depicting naval battles. These placements seem to reflect a curatorial interpretation of the connections and contrasts between Constable's and Turner's art much more explicitly than other thematic relationships that are intended to be conveyed in other parts of the layout.

Experience of the exhibition through visual connections:

In addition to expressing the content themes with physical connections (based upon permeability relations), through the visual connections between the galleries the YCBA's gallery layout brings another dimension to reading the narrative. For example, galleries 8 and 9 displaying art from Queen Victoria's period offer a panoramic view of the main atrium allowing view of the galleries in diagonal directions (Fig.4.12). This location implies a powerful positioning for a viewer visiting the Early Victorian England and Queen Victoria's England galleries. As discussed earlier, these galleries give a narrative of the great expansion of the British Empire during Queen Victoria's reign and subsequent flourishing art. The location of these galleries in the layout establishes the importance of the Queen Victoria period through a spatial experience. The placement of pieces in bay 8 also creates interesting opportunities for the viewer. The pieces in this bay and in bay A, portraits from the Queen Victoria and Queen Elizabeth

Figure 4.12 Views from rooms 8 and 9 towards atrium void and the galleries at two sides, seeing the displays on the atrium walls, building staircase in the middle and displays at the galleries on the diagonal positions.

periods, can be seen synchronously through an observer's movement from the former to the latter. In bay 8, a portrait depicting "beauty" is displayed perpendicular to the direction of movement in the room sequence. This brings the portraits from the Queen Victoria period into the same visual field as the Elizabethan and Jacobean Portraits across the distance (Fig. 4.13a).

A similar synchronous viewing experience is afforded in the other parts of the layout as a result of the placement of the pogo walls and pieces of art on them. As can be seen in Figure 4.13b, as a viewer moves from room 24 to 25 the Romantic portraits depicting male figures can be seen in conjunction with the portraits of the Late Georgian Women in the same visual field. This encounter provides an opportunity to compare two groups of Romantic portraits, in addition to giving a clue of what could later be viewed in the galleries.

During the installation of the exhibition in 2005, it is apparent that curators' decisions on the placement of the pieces were guided by the gallery layout's potential for visually connecting displays at distant locations. For example, two panoramic openings of the main atrium (the east side atrium) led the curators' decision to install the pieces on the walls facing those openings. Three Conversation Pieces works in bay 5 are on the wall facing the atrium opening so that they can be seen from bay 12 on the opposite side, thus visually connecting the display through atrium openings. Through atrium openings in galleries 5 and 12, pieces in the opposite direction (in

Figure 4.13 Views from the eastern and western end galleries **a)** room 8 towards room A **b)** room 24 towards room 25

galleries 5 or 12) as well as masterpieces on the atrium walls can be seen. In gallery 12, the paintings depicting animals and hunting scenes are visually connected to George Stubb's animal pictures hung on the atrium walls a level below. At the same time, viewers in gallery 12 are able to glimpse the Conversation pieces displayed on the wall of gallery 5 (Figs. 4.14 and 4.15). This glimpse may possibly open a narrative comparing two different groups, Conversation pieces on the one hand and sporting scenes, both of which are painted with attention to detail. When the opportunities provided by the atrium openings are examined from the point of an observer in gallery 5, it is possible to notice that the atrium opening reveals other portraits hung on the atrium walls, and thus adds another dimension for experiencing portrait painting in gallery 5 (Fig. 4.16). Additionally, the view from gallery 5 towards the atrium allows for a synchronous viewing of animal paintings on the lower level of the atrium wall and fictional hunting scenes on the opposite side in gallery 12. This may aid in viewing depictions of hunting and animal paintings, which capture the leisure interests of the British aristocracy who engaged in hunting, sporting with animals and animal breeding. These experiences provide further interpretations of the narrative as other possible of themes associated with portrait and animal paintings are revealed. Additionally, visibility through the atria openings relaxes the sequences laid out in a single direction at the local level, while informing viewers of what can later be viewed in the galleries.

An examination of the placement of the thematic display groups within the navigation routes in the gallery shows that the exhibition is installed to be viewed starting from four possible points leaving the Introduction gallery. The curatorial team considers that following any of these viewing sequences would convey the intended message to visitors. For the team, presenting the content this way can reveal the inherent complexity of the content as well as its richness through various associations among the themes (Trumble, 2005b). Indeed, the four viewing sequences originating in the Introduction gallery present the evolution of art starting from the mid-1700s' (I towards the two sides of the layout. The sequence towards the northeastern direction expresses

Figure 4.14 View from room 12 towards the displays at room 5 through the panoramic atrium opening.

Figure 4.15 View from room 12 towards the displays at room 5 and on the atrium walls.

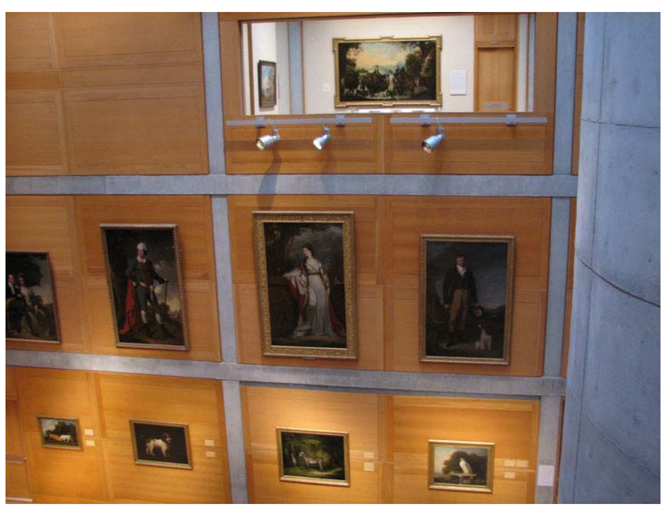


Figure 4.16 View from room 5 towards the displays at room 12 and on the atrium walls

the development of Conversation pieces influenced by Hogarth's art and ends with the History painting which appeared later in the century. The sequence going in the northwestern direction focuses on the Romantic portraits starting from Mercier's work in 1750s and ending with Romantic Portraits (gallery 24) of the late 1700s. On the southern side, visitors starting their navigation with the Wright of Derby bay may connect his work to the natural scenery painting displayed under Pastoral Landscape (bay 13), Sport (bay 12), Ideal Landscape (bay 11) and Landscape into Genre (bay 10) galleries. The visitors proceeding in the southwestern directions start their exploration with the culminating works of Romantic landscape by Constable and Turner. Indeed, any of these sequences can potentially present the 'British-ness' of the collection. Moreover, the potential of the layouts to allow alternative sequences and the curators' acknowledgement of this potential create a non-hierarchical presentation without seemingly prioritizing any of the sequences.

These observations describe how the content is expressed through the organization and placement of displays in the galleries using formal characteristics of the layout. This description suggests that the exhibition narrative on the British art between 16th and mid-19th centuries is structured through gallery room sequences expressing implicit chronological and artistic development of portrait and landscape works. The thematic groups within these sequences refer to the themes through which British Art is studied and understood in the scholarly literature. These themes more often refer to subject matter and individual artists than the historical periods. Therefore, the exhibition narrative seems to be established on the basis of a scholarly interpretation of the exhibition content that appreciates the British art in relation to political ties as well as more autonomous artistic and experiential qualities. In addition to this interpretation, visual connections between the galleries seem to create additional opportunities for encountering the works of art and thus bring an additional dimension to the narrative. This implies that the spatial structure might also be creating some other potential for conveying the narrative, which can be explored through a further analysis.

4.3.4 How Does the Spatial Layout Present the Exhibition Narratives?

A comparison of the narrative organization with the permeability and visibility structure can demonstrate the parts of the narrative that are more strongly emphasized by the spatial structure of the YCBA's fourth floor gallery.

To compare the narrative structure and the permeability structure, the narrative organization is examined in conjunction through axial line analysis. This examination shows that the most integrated axial lines coincide with the promenades of portraiture and landscape at the south and north sides of the atria core. The moderately integrated lines go through the Introduction gallery where highlights of the 17^{th} to 18^{th} century British Art are presented. As discussed in the previous sections, these sequences of portraiture and landscape paintings are the essential core of the narrative, and the axial line analysis shows that the potential movement is predicted by the gallery layout along these major themes of the narrative. This suggests that the permeability structure works in concert with the intention of telling a story on the basis of two key artistic productions, portraiture and landscape, which also refer to two key subject matters painted, figures from British bourgeoisie and natural and urban scenery (Figs. 4.17a, b and 4.18).

A comparison of the exhibition narrative structure with the visibility structure can elucidate other potentials of the spatial structure in conveying the narrative. The visual integration graph in Figure 4.19c shows that relatively high visual integration values are distributed in the longitudinal direction through doorways at both the northern and southern side room sequences. This provides the potential for an observer to retain an awareness of the entire layout while walking through the promenades of portraiture and landscape. This implies that along the progression in these promenades visitors can continuously relate what they see to the other

Figure 4.17 Views towards the promenades parallel to the atria core. **a)** View from gallery 27 towards north east corner b) View from room 21-23 towards the south-east corner

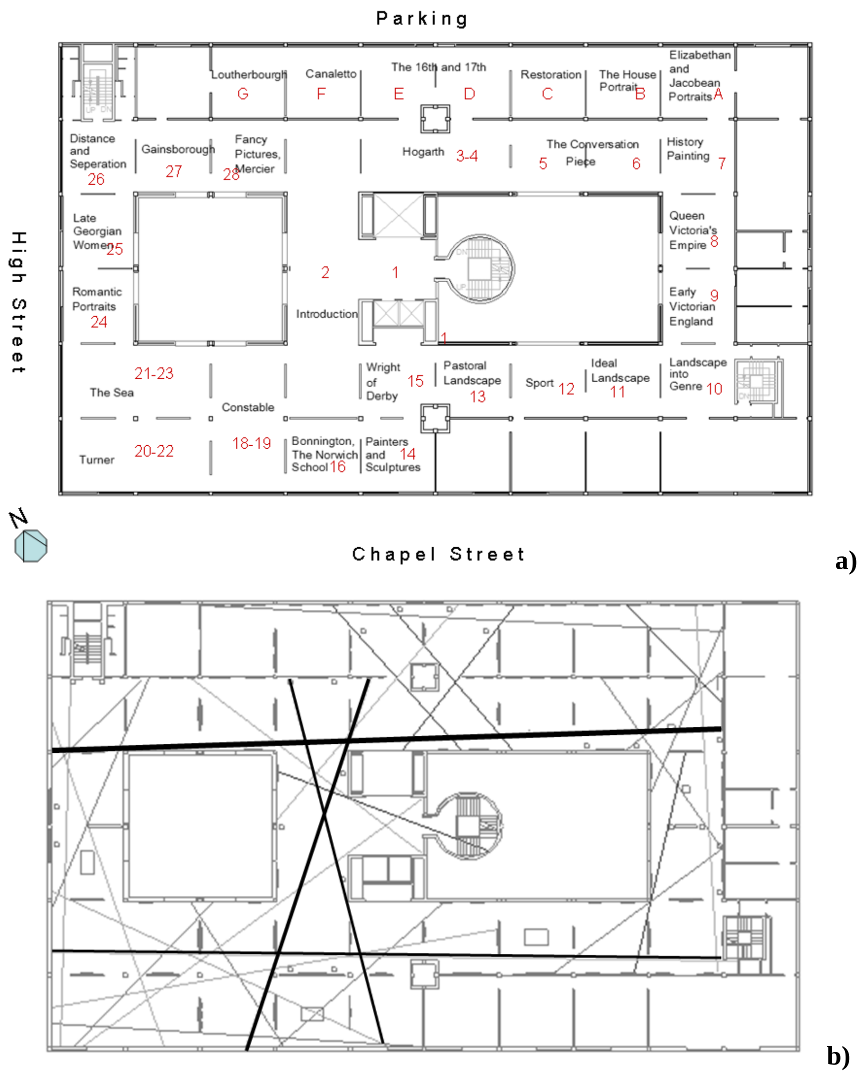
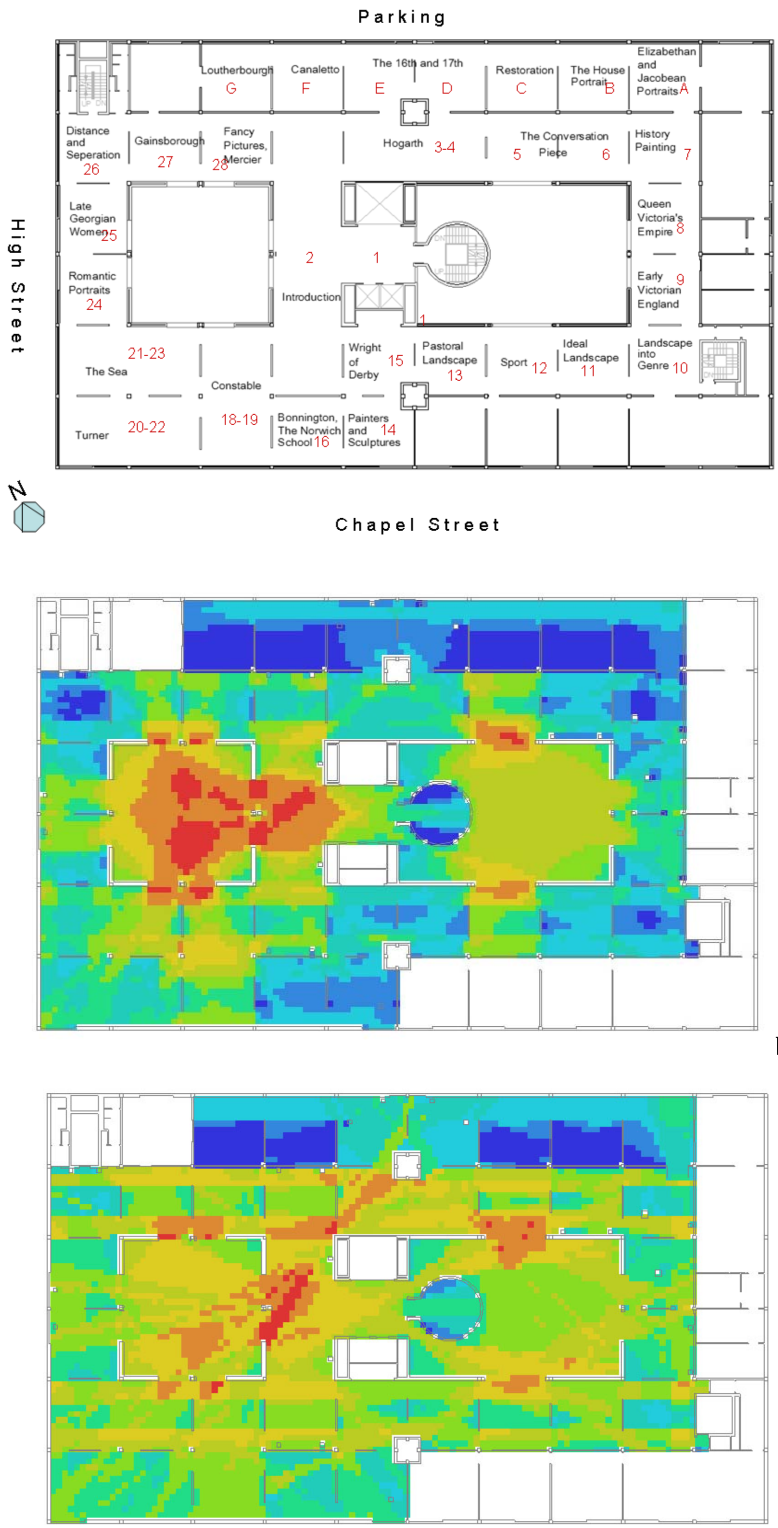


Figure 4.18 A comparison of **a)** exhibition themes and **b)**axial line analysis (dark-colored lines denote the ones with the highest integration values)

displays around them. This potential also takes into account that visitors' visual exploration of displays and navigation coincide with each other.

As can be seen in Figure 4.19c the highest visual integration values are located in the region that extends from the middle part of the Introduction gallery towards its northeastern corner, and passing through bay 3*4 (Hogarth), as well as places around the north and south side openings of the atria. This indicates that visitors moving from the Introduction gallery towards bay 3*4, and those standing at the north and south side atrium openings have the opportunity to grasp the entire exhibition layout within fewest steps in their exploration. This may enable visitors to relate the displays representing key artistic developments in the 18th in the Introduction gallery century to the conversation pieces in bays 3*4, 5, 27, sports painting in room 12, works of Constable and Turner in 18*19 and 21*23 to the display content in the rest of the gallery. The ability to be within fewest visual steps to other galleries makes it possible to connect the highlights of the exhibition presented in the Introduction gallery to the other themes in the Main Galleries, such as Hogarth's art initiating Conversation pieces and its connection to British literature highlighted in the Introduction. Indeed, Hogarth's leading role in the development of the Conversation piece genre, and the connection between his art and the British literature school (represented by Alexander Pope's bust) is one of the key developments of British art that are interpreted in scholarly and curatorial sources. The emphasis placed on these themes by the visibility structure reflects the intended exhibition narrative quite strongly. Other high visual integration values concentrated in bays 3*4, 5, 27 and 28 suggest that visitors in any part of the layout may see within fewest visual steps the Conversation Piece paintings of Hogarth, Davis, Gainsborough and Mercier' in those galleries. As can be seen from these observations, the visibility structure brings the highest degrees of visual integration to the northern side of the atria core. Thus, the themes presented at this core, which are associated with portraiture, become visually prominent within few changes of direction. This potential facilitates a greater emphasis



a)

b)

c)

Figure 4.19 a) The exhibition organization with the visibility structure, **b)** visual connectivity, **c)** visual integration graphs on British portraiture in the entire narrative. In particular, the works representing the Conversation piece genre is celebrated in the narrative, thus indicating the significance of this genre in British Art.

The lowest visual integration values, on the other hand, are located in the Long Galleries section. This suggests that the sequence in the Long Galleries, “the British Art in 16th and 18th centuries”, remains peripheral to the entire narrative, and visitors in this section are least likely to relate this content to the entire exhibition. This implies that the themes associated with British Art in the 16th and 18th provide more direct reference to the historical periods and political context and therefore contribute to the narrative only as a contextual backdrop. The same may also be true for the themes associated with the Queen Victoria period. The gallery bays that display art from this period has relatively low integration. Even though Queen Victoria’s reign is known as the most important period in the history of British Empire and art in this period has a sophistication reflecting the subsequent cultural developments, the spatial structure of the layout suggests that the themes associated with this period nonetheless are not of central importance in the narrative. This suggests that the exhibition narrative does not emphasize the historical periods and political context of the British Empire as a primary defining force in the development of British art.

Furthermore, examining the narrative organization in conjunction with the visual connectivity graph can demonstrate visitors’ experiences of viewing displays in the visually neighboring locations. As can be seen in the visual connectivity graph in Figure 4.19b, visitors situated the central part of the Introduction gallery and at the atrium openings would have higher degree of mutual visibility with the neighboring locations. A comparison between the visual connectivity graph and the narrative organization (Fig. 4.19a) layout suggests that the bays around the entrance court (the west side atrium) are visually quite connected to each other. This introduces the potential for visitors to read the relationships between the works of art grouped under Mercier, Fancy Picture (bay 28) and Gainsborough, between Late Georgian Women (bay 26) and the Romantic Portraits (bay 27).

These comparisons between exhibit narrative organization and syntactical properties of the gallery layout suggest that permeability and visibility relationships prioritize some themes in the narrative. The story of the development of the British art between sixteenth to mid-nineteenth centuries is told without considering the historical period and political agenda as a major determinant of these developments. The works of art that characterize historical periods (16^{th} and 17the centuries, the sequence starting with Elizabethan and Jacobean art) are instead placed in more peripheral locations. In contrast, the British portrait commissioned by patrons, and the British landscape painting developed with artistic exploration are placed in corresponding and syntactically the most integrated promenades. This placement acknowledges the importance of the artist's autonomy and individual endeavors as a force driving the developments of British art in addition to political developments. This acknowledgement is reflected in the curators' position towards interpreting the British art within confines of the conventional and scholarly interpretation of the content, which often explain artistic developments within political context.

Consistent with the permeability structure, the visibility properties also contribute to relegating the historical periods (particularly sixteenth and seventeenth centuries) to a secondary role, treating these themes as the contextual background to the artistic developments in the eighteenth and nineteenth centuries. On the other hand, the visibility structure prioritizes the themes and artists associated with the conversation pieces and other portraits over other thematic sequences of art presented. As described earlier, the Conversation Piece genre painting has a very important place in the British Art. Reflecting this importance, the visibility structure emphasizes the Conversation Piece display groups which are placed in the central section of the portraiture promenade.

4.4 The Spatial Layout and Visitors' Space Use Patterns

This section analyzes the distribution of space-use patterns culled from the data on visitors completing an entire tour of the YCBA's fourth floor, and explores the extent to which the gallery layout of the YCBA's fourth floor may predict visitors space use patterns.

Before discussing the in-depth analysis of the space use patterns, this section first examines the sample data of visitors to see how many visitors visit each gallery room. As explained in Chapter III, the aim is to confirm that the sample consists of randomly picked individuals which show a normal distribution of fast or slow moving visitors. The histogram in Figure 4.20, illustrates how often visitors entered the rooms they visited during the course of tracking. As can be seen from the figure, the histogram approximates a normal distribution, skewing slightly towards the left. This means that more visitors (with frequency of 3 and 4 in the histogram) visited a fewer number of rooms (such as 15-19 rooms), and thus the data sample consists of randomly picked individuals; however, there are more visitors moving slowly than fast. The mean value of the histogram is 23.91, indicating that on average the sample visitors visited 23-24 rooms in the course of tracking, even though there are 30 rooms available on the

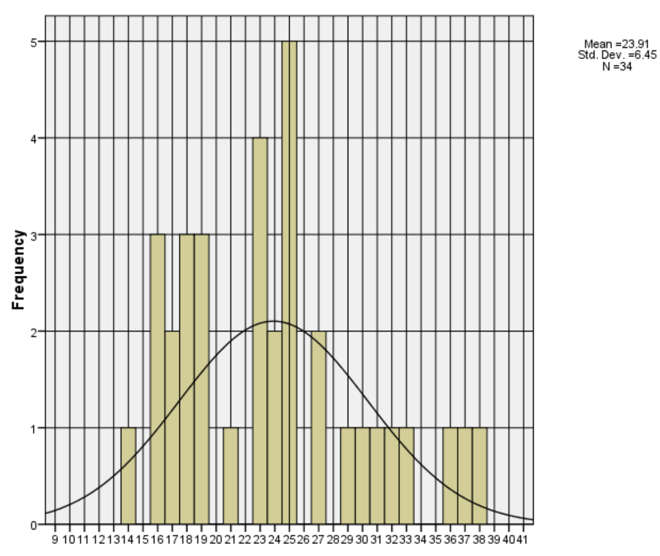


Figure 4.20 Histogram of the number of rooms attended by visitors during the course of tracking

fourth floor. In the sample, the room visit rate by highest number of visitors is 23-25 rooms while only a few visitors visited more than 30 rooms, showing repeat visits to some rooms.

4.4.1 The Space Use Patterns and Their Correlation with Visibility Relationships

The sample data are used to examine three types of space use patterns: patterns of exploration, patterns of contact with displays, and patterns of contact with the layout. The three types of space use patterns are first examined descriptively to demonstrate how visitors' space-use patterns are distributed throughout the gallery floor. Second, the analysis compares the extracted space use measures with the visibility properties. The purpose of this analysis is to investigate the extent to which the fourth floor gallery layout of the YCBA may predict visitors' space-use patterns.

Patterns of Exploration and Visibility Properties

In order to describe the visitors' patterns of exploration and their distribution in the layout, the data of movement paths are analyzed in a number of steps. The patterns of exploration are captured from the movement data in two ways. The first involves looking at the number of movement lines crossing each gallery in relation to the number of visitors entering each gallery. The second entails examining the distribution of movement into various directions at the spaces offering choice.

In the first step of capturing the exploratory patterns, the number of movement lines crossing each gallery is examined in relation to the number of visitors entering each gallery. This relationship is then compared for different rooms in the gallery layout to determine how many times a gallery room is visited or re-visited for each visitor. Therefore, beyond showing how many visitors visited each galleries, the number of movement lines entering and crossing each gallery can explain the extent to which visitors visited rooms many times returning these rooms to explore further.

As shown in Fig 4.22, the Long Gallery bays on the northern end are visited by the fewest number of visitors, in fact less than 60% of visitors. The sections that attracted highest number of visitors are in the Introduction gallery, specifically bay 2 and bay 3*4, which received between 80-100% of the visitors. Figure 4.23 shows how the movement lines entering the galleries are distributed throughout the gallery floor. As can be seen in the figure, the movement lines are most frequent at the north side of Introduction gallery, bay *2*, and bays 3*4, 7 and 15, which are the spaces offering choice in exploration. Thus, the galleries arrayed in the direction of bay 3*4 are most frequently visited and these galleries are where exploratory movement accumulates.

The second technique of capturing the exploratory behavior examines how movement is distributed into the directions available at the spaces offering choice. Among the spaces offering choice is the Introduction gallery, located in the most integrated location immediately next to the gallery floor entry, which is between the two atria (bay 2). This gallery is a key location that may influence the distribution of movement into the entire layout because it is generally crossed when visitors begin their exploration and very likely to be crossed after their first tour of the gallery floor. The distribution of movement into various directions offered by the Introduction gallery is examined by counting the movement lines of visitors who crossed the gallery at the beginning of

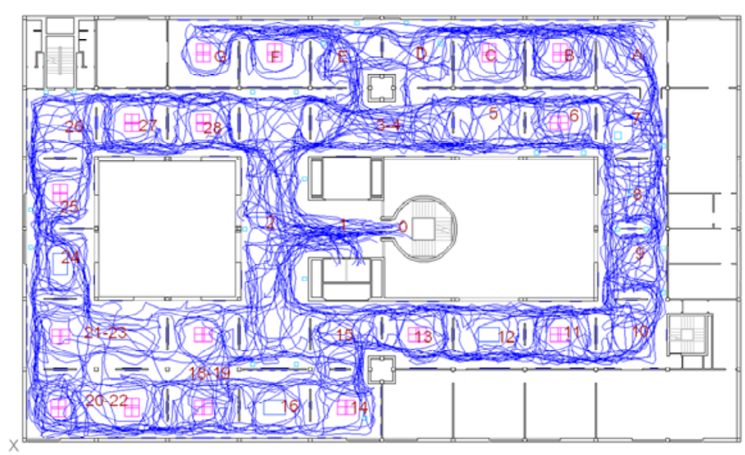
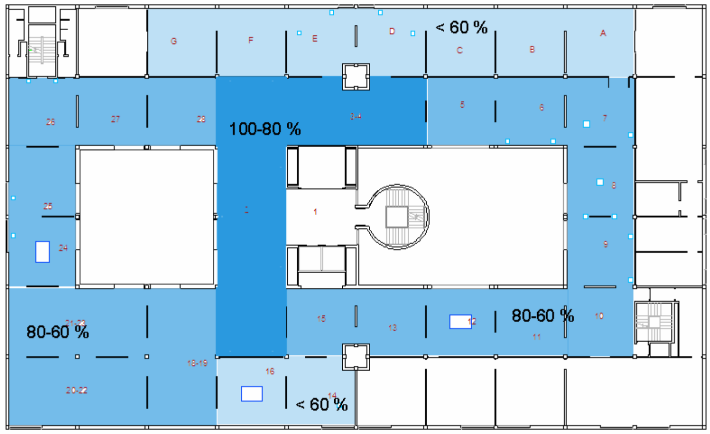


Figure 4.21 Transcribed data of movement paths.



Darkest shade: *100-80 % of visitors*
Medium shade: *80-60 % of visitors*
Lightest shade: *less than 60 % of visitors*

Figure 4.22 Percentage distribution of visitors crossing galleries

Darkest shade: *47-33 paths*
Medium shade: *32-20 paths*
Lightest shade: *Less than 20 paths*

Figure 4.23 Distribution of movement lines crossing galleries

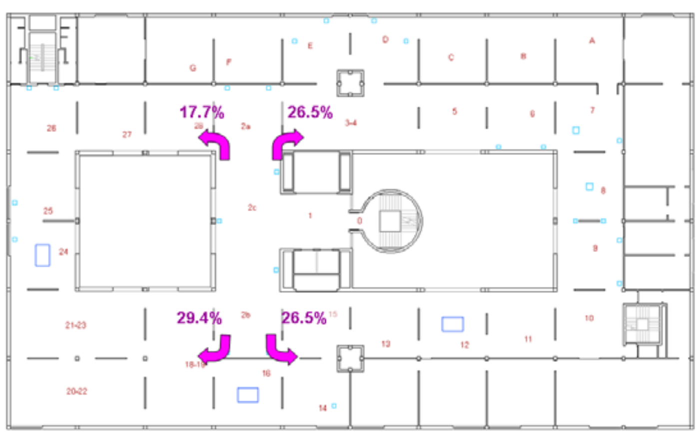


Figure 4.24 Percentage of visitors distributed into four directions after entering the Introduction gallery for the first time

their exploration. The analysis shows, among the visitors who entered the fourth floor for the first time (33 visitors), the largest percentage of them (29.4%) went to southwestern corner, towards bay 18*19; 26.5% of visitors moved toward the northeastern and southeastern corners, while bays 3*4 and 15 each received equal percentages of visitors. The fewest number of visitors moved in the direction of bay *28* (17.7 %). A rough examination of the distribution of movement to the north and south sides of the layout, which corresponds to turning right or left after entering the galley, indicates that 44.2% of the visitors turned right and the 55.9% turned left. After this split, among the visitors turning toward either end, the majority preferred moving to their right hand side (either turning north to bay 3*4 or to the south toward bay 18*19).

In order to investigate the effects of the YCBA's gallery layout on the patterns of exploration, the key measures of exploratory movement are compared with the visibility properties of the layout. To investigate if the exploratory movement in each room might be predicted by the visibility properties of those rooms, first the number of movement lines is correlated with key syntactic and non-syntactic visibility measures of each room obtained from the *Depthmap* visibility graphs. This investigation shows that the number of movement lines is significantly linked with visual integration and visual connectivity ($R^2_{int\text{-}max}$= 0.59, p=0.000; $R^2_{int\text{-}avg}$= 0.58, p=0.000, $R^2_{conn\text{-}avg}$= 0.36, p=0.000), while the link with the visual control value is less significant ($R^2_{control}$= 0.14, p= 0.031; Table 4.1).[19] These results indicate that in the YCBA's fourth floor gallery, 58% of variation in the number of movement lines can be explained by variation in visual integration, which is the capacity to be visually close to every other parts of the layout. In contrast, only the 36% of the variation in the movement lines can be explained by the variation in visual information of neighboring places. In other words, visitors are likely to visit

[19] A link between two variables can be indicated by ***r** (correlation coefficient)* and ***p-value*** obtained in the correlation analysis. "r" value expresses the magnitude (weak or strong) and direction (positive, or negative) of a correlation, while the p-value denotes the significance, which is how unlikely that the result is obtained by chance. When the p-value is smaller than 0.05, the result is considered significant. For a significant correlation between two variables, say X and Y, R^2 (coefficient of determination indicates how much of the variance in X can be explained by variation in Y. The correlation results are interpreted on the basis of R^2 as it provides a more descriptive explanation on the relationship between two variables.

the gallery rooms that are at global level visually accessible from all other spaces, and visitors have a greater tendency to visit the rooms that are visible from neighboring locations. As indicated by the less significant correlation with visual control, variation in the visibility of less interconnected spaces explains only 14% of the variation in the movement lines.

The number of movement lines is also compared with (non-syntactical) grid isovist values of the rooms in order to understand which aspects of local visibility may have an effect on movement. This investigation shows that the number of movement lines co-vary with isovist perimeter (total length of the visual field boundary), isovist occlusivity (the length of occluding boundary only), isovist area (size of the visible area), and isovist maximum radial (longest lines of sight) measures in each gallery ($R^2_{perimeter}$= 0.48, p=0.000; $R^2_{occlusivity}$= 0.45, p=0.000, R^2_{area}= 0.41, p= 0.000; Table 4.1). The correlation with perimeter indicates that the 48% of the variation in the movement lines can be explained by variation in terms of the boundary of the visual field (perimeter), while 45% of this variation is predicted by variation in the length of the occluding boundary, which denotes hidden regions around the corner. These results show that both visual information of exposed surfaces and the availability of hidden regions behind corners are important factors in predicting exploratory movement. The correlation with visual area measure also indicates that 41% of the variation in movement lines is influenced by the variation in the size of visible regions. However, the correlation with the isovist maximum radial provides only suggestive evidence that 14% of the variation in the movement lines is influenced by the longest lines of sight.

The second investigation reported here examines the relationship between movement lines and visibility properties through a finer grain analysis in which movement line counts are extracted from (5-foot) grid cells[20] designated to generate visibility graphs using *Syntax 2D*.[21]

[20] This size of the grid cells corresponds to the width when a person extends their arms to each side.
[21] The idea of counting movement lines in designated grid cells is brought to the Syntax 2D program by Sophia Psarra, (J. Turner et al., 2006)

The movement line counts crossing the grid cells are correlated against the visibility graph values of those cells. This correlation investigation shows no association between the movement lines and grid-isovist or visibility graph measures at those grid cells. This demonstrates that visitor movement is not influenced by minor variations in the visibility structures in the YCBA's fourth floor galleries.

Table 4.1 Correlation of number of movement lines & VGA measures in each gallery room

	Visual Integration (HH)[22] (Max.)	**Visual Integration[23]**	**Connectivity**	**Visual Control**	
Number of movement lines crossing each gallery	0.77	0.76	0.60	0.38	***r***
	0.000	0.000	0.000	0.031	***p-value***
	0.59	0.58	0.36	0.14	***R^2***
	Isovist Area	**Isovist Max Radial**	**Isovist Occlusivity**	**Isovist Perimeter**	
	0.64	0.38	0.67	0.69	***r***
	0.000	0.033	0.000	0.000	***p-value***
	0.41	0.14	0.45	0.48	***R^2***

The investigation of the effect of local visibility on choice in the movement direction:

As discussed in the methodology chapter, the examination of the effect of local visibility on visitor movement in spaces offering choice is intended to explore which of the directions visitors take are based on the gradual unfolding of visual information in permeable directions. This entails counting the movement lines leaving the spaces in each of the offered directions. The percentage values of these lines among all movement lines leaving those spaces are correlated with (point isovist) visual field measures obtained for the corresponding directions at the permeable level. For each of the corresponding directions, the percentage of movement lines is correlated with the measures of occlusivity (the measure of hidden regions that can be seen with further movement) and compactness, the degree to which the boundary of visual field does not meander, but visual field has the compact shape ($R^2_{occ.}$= 0.33, p= 0.002, $R^2_{comp.}$= 0.15, p= 0.044; Table 4.2). Thirty-three percent of the variation in the percentage rate of movement lines is

[22] Visual Integration (HH) is a global measure that *Depthmap* calculates with a closes algorithm to the original 'integration' measure described in Hillier and Hanson (1984).
[23] Unless labeled otherwise, all visibility graph measure values used in the correlations are the average values obtained from the grid points of the layout area analyzed.

predicted by variation in occlusivity, while only 15% of the variation in the rate of movement is influenced by variation in compactness. The correlations with the occlusivity measures provide some evidence that visitors are attracted to places that reveal hidden regions, while the weaker link with the compactness measure suggests visitors may prefer to visit visible areas that have consistency in the depth of visual information obtained in a vantage point.

Table 4.2 Correlations between percentage of movement lines and visual field measures in corresponding directions at the choice locations

	Occlusivity	**Compactness**	
Path Ratio in Different Directions	0.58	0.40	***R***
	0.002	0.044	***p-value***
	0.33	0.15	R^2

Patterns of Contact with Displays and Visibility Properties

Visitors' patterns of contact with exhibitions on the YCBA's fourth floor are analyzed through a number of measures extracted from the stop counts associated with display viewing. These recorded stop count data are given in Figure 4.25. As can be seen from this figure, the displays placed at the northeastern corner (bays 6, 7, 8, as well as A and B) received a higher number of stops than the displays in other parts. For a more precise analysis, the patterns of visitor contact with displays are described using a number of measures, one of which is devised to obtain the percentage ratio of the displays contacted in each gallery. The results obtained by using this measure show that despite the high number of stops, in some bays not all displays are visited. As can be seen in Figure 4.26, only in gallery bays 5, 6, 7, 10, 12, 15 as well as bays 20*22, 18*19, 28 and 25 are 100% of the displays viewed. Thus, it can be argued that in those bays, the displays are not cross-comparatively read; in other words, the display content is not broadly grasped. The stop counts were also examined through another measure that describes the patterns of contact with respect to the frequency of stops each display in each gallery might receive. This measure is examined throughout the layout by dividing the stop counts in each bay by the number of displays viewed in each room. The results show that bays 5, 8, 9, 11, 13, 15 and 20*22 received highest number of stops per visited displays (Fig.4.27).

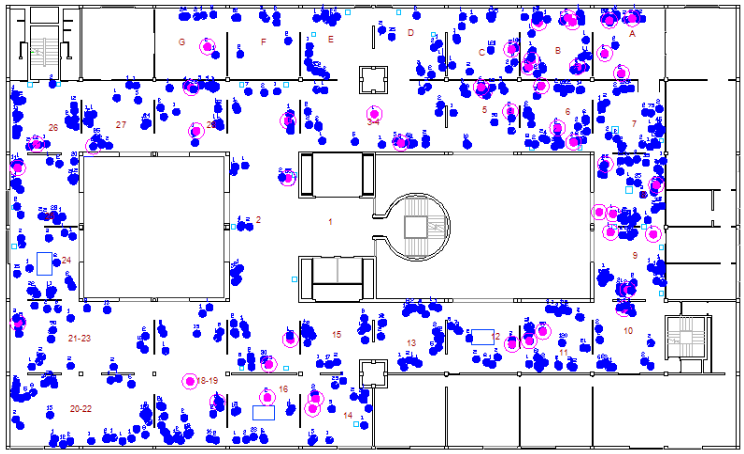


Figure 4.25 Transcribed data of stop counts associated with viewing displays.

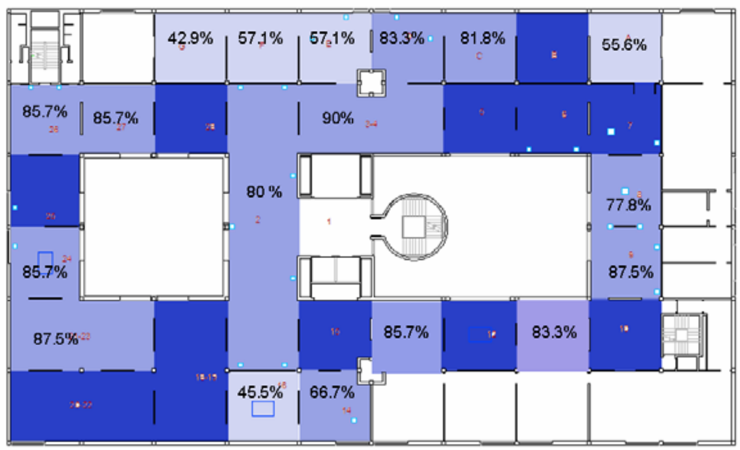


Figure 4.26: Percentage of displays viewed in each gallery room. Darkest shade denotes where 100% of the displays viewed.

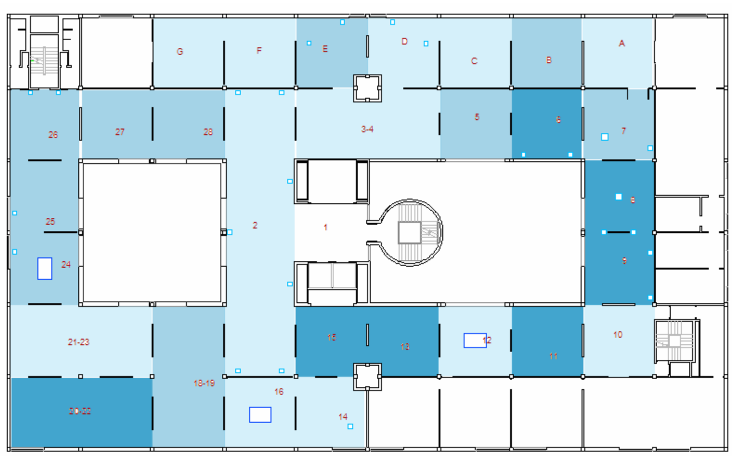


Figure 4.27: Distribution of average stop counts per display in the gallery floor. Darker shades show the higher number of stop counts per display.

To investigate the influence of the layout on the patterns of contact with the displays, the key stop count measures describing the display viewing behavior are compared to visibility properties. The first step in this investigation explores the link between the number of stops toview displays and the visibility properties of each room. The counts of stops registering visitors' contact with displays in each room are then correlated with syntactic and non-syntactic visibility measures obtained in each room. This is done for both the gross number of stop counts and the counts obtained by normalizing the gross counts by room size and the displays available in each room. The investigation of the correlation between the gross stop counts for display viewing and syntactic and non-syntactic visibility values reveals that the frequency of stopping to view displays is associated with only non-syntactical visibility values. This investigation yields a positive correlation with isovist maximum radial and a negative correlation with isovist compactness ($R^2_{max.radial}$= 0.18, p= 0.017; $R^2_{comp.}$= 0.13, p= 0.045; Table 4.3)[24]. The correlation with the isovist maximum radial implies that only 18% of the variation in the viewing display stop counts can be explained by variations in the longest lines of sight that can be projected from the rooms. Thus, visitors tend to stop to view displays more often in the rooms where they can view longer distances.

When the correlation is investigated by normalizing the stop counts by room areas, no correlation is found. When the correlation is repeated with the stop counts normalized by number of displays available in each room, the stop counts are found to be linked to visual integration, while higher proportions (23% and 27%). are found for the associations with isovist compactness and isovist maximum radial ($R^2_{int\text{-}avg}$= 0.20, p= 0.012; $R^2_{max.radial}$= 0.27, p= 0.003; $R^2_{comp.}$= 0.23, p= 0.006; Table 4.4). This result suggests that regardless of the number of displays available, visitors stop more frequently to view displays in the galleries that are visually close to all other locations. Finding stronger correlations with compactness and isovist maximum radial than with gross (not

[24] As the spatial layout is considered only one of the environmental factors influencing space-use patterns, these results are found worth discussing, although the results do not show a very strong correlation.

normalized) stop counts confirms that visitors tend to view displays more often in the galleries where the visual field extends to various depths, and this tendency is consistent in the rooms containing varying number of displays.

Table 4.3 Correlations between display stop counts and visibility measures in each gallery room

	Isovist Compactness	Isovist Max Radial	
Display stops (gross)	-0.36	0.43	***r***
	0.045	0.017	***p-value***
	0.13	0.18	R^2

Table 4.4 Correlations between display stop counts (normalized by displays) and visibility measures in each gallery room

	Syntactical measures		Non-syntactical measures		
	V. Integration (HH) (Max.)	**V. Integration (HH)**	**Isovist Compactness**	**Isovist Max Radial**	
Display stops (normalized by n. of displays)	0.38	0.45	-0.48	0.52	***r***
	0.033	0.012	0.006	0.003	***p-value***
	0.14	0.20	0.23	0.27	R^2

The second step in this investigation explores the link between the average frequency of stopping at each display and visibility properties. As introduced in the descriptive analysis, the average frequency of stopping at each display is obtained dividing the stop counts into the number of displays viewed in each room. This measure obtained in each room is correlated against the key syntactic and non-syntactic visibility measures. The results of this correlation reveal a barely significant correlation with the average visual integration (Table 4.5). This provides only suggestive evidence that the displays in the rooms that are visually close to other locations might be visited more frequently.

In another step, the stop counts are compared with visibility to determine whether there is a link between the content in each room that is read and the visibility properties of those rooms. To this end, the number of displays visited in each gallery is taken as a measure of stopping behavior. In order to explore the effects of visibility properties on this behavior, the percentage of displays contacted (Fig.4.23) is correlated with the key syntactic and non-syntactic visibility measures of the gallery rooms. This investigation demonstrates that the percentage of displays viewed in each room is linked with the visual integration and connectivity values of the rooms, ($R^2_{int\text{-}max}$= 0.25, p=0.004, $R^2_{conn\text{-}avg}$= 0.19, p=0.014; Table 4.6). This result suggests that 25% of variation in the number of displays visited in each gallery is determined by the capacity of the room to be visually close to all other locations, while 19% of this variation is explained by potential of the room to be seen from neighboring locations.

Table 4.5 Correlations between frequency of stopping at each display (obtained at each gallery) & VGA measures

	Visual Integration (HH)	
Average number of stops at displays	0.34	***r***
	0.06	***p-value***
	–	***R^2***

Table 4.6 Correlations between percentage of displays viewed in each room & VGA measures

	Visual Integration (HH) (Max.)	Visual Integration (HH)	Connectivity	
Percentage (%) of displays viewed in each room	0.50	0.49	0.44	***r***
	0.004	0.005	0.014	***p-value***
	0.25	0.24	0.19	***R^2***

The fourth part of this investigation considers the visibility properties of the display locations (instead of average values in rooms) and compares them with the stop counts for each display object. An examination for the entire gallery floor did not show any link between the stops to view display objects and visibility of their locations. When this same investigation is conducted for each gallery, it is observed that the gallery rooms that have lower average connectivity and integration produce similar correlation results; however as the sample size (display locations in each room) is too small to obtain significant results. To strengthen the correlation results, this investigation is repeated by taking a group of gallery rooms that are characterized by a lower range of average visual connectivity values. The aim is to investigate whether the frequency of visits to each display is linked with those displays' local visibility values in the galleries that have comparably low visual connectivity and integration. Given that the average connectivity value of all galleries is 626 and the average maximum visual integration value of all galleries is 9.3, this correlation investigation is conducted for galleries A, B, C, F, and

G which have connectivity values between 235 and 326 and maximum visual integration values between 5.7 and 7.5. The results show that the frequency of visits to display objects is significantly linked to visual connectivity, control, and integration measures at those display locations (Table 4.7). The results also indicate that 29% of the variation in stop counts for each display can be explained by the potential of display locations to be seen from neighboring spaces. Consistent with this result, the potential for these locations to be visually close to every other location seems to be relevant (21%) for the frequency of visits. When two other galleries, D and 14, which have slightly higher average connectivity (366) and maximum integration (8.0) values are added to this investigation, the correlations are weaker (Table 4.8). Thus, the capacity of a display location to be close to other locations has a much weaker effect on the frequency of visits. These interesting results imply that the more visually segregated the galleries are, the more influential are the visibility properties of the display locations on the frequency of visits. This suggests that, in the visually segregated locations, visitors tend to stop at the relatively connected displays.

Table 4.7 Correlation between the number of stop counts received by each displays and visibility properties at the display locations (in galleries)

	Galleries Investigated	**Visual Integration**	**Visual Connectivity**	
Number of stops received by each display	*A, B, C, F and G*	0.44	0.54	***R***
		0.003	0.000	***p-value***
		0.19	0.29	***R^2***
	A, B, C, F , G , D and 14	0.29	0.41	***R***
		0.026	0.002	***p-value***
		0.08	0.17	***R2***

Patterns of Contact with Layout (Scanning stops) and Visibility Properties

Visitors' patterns of contact with the layout are examined using the data on "scanning stops" recorded where visitor's pauses were not associated with viewing particular displays, but with scanning the layout, looking at the spaces of architectural expression and looking out the windows. The scanning stop data recorded on the YCBA fourth floor plan diagram shows that visitors seem to stop most frequently in the Introduction gallery bays 2, 5, and 20*22 (Fig. 4.28).

For a more precise understanding of scanning stop distribution in the layout, a number of measures are retrieved from the scanning stop data. One of these measures is the percentage of scanning stops among all stop counts, which describes the behavior of stopping that is not associated with display viewing within the general stopping behavior (Fig. 4.29). The analysis using this measure shows that gallery bays 2, 5, 12, 3*4, 21*23, 20*22, 14, 7, 8, and 10, have the highest percentage ratio of scanning stops. However, for bays F, D and C in the Long Gallery and bays 26, 16 and 13, there are no recorded scanning stops.

The distribution of scanning stops is also analyzed by examining the stops associated with separate scans of the galleries and stops looking at the atria. This is important because the behavior of stopping to visually scan the galleries and stopping to look at spaces of architectural spaces (i.e. atria) indicate visitors' contact with the layout in two different ways. As for the stops associated with scanning the galleries, Figure 4.30 shows that those stops are highest percentages in bays 3*4, 7, 2 (the Introduction), 21*23, 12, 10 and 24. Among those, bays 3*4, 2, 7, 21*23 are the bays where visitors' movement is distributed in various directions, and thus the stops for scanning may be associated with looking at the available movement directions. As for the stops associated with looking at the atria, those stops are quite expectedly concentrated in the bays that have openings to the atria void. Bays 2, 5, 12, and 8 are the spaces where visitors stop most frequently to view the atrium. The analysis further shows that visitors stop more frequently at the main court (eastern side atrium) openings than at the entrance court (western side atrium). The higher number of stops around the main court might be motivated by the displays on the main court walls at the lower levels, which are be best viewed from the atrium openings in the fourth floor bays 5, 12, 7 and 8. In contrast, the entrance court (western side atrium) provides only visual access to the building entrance court and may help visitors retain orientation.

To investigate the effects of spatial properties on patterns of contact with the layout key measures extracted from scanning stops are compared to visibility properties. In the first step of

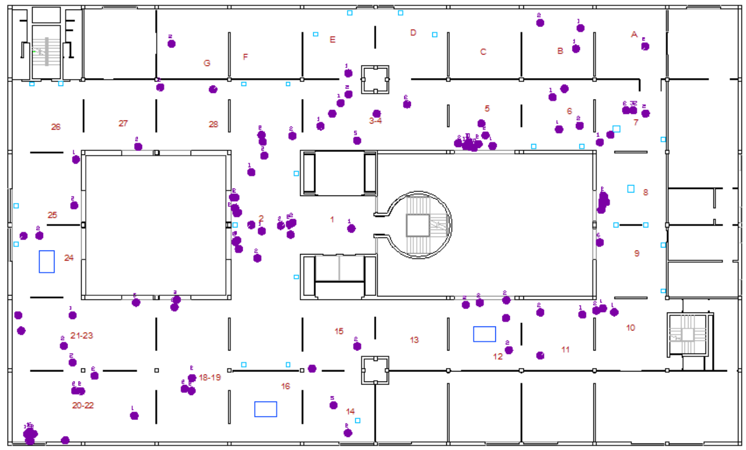


Figure 4.28 Distribution of all stops in the gallery

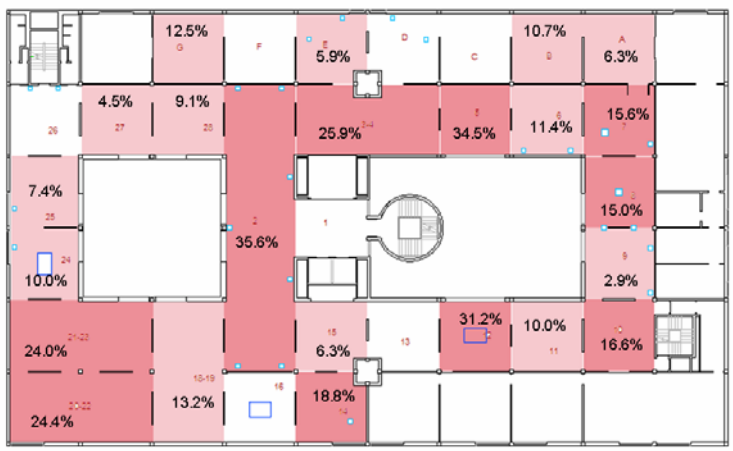


Figure 4.29 Distribution of percentage of scanning stops (scanning, looking at atrium and outside window) in all stops

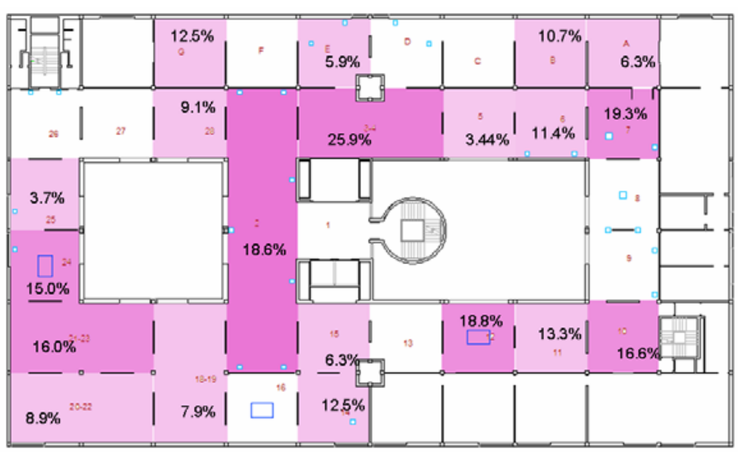


Figure 4.30 Distribution of percentage of scanning stops (scanning only) in all stops

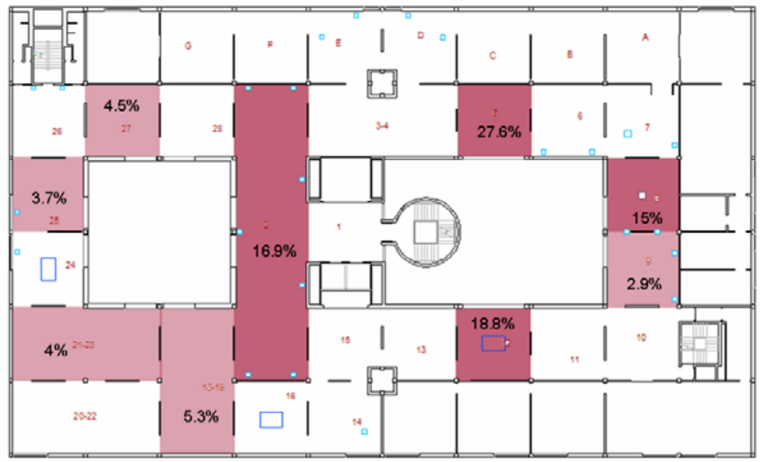


Figure 4.31 Distribution of percentage of scanning stops for looking at atria in all stops

this investigation, gross counts of scanning stops in each gallery are compared with the syntactic and non-syntactic visibility measures of the galleries. The results show that the number of scanning stop counts in each gallery is significantly correlated to average values of visual connectivity, visual control visual integration as well as isovist occlusivity and perimeter (Table 4.8). Among these correlations, the capacity of the gallery rooms to provide visual access to the neighboring locations (connectivity) and the less interconnected rooms (control), as well as the capacity to be visually close to all other spaces influences the number of scanning stops (37%, 34% and 24% respectively; Table 4.8). The correlations with isovist perimeter and occlusivity indicate that variation in the visual information of exposed surfaces and hidden regions contributes to the prediction of scanning stops (29% and 26% respectively, Table 4.8). This correlation investigation is conducted by normalizing the number of scanning stops by area. The correlation results are found to be similar to those obtained using the gross number of scanning stops (Tables 4.8 and 4.9). The normalized values of scanning stops are found to be linked with visual connectivity, control and integration measures, as well as isovist perimeter and occlusivity. These correlations show that the visual information of exposed surfaces and hidden regions has a consistent a role in the prediction of the behavior of stopping to visually scan and look at the atrium. Thus, visitors tend to stop to scan galleries and look at atria where they can access visual information of the neighboring locations regardless of the room size. When a space is within the few steps of other locations, this also seems to influence visitors' behavior of visually scanning and looking at atria. In regard to the effect of local information, exposed wall surfaces as well as hidden regions behind the corner play some role in motivating visitors to stop to scan galleries and look at atria.

Table 4.8 Correlations between the number of scanning stops in total stops & VGA measures in each gallery

	Syntactic			Non-syntactic		
	V. Integration (HH)	**Connectivity**	**Visual Control**	**Isovist Occlus.**	**Isovist Perimeter**	
Scanning stops (scanning + looking at atria, gross count)	0.49	0.61	0.58	0.51	0.54	***r***
	0.005	0.000	0.001	0.003	0.002	***p-***
	0.24	0.37	0.34	0.26	0.29	R^2

Table 4.9 Correlations between scanning stops (norm. by area) in all stops & VGA measures in each gallery

	Syntactic			Non-syntactic		
	V. Integration (HH)	**Connectivity**	**Visual Control**	**Isovist Occlus.**	**Isovist Perim.**	
Scanning stops (scanning + looking at atria, normalized count)	0.46	0.59	0.59	0.45	0.47	***r***
	0.010	0.001	0.000	0.012	0.007	***p-***
	0.21	0.35	0.35	0.20	0.22	R^2

In order to investigate the effect of visibility on the visitors' scanning behavior within general stopping behavior, the percentage of scanning stops among all stops is correlated with the average visual graph measures for those rooms. In this investigation, the correlations found for visual connectivity, control and integration as well as isovist occlusivity and perimeter slightly stronger than those found in direct correlation of scanning stops with those measures (Table 4.10). However, when only the percentage of scanning stops within all stops is correlated with the visibility properties of the room (by removing the stops looking at atria), the behavior of visually scanning is linked only with the visual integration property of the room, and this link is barely significant (Table 4.11). These results indicate that tendency of stopping to visually scan the galleries or to look at the atrium within the general stopping behavior is linked to the visibility properties of the rooms. However, stopping to visually scan the galleries alone is marginally linked to those properties. This suggests that a visitor's behavior of stopping to only scan the galleries might be motivated by factors other than visibility.

Table 4.10 Correlations between rate of scanning stops in all stops & VGA measures in galleries

	Syntactic			Non-syntactic		
	V. Integration (HH)	**Connectivity**	**Visual Control**	**Isovist Occlus.**	**Isovist Peri.**	
Percentage of scanning stops (scan. + look. at atria) in all stops	0.50	0.62	0.62	0.48	0.51	***r***
	0.005	0.000	0.000	0.007	0.003	***p-value***
	0.24	0.38	0.38	0.23	0.26	R^2

Table 4.11 Correlations between rate of scanning stops (scanning only) in total stops & VGA measures in each gallery

	Visual Integ. (HH) .	
Percentage (%) of scanning stops (scanning only) in all stops	0.36	***r***
	0.049	***p-value***
	0.13	R^2

Movement -- Stop Counts Relation and Visibility Properties

In addition to examining the three patterns of space-use, the relationship between explorative movement and stopping behavior is investigated by comparing the distribution of movement lines and stops counts. This comparison is made by calculating ratios between the number of movement lines and the stop counts in each room, as well as correlating these counts with each other.

The calculations of the number of movement lines and the stop count ratios explore if visitors stop in the locations they move, or just meander without stopping. When the ratio of moving to stopping equals 1, this represents a usage where visitors stopped once each time they enter a gallery room; ratios larger than 1 indicate that visitors stopped less frequently during their movement. Figure 4.32 provides the calculated ratios between the number of movement lines and stops in each gallery room. In this calculation the Introduction gallery, (room between the two atria) is done separately for each of its three parts in order to examine the movement and stopping

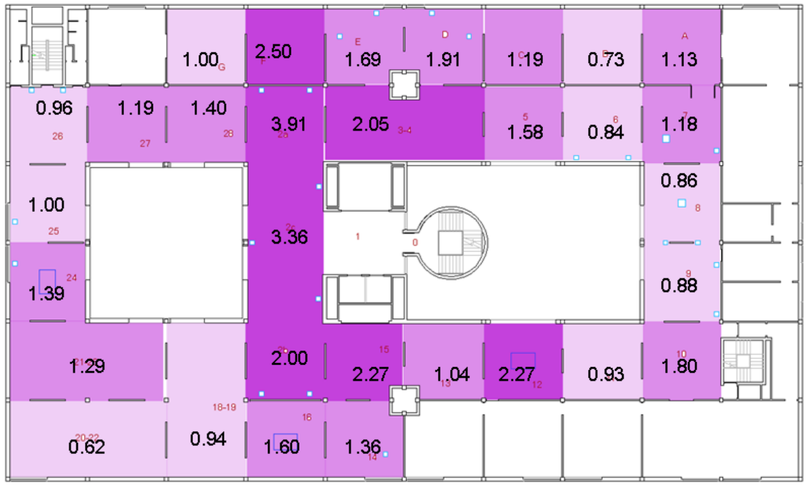


Figure 4.32 Ratio of movement paths crossing galleries to stops at displays

relationship in finer detail and provide results for spaces that are similar in size to the other galleries, allowing for comparisons among the different spaces. As can be seen in Figure 4.32, the ratios between the number of movement lines and the stop counts vary widely, between 0.62 and 3.91. The ratios are much higher in three parts of the Introduction gallery, (especially in its middle and northern sections), than in other galleries in the layout. These results imply that, in the Introduction gallery visitors seldom stop for displays and instead mostly meander or stop to visually scan. In other words, visitors' occupation in the Introduction gallery is characterized by exploratory behavior, such as choosing the direction to navigate and getting oriented. This skewed relationship between moving and stopping in the Introduction gallery might limit the use of correlations to demonstrate a direct link between moving and stopping to view displays. Therefore, the movement lines and stop counts are compared in two steps, one including and one excluding the Introduction gallery. When the ratios between the number of movement lines entering galleries and the stops at displays are examined after excluding the Introduction gallery, the mean values of these ratios in the gallery rooms is 1.34, suggesting that visitors stop only once in most of the galleries, while a few other galleries are visited with no stops along the same movement line entering the gallery rooms. Implications of these observations with respect to how the narrative is received by visitors are discussed at the end of this chapter.

Another observation that can be drawn from Figure 4.32 is that the lowest ratios between the number of movement lines and stop counts are seen in the larger gallery rooms such as gallery 20*22a, which has ratio of 0.62. This suggests that the room size may motivate more frequent stopping. Another factor influencing the stop counts might be the number of displays available in each room; it is possible that visitors stop more often in galleries that have a higher number of displays. Therefore, in addition to direct correlations, the number of movement lines and the stop counts are compared by partial correlations that include the number of displays in each room and room size as controlling variables. As explained in the methodology chapter, the partial correlation technique is used to investigate the link between two variables where other variables may interfere with this link. The partial correlation procedure virtually removes the third factor to explore the link between the two variables interested.

The correlations between the number of movement lines and stop counts aim to demonstrate how the relationship between moving and stopping co-vary throughout the layout. For the YCBA's fourth floor, the direct and partial correlations are separately calculated for stop counts of viewing displays and scanning stops.[25] The direct correlations (Table 4.13) show that visitor movement is directly linked to scanning stops; however, there is no such link between movement and stops for viewing displays. When these correlations are repeated by separately considering the number of available displays and room areas as controlling variables (Table 4.13), a link between movement and stops viewing displays still cannot be demonstrated, while the link between movement and scanning stops become weaker.

[25] Partial correlation analysis is aimed at finding correlation between two variables after removing the effects of other variables. This type of analysis helps spot spurious correlations (i.e. Correlations explained by the effect of other variables) as well as to reveal hidden correlations - i.e. correlations masked by the effect of other variables.

Table 4.13 Comparison of movement lines and stop counts using direct and partial correlation techniques (including all galleries)

	Correlation type	Stops at displays	Scanning stops	
Number of movement lines crossing each gallery	*Direct Correlation*	0.17	0.53	***r***
		0.376	0.002	***p-value***
		-	0.28	$\boldsymbol{R^2}$
	Partial correlation controlled by n. of displays	0.26	0.51	***r***
		0.165	0.004	***p-value***
		-	0.26	$\boldsymbol{R^2}$
	Partial correlation controlled by gallery room areas	0.096	0.46	***r***
		0.614	0.01	***p-value***
		-	0.21	$\boldsymbol{R^2}$

When these calculations are repeated without including the Introduction gallery, the direct correlations indicate that the number of movement lines is associated with counts of both stops to view displays and stops for scanning. This indicates that the frequency of stops for viewing displays and for scanning stops along movement is less varied throughout the galleries other than the Introduction gallery. In the partial correlation where the number of displays is a controlling variable, the association between movement and the stops to view displays is stronger (Table 4.14). However, the partial correlation where the room size is used as a controlling variable, no significant link can be demonstrated between movement and stops viewing displays. These investigations suggest that the frequency of stopping to view displays is influenced by the available displays in each room, whereas the room areas do not factor stops viewing displays or scanning stops.

Table 4.14 Correlation of movement lines and stop counts using direct and partial correlation (excluding Introduction gallery)

	Correlation type	Stops at displays	Scanning stops	
Number of movement lines crossing each gallery	*Direct Correlation*	0.44	0.40	***r***
		0.020	0.035	***p-value***
		0.19	0.16	$\boldsymbol{R^2}$
	Partial correlation controlled by n. of displays	0.48	0.39	***r***
		0.012	0.042	***p-value***
		0.23	0.15	$\boldsymbol{R^2}$
	Partial correlation controlled by gallery room areas	0.37	0.26	***r***
		0.060	0.186	***p-value***
		-	-	$\boldsymbol{R^2}$

In addition to these investigations on of the covariance between movement and stopping behaviors in the gallery rooms, the analysis examines whether gallery layout might also influence the covariance between movement and stopping. This investigation aims to understand which aspects of the layout may motivate visitors to explore the galleries by moving instead of stopping more often in each gallery. To this end, the key measures concerning the ratio of movement to stops to view displays are correlated with syntactic and non-syntactic visibility measures.

In order to determine whether visibility structure may motivate visitors to meander instead of stopping more often to view displays, the ratios of the number of movement lines to stop counts of display viewing are correlated with syntactic and non-syntactic (grid visual field) measures. This investigation first considers ratios of movement lines with the stops normalized by area. This correlation of these ratios is quite significant for the maximum and average values of visual integration as well as the average isovist perimeter in the galleries. However, the correlation with the average values of connectivity is only marginally significant (Table 4.15). This result indicates that a gallery room that is within a few visual steps away from all other rooms and reveals exposed surfaces has an impact on meandering and stopping/influences whether a visitor meanders or stops to view displays (Table 4.15). This investigation is repeated by examining the ratio of the number of movement lines and stops to view displays normalized by display numbers in relation to visibility properties; however, no correlation can be found between those movement-stop count ratios and visibility properties. This result indicates that only when all room sizes are equal does visibility seem to partially influence the motivation to meander instead of stopping more often to view the displays.

Table 4.15 Correlations between movement line-display stops ratio (normalized by area) and VGA measures

	Syntactic			Non-synt.	
	Connectivity	**Visual Integration**	**Visual Integration (Max)**	**Isovist Perimeter**	
Movement line/Display Stop Ratio normalized by Room areas	0.35	0.37	0.41	0.37	***r***
	0.057	0.039	0.023	0.039	*p-value*
	-	0.14	0.17	0.14	R^2

4.4.2 To What Extent Does the Spatial Layout Predict Space Use Patterns?

The results discussed above illuminate to what extent the gallery layout of the YCBA's fourth floor influences the space use patterns through its visibility structure. Most notably, the correlation results found between the number of movement lines and visibility properties provide strong evidence that more than half of the variation in the exploratory movement at the room scale is predicted by the room's visual integration property (how visually close the room is to all other locations), as shown in Table 4.1. This result indicates that visitors have a considerable tendency to visit or move through the rooms that are within a few visual steps from all other locations in the layout. The exploratory movement at the room scale is also predicted by according to whether a room can be seen from the neighboring locations or allows these neighboring locations to be seen, although at a local level this quality has a weaker effect on modulating the movement than at global level (i.e. integration). The results also suggests that the gallery room attribute of allowing visually least interconnected locations (visual control) to be seen explains a much smaller portion of the variation in the exploratory movement. This means that whether a visitor sees visually segregated locations or not has little impact on their motivation to move through galleries. In addition, the correlation results obtained from the comparison of movement line rates with the average non-syntactic visibility properties in the rooms helps identify which aspects of local visual information may play role in modulating the movement. The results provide strong evidence that almost half of the variation in the exploratory movement is determined by exposed wall surfaces as well as hidden regions that could be discovered with further movement. Additionally, the size of visible region has also a considerable effect on the modulation of movement (Table 4.1). These results indicate the significance of wall surfaces as well as display areas beyond the gateways as factors motivating visitors' exploration, and thus have important implications for understanding how the gallery morphology of the YCBA works in predicting exploratory movement. Interestingly, these correlation results revealed that the longest lines of sight in the visual field (denoted by the isovist maximum radial) have only a weak effect on predictions of exploratory movement.

The detailed comparison of exploratory movement and visibility properties indicates that exploratory movement is not predicted by visibility properties at the scale of a space around an individual. This has two potential implications. First, the distribution of movement may not be affected by minor variations in the visibility properties within a room. Second these variations in visibility are not significant because visibility properties vary little within the same room.

The analysis concerning the prediction of exploratory movement also focused on the visitors' choices of direction movement at spaces offering choice and investigates to what extent this choice may be shaped by visibility in permeable directions. The results provide strong evidence that nearly one third of the variation in visitors' choice to move into an available direction is influenced by the availability of hidden regions in visual fields (Table 4.2). Specifically, as they move in the layout visitors are drawn towards the areas where hidden regions can be revealed or can unfold within the permeable level. This result is in fact consistent with the effect of hidden regions at eye-level visibility on the distribution of movement through gallery rooms, reported in the previous step (Table 4.1.)

The analysis investigating the influence of layout on patterns of viewing displays shows that the gallery layout influences stopping to view displays as a result of visibility. The correlation results obtained from this analysis in general indicate that on the YCBA's fourth floor the same syntactic aspects of visibility structure predict stopping behavior and exploratory movement, although there is variation in the degree of the effect.

The analysis of the gross number of stops to view displays in each room established links between only the stops and the non-syntactic visibility properties of the rooms. Accordingly, there is a link between the stop counts for display viewing and the longest lines of sight in the visual field, while the stop counts are inversely linked to the degree to which the visual field has meandering boundaries (a visual field not having a compact shape) (Table 4.3). The analysis involving the stop counts normalized by the available displays shows that the visual closeness of a room to all other locations influences the frequency with which visitors stop to view displays in each rooms. This result is consistent with the correlation found for the movement lines. Additionally, this analysis shows a significant link with the longest lines of sight and the compact shape of the visual field with a greater role (more than 20% percent) in the prediction of stops to view displays (Table 4.4). According to these results, regardless of the number of available displays, visitors stop more frequently to view displays in rooms that are visually close to other locations in the layout and that can provide long vistas. Interestingly, the results suggest that rooms where the visual field has a meandering boundary (a less compact shape)[26] motivate visitors to stop to view displays. This may be explained by the fact that visitors prefer to stop and view displays where they can maintain visual information beyond the confines of the visited galleries. Thus further suggests that visitors are motivated to view displays when they have visual opportunities to compare the displays with those in the other locations.

The correlation analysis shows that the number of displays (measured by percentage) viewed in each room is partially influenced by the connective properties of those rooms, i.e. whether the rooms allow visitors to see neighboring locations, provide the potential for being seen from other locations, or are visually close to other locations (integration) (Table 4.6). In light of this, the content of the gallery rooms is more broadly read in rooms that provide visual access to neighboring locations and the rooms that are within a few visual steps from other locations in the layout. This result is consistent with the results explained above, suggesting that visitors tend to stop and the view displays where visual information beyond the confines of the visited galleries is revealed. Other implications of this result relate to how the narratives might be read as a result of the influence of the layout, which is the focus of section 4.5 in this chapter.

[26] Visual fields that are in spiked shape might be considered less compact, as area-perimeter ratio might get smaller due to longer perimeter.

Another very interesting result is obtained when the frequency of contacting each display is compared to the visibility properties of the display locations. In the entire layout, there is no consistent correlation between the number of stops received by each display and the visibility properties of those display locations. Nonetheless, in the visually least connected galleries (those that can hardly be seen from neighboring locations), the frequency of visits for each display is predicted by whether the display location can be seen from neighboring locations and whether the display is within a few visual steps from all other regions (Table 4.7). This result is interesting because the other results based on the prediction of movement lines and stop counts using the connectivity and integration properties of the rooms indicate that visually segregated rooms along with their displays are visited less frequently (Tables 4.1. and 4.4). The less frequent visits and fewer stops to view displays suggest that visitors who happen to visit those segregated galleries seem motivated to stop at the displays that are easily seen from the neighboring locations and are a few visual steps ahead within the confines of those galleries. Thus, the lack of this visual information of neighboring galleries and other locations may motivate visitors to pay attention to the displays that are located in relatively more integrated and connected points within a room. This interesting result also implies that even in segregated locations, visitors seem to look for larger more extensive visual links.

The analysis using spatial properties to compare visitors' patterns of contacting the layout (described on the basis of scanning stops) indicates that those patterns seem partially predicted by the visibility properties. The analysis shows that the frequency of stopping to scan galleries and looking at the atria is predicted by how well the gallery rooms can be seen from neighboring spaces as well as how visually close the rooms are to other locations in the layout (Table 4.8). Although these findings show that "scanning stops" seem to be predicted by the same syntactic visibility aspects that also predict exploratory movement, the distinctive aspect of a room that predicts scanning stops is whether visually less interconnected spaces (the property of visual control can be seen from the room. This seems to indicate that visitors tend to stop to scan the galleries and atria where they have control over visual information in their neighborhood. As discussed earlier, visually less connected spaces are seldom visited, and thus the link between scanning stops and visual control indicates that visitors scan and compare the visual information in visually controlling spaces without moving forward to the visually segregated spaces. In addition to the effect of syntactic aspects, the correlation found between scanning stops and the perimeter and occlusivity properties of visual fields suggests that visual information from exposed wall surfaces and hidden information plays a role in whether scanning stops occur. When scanning stop counts normalized by room areas are compared to visibility, there are consistent links between syntactic and non-syntactic properties as established by the gross number of scanning stops.

Additionally, when the percentage of scanning stops within all stops recorded in each gallery is compared to the visibility properties, the syntactic properties seem to have greater influence on the behavior of scanning within the entire stopping behavior (Table 4.10). These results suggest that the gallery layout motivates visitors' behavior to visually contact the gallery space and the exhibitions in the locations where there is an unfolding of visual information on less connected spaces and other spaces in the neighborhood, and where spaces are within few visual steps away from all other spaces. Since these locations are mostly located adjacent to the atria openings, by opening up the visual information of the gallery space the atria spaces have are very important in motivating visitors to contact the layout. The results also indicate that behavior of scanning the galleries without looking at the atria is not influenced by the layout properties, but might be motivated by other factors (Table 4.11).

4.5 Interactions among the Spatial Layout, Narratives and Space Use Patterns

This in-depth analysis of the YCBA provides results for two key investigations concerning the ways in which the YCBA gallery layout shapes the exhibition narratives, and the extent to which the layout predicts space-use patterns. Since these investigations are performed on the basis of top-down and bottom-up characterizations of the space as described by its syntactic and non-syntactic visibility properties, the results can illuminate the interactions among the gallery layout, exhibition narratives and space-use patterns and thus explain which morphological characteristics may shape those interactions in the YCBA's fourth floor layout.

Presentation of Exhibition Narratives based on the Visibility Properties

With regard to the explorations of how the YCBA gallery layout shapes the exhibition narratives, the examination of the visibility properties in conjunction with the narrative organization suggest that global levels of visibility prioritizes two chronological sequences, one is the development of British portraiture, the other is British natural scenery painting in the 17th and 18th centuries. As highest visual integration values in the Introduction gallery and the northern side promenade of the atria core, places an emphasis on the highlights of the political and historical context of the British Empire that influenced artistic development in the 17th and 18th artistic production, and particularly on a special genre of portraiture, the Conversation Pieces. This is because, the strong global visibility properties in those galleries created opportunities of relating these displays to all other displays in the layout, thus enabled to read the entire narrative on the British art between 16th to mid 19th centuries from the lens of the 17th and 18th century developments and British portraiture genre painting.

While the single direction sequences of galleries presented of British portraiture and landscape painting in partially dictating manner, the visual connectivity enhanced through atria openings provided glimpses towards the works in the parallel sequences. This created opportunity to visually compare the works of portraiture and landscape. The placement of Victorian era paintings in the eastern end of the gallery also takes advantages of glimpses to the portraiture and landscape sequences in the diagonal directions. In this way, the mixed appearance of portraiture and landscape paintings in the Victorian era can be assured. In conclusion, the narrative on the

British art between 16th and mid-18th century was organized with a scholarly interpretation using conventional categories of the British painting and sculpture, and within a strict geometry of the YCBA's layout, the visibility relationships prioritizes certain sequences and relaxes the strict sequences with glimpses across space.

Prediction of Explorative Behavior and Its Implications for Conveying the Narratives

One of the most important results of this case study is obtained from the correlations between the number of movement lines entering galleries and the visibility properties of those galleries. The results show that visitors' exploratory movement is modulated towards the spaces that are visually close to all other locations, denoted by the integration property. In other words, the gallery layout guides visitors to spaces as a result of the property of being in visual proximity to other spaces in the layout. Secondarily, visitors' movement is also modulated towards the spaces that can be seen in the neighborhood of visited locations, meaning that as the layout can expose the neighboring spaces this influences the exploratory movement of visitors. The implications of these results are twofold. First, visitors most frequently move through the spaces they are able to access most conveniently from all other locations. Second, visitors maintain their movement through these highly integrated spaces since they can also see all other locations with the shortest visual steps.

In order to understand the interactions among gallery layout, exhibition narrative and patterns of exploration these results can be discussed in conjunction with the ways in which the exhibition narrative is presented within the spatial structure of the layout. The potential of the gallery layout to predict exploratory movement through global visibility relationships (i.e. integration) has relevance for the ways in which exhibition narratives are conveyed. First, if the layout modulates movement towards the places that visually close to every other space in the layout, then the themes presented in the visually integrated location, like the north side of the atria core, are prioritized because those themes are consequently the most likely read. In the YCBA layout, these prioritized themes are those associated with portraiture in the eighteenth century and the Conversation Pieces, in particular Hogarth's satirical compositions related to British literature. Second, from the most visually integrated places where these themes are presented, visitors also potentially have visual access to other corners of the layout within fewest visual steps. This enables visitors to connect all other displays from the lens of the British portraiture in the eighteenth century.

The descriptive analysis of visitors' exploratory movement shows that the majority of visitors who enter the galleries for the first time are directed from the Introduction gallery towards the southwest corner where the Romantic portraits of Constable and Turner are displayed. The data shows that the same number of visitors moved to the northeast (to Hogarth) and to the southeast (to Wright of Derby), while fewer visitors are directed northwest (to Mercier). When the distributions of visitor movement are examined using the number of movement lines entering each gallery (also including the return visits for further exploration) there seems to be a trend towards the northeast sequence which starts with Hogarth. Given that this sequence is at a visually integrated location, this observation is consistent with the finding that exploratory movement can be predicted on the basis of the integration property, and that the themes presented in the northeast sequence are likely transmitted to visitors. As discussed in the comparison of the visual integration graphs generated at eye level and at knee level (with and without atrium voids), the atria core seems to be influential in making distant connections along many directions, leading to concentrations of higher integration values on the north side of the atria core. By creating a global visibility relationship in this way, the atria play a role in emphasizing the themes associated with portraiture, in particular those related to the Conversation Pieces. By predicting the visitors' explorative behavior on the basis of the integration property, the layout facilitates the likelihood that those themes are more broadly received by visitors.

Other strong qualities of the gallery layout predict exploratory movement through local visibility relationships (connectivity), which also influence the ways in which the exhibition narrative is conveyed. The results confirm that exploratory movement is also modulated towards the rooms that can be viewed from neighboring spaces. This suggests that the display themes presented in the locally connected rooms might be conveyed more explicitly because those rooms would likely be visited one after another. As can be seen in Figure 4.19, the highly connected galleries are the Introduction gallery (the central part), Late Georgian Women (25), Romantic Portraits (24), Constable (18*19), the Sea (22*23), The Conversation piece (5) and Sport (12), all of which are located near the atria openings. As the results suggest, visitors are very likely to visit these places, and once they arrive in those galleries they encounter the displays that are visible through the atria. The atria openings bring synchronous views of the displays across a distance, and this provides opportunities for visitors to recognize that displays can be read in various other combinations, as revealed through visibility and alternative dialogues between the displays. This implies that the atria also contribute to the presentation of alternative dialogues between the displays at the local level.

Prediction of the Exploration and Viewing Behavior and Its Implications the Narratives

The extent to which the YCBA's layout predicts the behavior of contacting displays is explored in the correlations between the measures of stop counts for display viewing and visibility properties. The results show that visitors' stopping behavior associated with viewing displays is partially influenced by visibility properties. More importantly, visitors' stopping to view displays is predicted by nearly the same visibility properties that predict movement, and thus visitors are likely to have contact with displays in the spaces they navigate. Given this result, one can argue that the effect of the layout on exploratory movement would also have an effect on the degree to which narratives are read. Indeed, the descriptive results for the stopping behavior suggest that this argument is partially true. While the gallery rooms that are entered and crossed most frequently do not have the highest counts of stops, stopping to view displays is nevertheless quite frequent in those rooms. The descriptive results demonstrating stopping behavior suggest that displays of Turner (20*22), Wright of Derby (15), Pastoral Landscape (13), Ideal Landscape (11), Conversation Piece (5) and those representing art in the Queen Victoria period (8 and 9) are visited most frequently and with repeated stops. Among these rooms, only a small number are characterized by space use consisting of exploratory movement. This observation can be supported by the diagram (Fig. 4.32) showing the ratio of movement paths to stops at displays. As this diagram indicates, in the galleries devoted to Turner (20*22), Constable (18*19), the art in the Queen Victoria period (8 and 9) visitors stopped more than once each time they entered the galleries, which indicates greater attention to the content displayed, perhaps because the narrative is found to be more engaging. Therefore, in addition to the consistent effect of the visibility on the patterns of contact with displays along the movement, independent of the layout, some of the display groups and the represented narrative also affect the stopping behavior.

Other results of this investigation concerning the effects of the bottom-up characterization of the space on the space use are obtained by correlating the space use patterns with the non-syntactic properties representing local visibility characteristics. The results for this correlation demonstrate that a number of local visibility characteristics contribute to predicting exploratory movement and stopping behavior. Along with the local visibility described using visual field properties, the longest lines of sight in each room (measured by the average isovist maximum radial), seems to have an effect on the stopping behavior associated with viewing displays. This implies that visitors tend to stop to view displays more often at the places where they can project their sight toward the longest distance possible in the gallery rooms. However, the results obtained by correlating visual field properties with the number of movement lines suggest that the longest lines of vision influence exploratory movement to a much smaller extent. The stronger effect of the longest lines of sight on stopping may be related to the opportunity to project sight to farther places while viewing displays. Given this property, visitors might be motivated to view certain displays when able to see the displays beyond the confines of the rooms they visit. As reported in Table 4.2 other non-syntactic visibility properties, isovist occlusivity, perimeter, and the size of the visible region seem to have a stronger effect on exploratory movement. Indeed, the effect of these properties on movement can be evaluated with respect to visual information exposed to the observer (at eye-level) through the configuration of interior partitions and atria. The effect of exposed surfaces (measured by the perimeter) implies that visitors are drawn to displays on the walls or informed by the information at the edges of their visible region. The effect of occlusivity on visitor movement may be due to the fact that visitors are drawn by the potential of exploring the displays around the corner of the partitions. Indeed, this property obtained at permeable directions also has a notable effect on the choices of standing visitors to move in a particular direction, as reported in Table 4.3. As can be seen from Figure 4.33, the position of interior partitions in the gallery and the atria opening (at the left side of the picture) create hidden areas that can be explored with further movement, and maintain the sense of surprise during the exploration. This element of surprise characterizes the visual information obtained while moving through the gallery doorways, and this property modulates the exploratory movement through the galleries and at the choice points.

Figure 4.33 View from gallery 7 where longest lines of sight can be projected

Prediction of the Scanning Behavior and Shaping the Museum Visit

The investigations concerning the stopping behavior associated with visually contacting the gallery space, described in terms of "scanning stops", suggest that visitors' stop to visually scan the galleries, look at the atria or take a restorative break when visual information is available through atria (Tables 4.8 through 4.11). As can be seen in Figure 4.28, the atria openings motivate visitors to stop and look around. In particular, in the Introduction gallery (located between the two atria) it was observed that visitors tended to stop and look through the entry atrium openings when they enter the gallery for the first time; the main atrium (on the eastern side), however, attracts visitors by providing an opportunity for viewing other works on the atrium walls. From this observation, it can be argued that the entry atrium function to facilitate visitor's orientation, whereas the main atrium provides opportunities for a restorative break by projecting vision to farther locations.

To sum up, in the YCBA's fourth floor layout, the visibility structure is primarily engendered by the atria core located in the central longitudinal axis as well as uninterrupted visibility through the gallery doorways. The visibility structure concentrates highly integrated areas on the longitudinal sides of the atria core and this structure places emphasis on the displays in this promenade. This emphasis prioritizes themes in the exhibition narrative related to eighteenth century portraiture and the emergence of the conversation pieces genre pioneered by Hogarth. As a result of the configuration with the atria core and the room geometry, the visibility structure of the gallery layout is in general highly integrated and this is the main property that predicts visitors' exploratory movement. The behavior of stopping to view displays is also predicted by these properties of the visibility structure, which means that explorative behavior and viewing displays mostly occur in the same locations in the layout. This property facilitates conveying the themes in the highly integrated areas around atria core, which are associated with eighteenth century portraiture and other integrated areas displaying eighteenth century landscape.

On the basis of these results, it can be argued that spatial properties play a role in conveying the narrative in a certain way. However, as the data of stopping behavior shows, it is also evident that some of the thematic display groups, such as those associated with art in the Queen Victoria era, Constable, Turner, and Pastoral Landscape attract visitors' attention independent of the spatial properties. This confirms that in the YBCA the narratives can have the same influence on visitors' stopping behavior as architecture. On the other hand, the morphological characteristics shaped by the atria core have a primary role in predicting visitors' behavior of contacting the layout, to get oriented, take a restorative break and scan the displays. These behavioral patterns seem more explicitly synergized by explorative behavior, and therefore, in the YCBA's gallery, visitors can experience the architecture while exploring the gallery layout for navigation.

The findings discussed in this chapter underscore how architectural design can contribute to the implementation of a museum program established at the commissioning of a building. The goal of creating opportunities for visitors to see interrelationships is achieved in a spatial layout where visitors can navigate comfortably while retaining their sense of orientation and stopping to view displays. During their spatial exploration, visitors have the potential to project their vision to farther corners of the gallery and this may help them relate the displays they actually visit with those that appear as they glance at a portion of the space. With its combination of differently sized spaces together with both high and low ceilings the gallery is legible and indeed evokes visitor curiosity and interest.

CHAPTER V

CASE STUDY 2:
THE MUSEUM OF MODERN ART (N.Y.)

5.1 Chapter Overview

This chapter presents an in-depth analysis of the fourth floor gallery of the new Museum of Modern Art, exploring how the gallery layout shapes the exhibition narratives and to what extent it predicts the space use patterns. After a description of the museum collection and the museum building design characteristics, the chapter presents two analyses. The first examines the exhibition content in terms of its organization in the gallery layout and then compares the exhibition narratives to the gallery layout characteristics; the second examines visitors' space use patterns and correlates those patterns with the spatial layout properties.

5.2 The Museum of Modern Art Collection and the Museum Building

The Museum of Modern Art (MoMA) was founded in 1929 with the primary purpose of "helping people to enjoy, understand and use of the visual arts of the twentieth century" (Lowry, 1998). The museum aims to preserve, collect and display the best works of modern and contemporary art, and to serve as a laboratory for understanding the visual art manifested by modernity. With this mission, the museum promotes artwork that is "contemporary for its age," and "experimental, progressive, original and challenging", rather than "safe and academic" (Elderfield, 2004, pp. 10-12). In maintaining this mission today, the MoMA's collection comprises works of both modern and contemporary art including the masterpieces of the early twentieth century that were then controversial and progressive.

Since the museum's early decades, the collection has continued to grow with the addition of pieces of contemporary art that are progressive for their age, and the collection pieces have been interpreted from the perspective of the museum's first curator, Alfred Barr Jr.'s. Barr interpreted artwork in terms of their formal and visual qualities (Kantor, 2002, p. 330). He grouped the works of art according to artistic style (art movement), or artist, location, and time period; this categorization, however, was mostly independent of political context or historical periods. In Barr's interpretative schemes, each artistic style or movement can be understood individually and situated in a diagram in such a way that the relationships among different styles can be read. Since each style may be influenced by or lead to several others, the development of each style can be traced on the basis of multiple trajectories, which account for derivations and influences of different artistic styles. This interpretation is based on a genealogical approach to explaining the multiplicities and complexities of modern art movements within their evolution from their origins in the nineteenth century art. This reading of modern art has been maintained through the curatorial strategies and programs even after Barr left the museum in 1968.

The MoMA's approach to interpreting its collection through a genealogical development of modern art movements influenced the design of its building and gallery spaces. The first official building of the museum, opened in 1939, consisted of different gallery rooms each of which represented a single art movement. These gallery rooms, so-called "chapter rooms" were of a scale smaller than that of traditional museums. In this regard, the building was considered to be a "decisive break with conventional museum design" (Wallach, 1998, p. 79). This is primarily because the gallery room size and organization established a more intimate relationship between visitors and the works of art than traditional museums of the time did, presenting the artwork independently of their social and historical context and shaping the exhibitions to create an unmediated experience of the art. In line with this aim and strategy, the primary element of the MoMA's gallery design has been a gallery room of an intimate scale and pure geometrical form where art is displayed against neutral colors with minimal contextual information (Noordegraaf, 2004).

Since the construction of its first building, the MoMA has undergone several renovations and expansions, the last being completed in 2004. The first three major commissions included the addition of the G. R. Rogers annex on the west (1949-51), the formal creation of the sculpture garden and its re-organized connection to the entrance (1952-53), and the addition of the East Wing (1964) by Phillip Johnson. After these modifications, the expansion of the gallery space and the addition of a tower (1984) by Cesar Pelli altered the visitor flow from the transverse direction to the longitudinal direction parallel to the street where the length of the building was doubled (Cesar Pelli, in Searing, 1982, p. 83). Each of these expansion projects has redefined the museum's spatial relationship with its visitors, while the gallery layout in each project and its subsequent interior alterations have re-explored the new ways in which modern art is understood (Elderfield, 2004; Lowry, 2005). Although the primary element of the gallery space has remained same, self-contained gallery rooms reflecting Barr Jr.'s interpretation of modern art in chapters of artists, periods and styles, the ways in which these chapter rooms are connected and ordered have evolved over time. In the 1964 expansion and subsequent reorganization of the interior, the gallery space was laid out in a sequence that can be experienced as a labyrinth, where the story of modern art was interpreted in chronological order and a directed sequence placed in a rectangular block. In the 1984 expansion the chronological order became even more determining, where contrasting and diversified styles were put side by side reflecting their order in history, but at the expense of understanding the internal logic of the styles (Elderfield, 2004, pp. 50-54).

The last expansion project of the MoMA, part of which completed in 2004, was planned with two objectives in mind. One was to create a larger gallery space to accommodate a greater number of visitors. The other was to create a space that would allow the museum to offer a synoptic overview of the story of modern art that acknowledged the complexities and contradictions in its development and allowed for pieces in the collection to be displayed in unique combinations (Elderfield, 2004, p. 56). This aim required enlargement of the gallery space, the end result of which enhanced both the function of the space and the perception of the collection. Although the increase in the size of the gallery space would change its modest scale, the museum wanted to retain the sense of intimacy in the gallery rooms so as to maintain a visitor's pleasure of viewing art (Lowry, 1998). Along with the physical expansion, the museum acknowledged that the way in which the story of modern art is told should be transformed to afford multiple narratives, and thus the new building should allow multiple interpretations within scholarship as well as a visitor's experience. Therefore, the new gallery space was envisioned as consisting of fixed and changeable galleries, and the layout shaped to offer multiple routes that would allow for visitors to have individualized explorations (Elderfield, 2004). This reconfiguration of the gallery space would truly fulfill Barr's original idea of the museum being a laboratory for understanding modern and pre-contemporary art within its complexities and multiplicities.

These objectives were incorporated in Yoshio Taniguchi's architectural design in collaboration with the MoMA in arranging the gallery rooms, and the new MoMA was opened to visitors in 2004. The new MoMA's main gallery building is a five storey block situated in the western potion of the museum site.[27] Doubling the space for the museums' exhibitions and programs, the new MoMA embraced an "urban" experience for the massive audience from Manhattan (Naredi-Rainer, 2004).

In the new MoMA the fourth and fifth floors of the exhibition building were designated to display the permanent collection of painting and sculpture masterpieces of modern and pre-contemporary art (dating from the 1880s to the 1980s). For the extant study, however, only the

[27] Full summary of the MoMA's expansion project can be found in "Museum History" http://www.moma.org/about/history, retrieved 08.17.2009.

fourth floor galleries will be analyzed because the fifth floor galleries display a number of masterpieces that attract very large visitor groups; thus the effect of the spatial layout would be difficult to ascertain. In contrast, the fourth floor gallery displays attract a more typical visitor volume and thus are a better focus for this study.

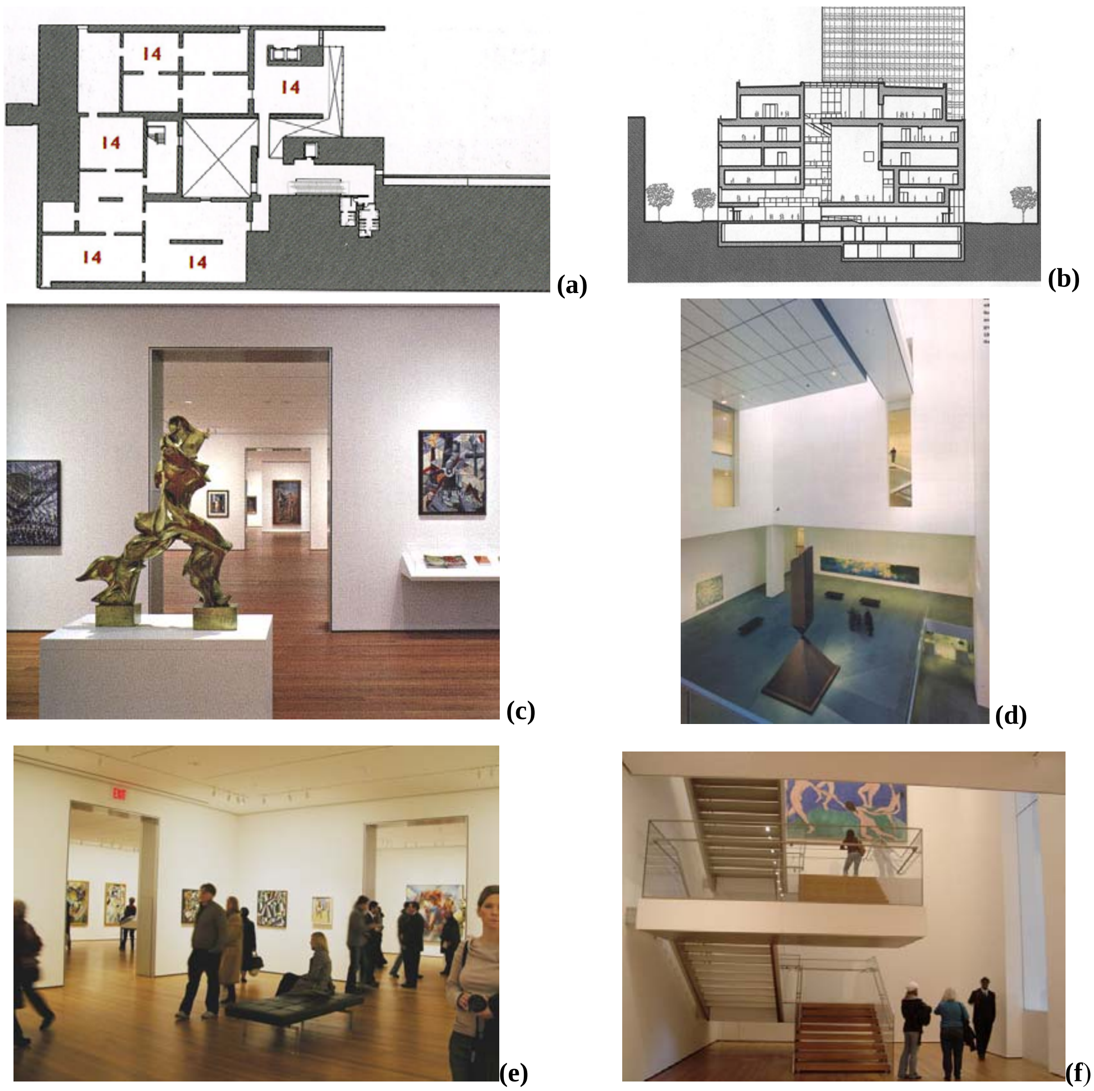


Figure 5.1 The new Museum of Modern Art, 2004, by Y. Taniguchi **(a)** fourth floor in the new main gallery building, **(b)** transverse section, **(c)** a view from fifth floor galleries (photo source: Architectural Record), **(d)** atrium, **(e)** a view from firth floor galleries (photo: Sophia Psarra); **(f)** view from the staircase connecting fourth floor to fifth floor (photo: Ying Xu)

5.3 The MoMA's Fourth Floor Layout and the Exhibition Narratives

5.3.1 The MoMA's Interpretation of Modern Art and Exhibition Content

As a first step toward understanding the exhibition narratives presented on the MoMA's fourth floor, this section reviews the major themes presenting the story of modern art in the exhibition. The exhibition presented in the fourth floor galleries concerns development of the late modern and pre-contemporary painting and sculpture from the 1940s to the 1980s. The information on this content was compiled in fall 2005 and spring 2006 as a part of a research project supervised by Sophia Psarra at the University of Michigan. The compiled information includes the curatorial assistant's comments obtained during the open-ended interviews, scholarly sources on MoMA's the collection and its curatorial interpretation including older and newest publications of the museum.

As discussed in the publication sources, the curatorial program of the Museum of Modern Art is dedicated to interpreting the history of modern art starting from its roots in impressionism (which emerged at the end of the nineteenth century) and tracing the development of modern art though the pre-war and post-war periods and until the 1970s (Lowry, 2005). The interpretation of modern art from its impressionist origins to the post-war period is based on the framework introduced by Alfred Barr Jr. in the MoMA's "Cubism and Abstract Art" exhibition catalogue in 1939. In Barr's framework movements of modern art began with impressionist painting in the 1880s and reflected later in the post impressionist works of, Cezanne, Seurat, Van Gogh, and Gauguin. Starting from these origins, the development of modern movements has been examined in terms of two major current of styles. The first and more important one was evolved through the avant-garde art of the Cubists, and found its delta in the various movements whose work is characterized by geometrically abstract forms and compositions (Barr, Miller, Fantl, & Newhall, 1936). The second current is that of short-lived movement of Fauvism, most strongly associated with Matisse and a group of artists called *Fauves* (*les fauves* meaning the wild-beasts) who painted with unnaturally bright colors and with violent manner at the beginning of the twentieth century (Elderfield, 2004). Fauvism led to Abstract Expressionism of the pre-War paintings and reappeared later in abstract art associated with Surrealism.

Barr contrasted the Cubism and Fauvism in terms of formal and compositional logic. Barr described Cubism, as “intellectual, structural, architectonic, geometrical, rectilinear and classical in its austerity and dependence upon logic and calculation,” and called it “geometrically abstract art. In contrast, he considered Fauvism, expressionism and Surrealism as “intuitional…, emotional… organic and biophormic in its forms; curvilinear,… decorative,… the spontaneous and the irrational (Kantor, 2002, p. 326), and referred to works of this kind as “non-geometrical abstract art” (Fig. 5.2). In Barr’s diagram interpreting modern art, the origins of geometrical abstract art can be found in the art of Cezanne and Seurat which eliminated classical perspective, used cylindrical and angular forms to represent objects, and painted forms through spotty brushstrokes with a pointillist technique (Barr et al., 1936). Emerging from the mixed influence of Cezanne’s and Seurat’s art as well as traditional African (so-called Negro) sculpture, Cubism disintegrated form by analyzing it into solid and angular objects, and diffusing object boundaries. On the other hand, non-geometrical abstract art emerged from the inspiration of Gauguin’s soft and primitive forms, and Van Gogh’s deformation in nature and bold colors. In Barr’s interpretation, the development of non-geometrical art was considered strongly influenced by art of Matisse, which is not completely devoid of forms and spatial relationships; however, lack a pull of gravity, or perspective (Kantor, 2002). According to Barr, followers of Matisse maintained the non-geometrical art through the subconscious and symbolic use of forms and figures, which later became associated with the Surrealist movement.

For the World War I period art, the MoMA’s curatorial interpretation focuses on the art of Surrealists. In this interpretation, the Surrealists are examined in two groups. One group is characterized by automatism and poetic sign language in painting (that appeared in the works of

Miro and Masson), while the other group is noted for its depictions of hallucinatory or illusionary scenes and dream pictures (such as works by Dali and Magritte). This last group of Surrealists is viewed as being associated with the Social Realism movement in which was part of the political context after World War I.

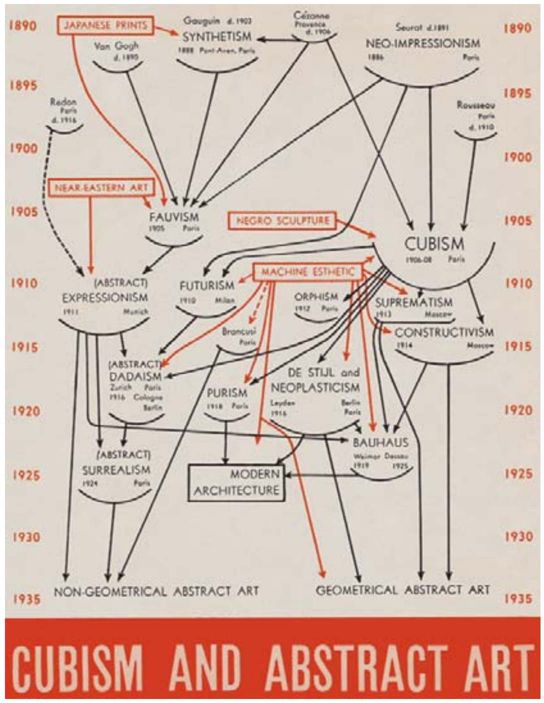


Figure 5.2 Alfred Barr, Jr.'s diagram published in the "Cubism and Abstract Art" exhibition catalogue.

Exhibition Content in the Fourth Floor: Late Modern and Pre-contemporary Art

The focus of the fourth floor gallery is art from the 1940s to the 1980s. The MoMA interprets artwork after World War II as transformed versions of Cubist and Surrealist influences and some other emergent movements. In this regard, works of art created in the post-war decade are analyzed in two groups: post-Cubist and late Surrealist work in Europe and America, and early Abstract Expressionists in postwar New York (Elderfield, 2004, p. 297). In the first group, post-Cubism and late Surrealism in Europe are represented with the late works of Picasso and Braque, and sculptor Giacometti, Dubuffet, and Bacon, and categorized under Postwar Figuration. Other late Surrealist works by Latin American artists, such as Bourgois and Lam, are grouped under the theme of Surrealists in Exile. The works in the second group representing post-war art in North America (particularly New York) are from the artists considered to be early Abstract Expressionists, such as Rothko, and Gorky, who anticipated Abstract Expressionism in post-war America (Elderfield, 2004). The early works of Pollock and Krasner are also included in this group in acknowledgment of their earlier explorations that led to Abstract Expressionism.

In the MoMA's collection, Abstract Expressionism is represented mainly by works of Pollock and Newman. Given the large number of paintings from these artists, one gallery room has been dedicated to an ongoing rotation of their work. Pollock's unique style is characterized by painting by dripping and illustrates art created by "spontaneity and chance" and driven by the subconscious. As indicated in the curatorial publications of the MoMA, other Abstract Expressionists recognized in the post-war New York are Rothko, Kline, Still and Newman. The paintings of Newman and Rothko present calm compositions of wide surfaces with single or a few color tones, whereas the paintings by Still and Kline reflects spontaneous action akin to Pollock's style (Museum of Modern Art (New York N.Y.), 2004).

The MoMA has examined modern art after Abstract Expressionism from the late 1950's and early 1960's from two principal perspectives. The first one is characterized by painterly abstraction that reflects artists' "personal styles in putting marks on the canvass" (Museum of Modern Art (New York N.Y.), 2004, p. 211). The second one is considered an opposite perspective in which "painterliness" is transformed through the infusion of other image content such as common objects or signs from the "mundane" world (Elderfield, 2004, p. 297). The artists of the first group, Louis, Frankenthaler and Caro are recognized by their spontaneous brushstrokes or dripping driven by a subconscious state of mind (Elderfield, 2004; Museum of Modern Art (New York N.Y.), 2004). The artists of second group, on the other hand, are those like Johns, Rauschenberg and Twombly who created work with instantly recognizable symbols or signs. Their work is often characterized by spontaneously produced compositions of daily objects or graffiti style scribbling (Museum of Modern Art (New York N.Y.), 2004). What unifies the two groups is that the artistic motivation is still driven by subconscious mind; they are distinguished, however, by their different artistic language; while the former works through the material existence of paint, the latter works through objects, lines or common symbols.

The MoMA's curatorial interpretation of these two directions of Post-Abstract Expressionism is that they are a part of the crosscurrents "that complicate, develop, while seeking to escape from a dominant style" (Elderfield, 2004, p. 297) Within these crosscurrents, Kelly's abstract compositions with their geometrical cut-out forms and Soto's sculptures assembling simple forms are considered abstract geometrical alternatives to other non-painterly styles. Within the continuum of non-painterly influence are works created by Central American and Latin artists in the 1960s and examined under the theme Reinventing Abstraction-1960c. In addition to this geometrically abstract group of art, other artistic motivations examined in the crosscurrents show various influences that anticipated Minimalism and Pop art of the late 1960s.

Having emerged from the crosscurrents in 1960s, Pop art is represented in the MoMA's collection by quite large number of works by Warhol and Lichtenstein. Other Pop art works in the collection are of Wesselman, Oldenburg, Dine, Ruscha, and Hamilton. Among these artists, Wesselman focused on images of consumer products to mimic consumerist life style in the American postwar years (Museum of Modern Art (New York N.Y.), 2004). Oldenburg depicted industrial objects in exaggerated sizes and deformed shapes. Ruscha and Lichtenstein used verbal expressions or scenes taken from comic strips. Lichtenstein's comic strip work was based on images of romance or war and showed how sensual elements of a picture (e.g. bright sun, female sexuality) could be conveyed by means of reproducible surfaces. Warhol's work also featured images of products and reproducible media images, and thus tried to "subvert the idea of painting as a medium of invention and originality." Using the banal and ordinary objects, Pop art artists re-conceptualized art by rendering the picture plane with more accessible, reproducible, cheap and transient language evident in the age of consumer culture (Museum of Modern Art (New York N.Y.), 2004, p. 238).

Another movement that is considered to have emerged from the crosscurrents is Minimalism. In Minimalist art objects are reduced to their most basic features; thus it is seen as a pure and irreducible form. Some Minimalist objects have been shaped into almost invisible forms incorporated into the gallery room environment. A subsequent movement, Post-Minimalism, is known for its strong associations with Minimalism, although Post-Minimalist artists worked with emphasize the sensual qualities of materials and use more amorphous shapes with fewer regular compositions. Another developed as an alternative to the reductive style of Minimalism is Conceptual Art. Conceptual artists have questioned the foundations of art by provocatively using text (i.e. John Baldessari's "What is painting?") and some have created ready-made style compositions out of leftover materials.

To sum up, the exhibition content presented in the MoMA fourth floor galleries is the story of late modern art between the 1940s and 1980s. This story focuses on representing artistic explorations in post-war era. Within these explorations, the exhibition features Abstract Expressionist artists' representation of their authentic feelings for the post-modern realities and non-painterly Post-Abstract Expressionist art, crosscurrents of 1960s, which led to Pop art, Minimalism, Post-Minimalism and Conceptual Art. As understood from the MoMA's curatorial intent, i.e. Barr's interpretation of modern art, since the art is too complex to be expressed in a single trajectory the museum situates the movements of late modern and pre-contemporary art in an evolutionary pattern. In this evolutionary pattern, some movements seem to have transformed into a number of others, which could be considered equally powerful and significant. Some others appear to be reactionary to the original and thus go in opposite directions. In order to present these complexities, oppositions and multiple directions in the story of modern art, the MoMA has revisited the notion of presenting a single narrative, and thus has planned the galleries in the new building in such a way that the collection can be explored by visitors in various sequences, as explained by Elderfield. In this regard, the role of architectural design is seen as a facilitator, as has been discussed by Psarra et al. (Elderfield, 2004; Psarra et al., 2007).

Having reviewed the content of the MoMA's fourth floor layout, the next section will examine layout characteristics and spatial properties of the gallery layout using spatial analysis techniques of space syntax.

5.3.2 Layout Characteristics and Spatial Properties

The fourth floor gallery is characterized by a large atrium and gallery room enfilade around this atrium. Its spatial structure is established within those characteristics. As explained in the methodology chapter, the spatial structure of the fourth floor is examined by analyzing permeability and visibility relationships.

Permeability Relations

The justified graph and convex map analyses of the fourth floor show that the gallery space is composed of rooms enfilade around an atrium and connected to each other through gateways. The justified graph (Fig.5.3a) of the fourth floor layout demonstrates that the permeability structure of the gallery is shaped with a big *ring* around the atrium, and smaller *rings* that are attached to this ring. In the gallery layout, one of the small rings is formed at the north side from room 15 through 18; another one has two smaller rings and is formed at the south side, from room 21b through 24b. A close examination of these rings can help identify the spaces offering choice: there is greater number of rooms offering choice on the south side of the gallery floor than on the north side (Fig's 5.3). This indicates that the north side galleries offer mostly directed sequences. Given that gallery signage in the museum encourages visitors to visit the north galleries first, visitors have less choice in the galleries they visit at the beginning; however, they are given alternative routes towards the end of their itinerary where more spaces in the south galleries offer choice.

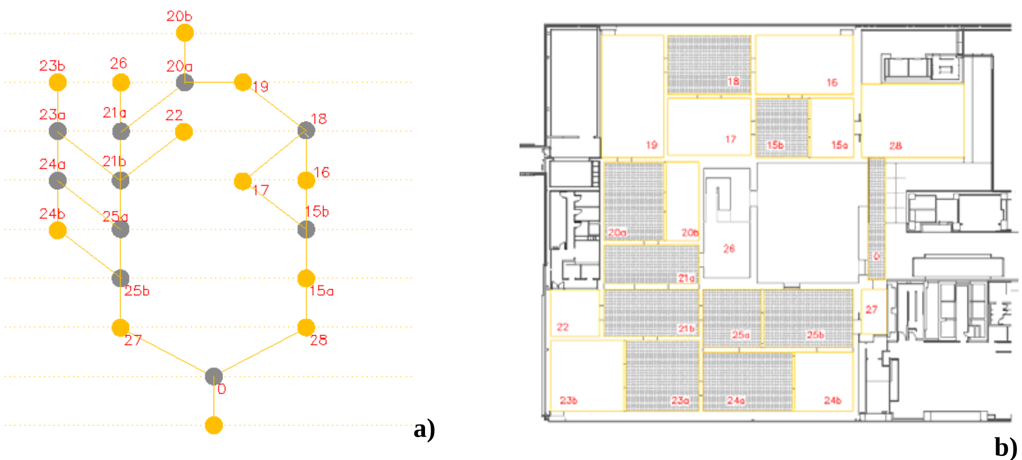


Figure 5.3: Permeability structure of the MoMA's fourth floor. Nodes of path-choice are with darker color a) Justified graph, b) Convex space map

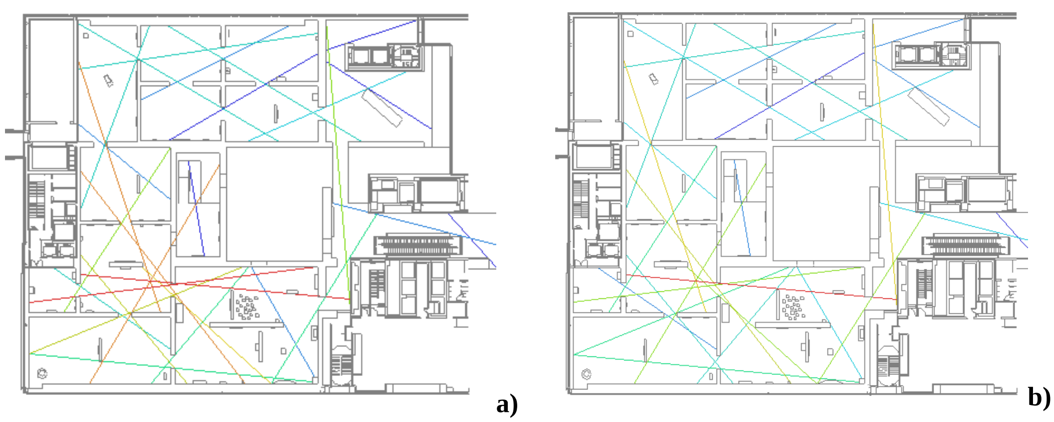


Figure 5.4 Axial line maps of the MoMA's fourth floor **a)** degree of connectivity **b)** degree of integration.

An examination of the fourth floor's axial line maps shows that, (on the floor plan) the longest line of permeability extends from the north to the south side, and from the south to the east end of the gallery space. On the fourth floor, axial lines with both high connectivity and integration values cross the galleries at the south side, more specifically, through rooms 25B, 25A, and 21B. The axial lines with middle-range connectivity and integration values are those connecting the south galleries to the north side (in the vertical direction on the floor plan). The axial lines with the lowest connectivity and integration values, on the other hand, are through the north side rooms. As these observations suggest, the north side and south side gallery sequences significantly differ in the degree of connectivity and integration (Figs. 5.4a and 5.4b); this is consistent with the more directed sequence offered in the north side galleries than south and with the fact that north part of the gallery is less integrated than the south side.

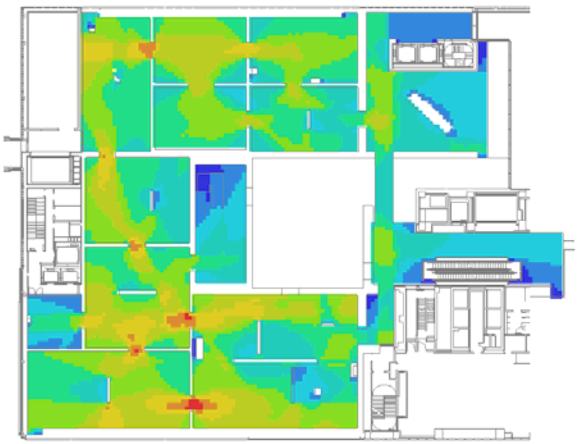
Visibility Relations

The visual connectivity graph of the fourth floor generated at eye-level, which includes the all visually accessible areas in the analysis, demonstrates that the regions with highest degree of visual connectivity are around the atrium openings, more specifically at the north eastern and the south openings of the atrium (Fig 5.5a). This indicates that spaces adjacent to these openings, the north entrance to the gallery space as well as room 25 are places where visitors have the greatest degree of visual access to their neighboring places. The middle-range levels of connectivity are located at the doorway thresholds and spaces around them. These middle range areas are more widely distributed in the south side galleries. On the other hand, the lowest degree of connectivity is located around the staircase in room 22 (which connects the fourth floor to the upper level). Other areas with low connectivity are the corners of rooms 23B and 24B. The knee-level version of this graph (which excludes the atrium from the analysis) shows that at the permeable level the high connectivity values are distributed into the central parts of the gallery rooms extending through the doorways. The highest values of connectivity are at the doorway thresholds between rooms 23A and 24A, as well as between 21B and 25A, which are located at the south side of the gallery. This shows that while visual connectivity among the rooms would have been relatively high without the atrium, the atrium carries the high connectivity to the center of the building.

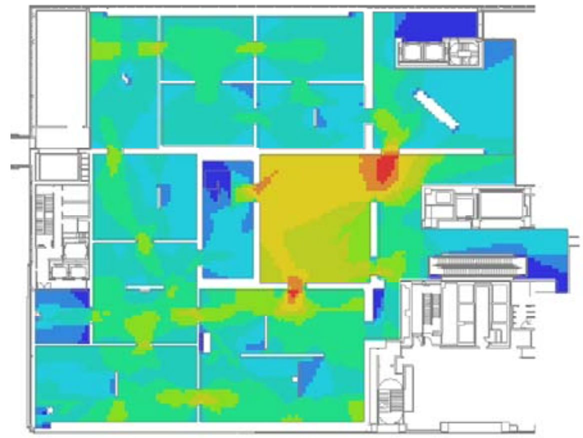
The visual control graph of the fourth floor generated at eye-level includes all visually permeable areas in the analysis and shows that the highest control values are located at the north-east corner of the atrium, and at the doorways between the rooms (Fig.5.5d). The highest values of control at those doorways suggest that observers have visual access to visually less connected spaces at their two sides.

The visual integration graph of the fourth floor generated at eye level shows that the regions with the highest integration values are located in room 25B, between the atrium opening and the interior partition of the room. The high values of integration also extend from this area through the atrium void towards its northeastern corner in the diagonal direction. The high integration values at this corner make the north entrance visually close to all other spaces in the layout. Other high values of integration are distributed in the diagonal directions of the gallery space, in particular extending through doorways connecting rooms 24A, 25A, 21B, 21A and 20, from the southeast to northwest direction of the gallery space. Another region with high integration extends from the exit of room 25 towards room 21 (from the east side to the west side of the south galleries). This indicates that displays placed at those locations could be visible from all other locations, while visitors situated at these spaces can capture the visibility of all other spaces within the fewest visual steps. The lowest integration values are located in room 17 and this seems to be determined by its few connections to other rooms. In addition to these observations, an examination of the knee-level version of the integration graph shows that if there were no visual continuity due to the atrium, the visual integration values in the diagonal direction through rooms 20, 21 and 24 would have been intensified, and high values of integration concentrated in a larger area in room 25. Consistent with the comparison of the knee level and eye level graphs of connectivity and control measures, this comparison suggests that the atrium concentrates the high values of integration on a diagonal core at the center of the gallery space, extending from the south galleries towards the north entrance.

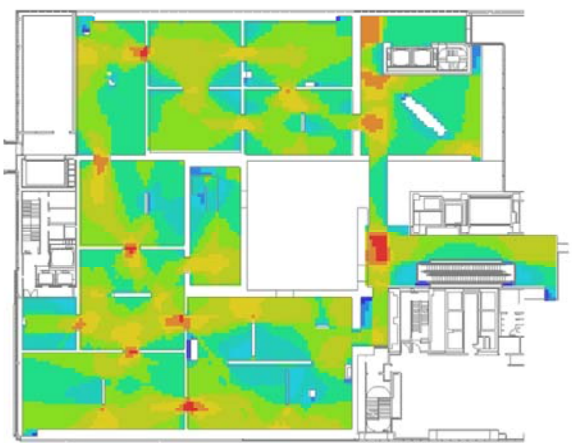
This examination of visibility suggests that the diagonal core through galleries 20, 21, 24 and gallery 25 are the places that are visually close to all other places in the layout and thus visitors are more likely to relate the displays in those galleries to all other displays.



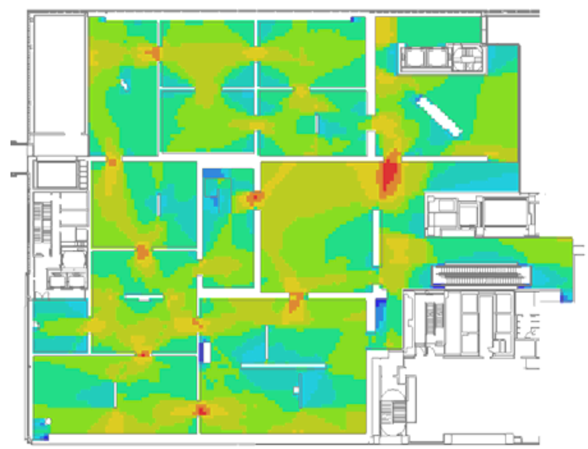
a) Visual connectivity graph at knee-level



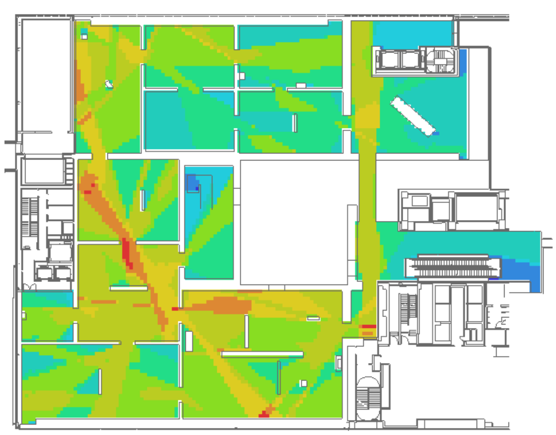
b) Visual connectivity at eye-level



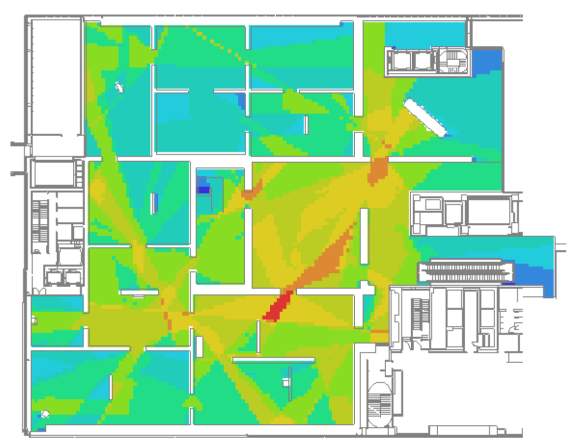
c) Visual control graph at knee-level



d) Visual control at eye-level



f) Visual integration graph at knee-level



g) Visual integration graph at eye-level

Figure 5.5 Visual graph analysis of the MoMA's fourth floor

5.3.3 Organization of the Exhibition Content in the MoMA's Layout

This section discusses how the spatial layout of the MoMA fourth floor relates to the exhibition narratives. To this end, this section examines how formal properties of the gallery layout are utilized to express thematic relationships among the display groups.

As indicated in the MoMA's curatorial publications, the fourth floor galleries exhibit the paintings and sculpture after World War II. On the basis of the MoMA's curatorial strategy, the works of art are grouped and displayed as autonomous chapters of movements or styles. As stated by the curatorial team, to reflect this strategy the gallery space around the atrium void is shaped by a series of rectangular rooms, each of which is designated for displays of a particular movement or a style.

Organization and placement of displays using the MoMA's layout characteristics:

A closer examination of the spatial layout in conjunction with the exhibition themes reveals some other important details of how layout characteristics are utilized to express the exhibition content. One of these characteristics concerns gallery room partitioning: The gallery rooms vary in size; for instance, among the rectangular gallery rooms, the smallest room (Focus Gallery) displays only six pieces, while the largest one holds twelve pieces (the named After Abstract Expressionism room). Some of the larger gallery rooms are divided in two by freestanding partitions so that parts of those rooms can be used to delineate further categorizations of the displays. In addition, the doorways connecting the larger gallery rooms are mostly of standard size. A number of doorways, however, are wider than others to express closer associations between the themes presented in the connected rooms. Another characteristic is that the gallery rooms are connected mostly through their central parts rather than at the corners; however, the gallery rooms are positioned axially or staggered in respect to each other. While axial positioning of two adjacent rooms reveals the paintings in one room at the end of an axis through a doorway, a staggered positioning of two rooms shifts the view of a painting in one room to the diagonal axis of the other. As discussed in Psarra et al. (2007), axial or staggered positioning of the adjacent rooms is a means to express the progressive development of one art movement to another. For example, the north galleries representing the art in the first decades of the post-war period, are connected through their central axis, and allowing paintings in adjacent rooms to be accessible through straight movement and at the end of a visual axis. As discussed by Psarra et al., this reflects the steady development of the art movements in the first decade of the post-war period (Abstract Expressionism and post-Cubism and late Surrealism). In contrast, the galleries in the central part are staggered, connected through gateways in the diagonal directions, and this strategy expresses the complexity in the movements after the 1960s that emerged with the shifting interests in artists' explorations (Psarra et al., 2007).

The display groups on the fourth floor start with two categories that represent the primary currents in the postwar decade: Late Surrealism in America, and post-Cubist and late Surrealist movement in Europe (Fig. 5.8). The displays representing those currents are placed in two adjacent rooms, 15 and 16. Although these rooms are geometrically parallel, perhaps implying a parallel positioning of the post-war movements in America and Europe, the viewing sequence starts with the group representing this movement in America, namely non-figurative late Surrealist works of Central American and Cuban artists (Surrealism in Exile). This viewing sequence prioritizes the Surrealism in Exile display group in the viewing sequence and places the figurative works of post-Cubists in Europe (Post-war Figuration) in a secondary position. The other work in room 15 are the pieces anticipating Abstract Expressionism; these are placed in the second half of the room (15B), so as to maintain the continuum to Abstract Expressionist works of Pollock in room 17. Thus, room 15B offers choices into two directions: visitors can either go to a gallery devoted to Pollock (room 17), or move in the other direction proceeding to room 16 called Post-War Figuration where post-Cubist works of Picasso, Braque and Giacometti (Fig. 5.9) are displayed. Completing a loop, both room 16 and 17 connect to room 18, where works of other

Abstract Expressionist artists, Rothko, Newman, Reinhardt and Still are displayed; additionally room 17 (Pollock gallery) is connected to gallery 18 via a gateway wider than other gallery gateways, thus emphasizing a close association between Pollock and the other Abstract Expressionist artists.

Starting with room 19 in the sequence, the galleries present works of art departing from Abstract Expressionism. In the curatorial interpretation, these works (which are known as Post-Abstract Expressionist) are examined through two principal directions: painterly and non-painterly abstractions (Elderfield, 2004). The pieces showing the influence of these two principal directions are respectively displayed in two consecutive rooms, 19 and 20. Room 19 focuses on painterly abstraction, but also includes works of Kelly and Otero that anticipate the early appearance of severely geometrical abstraction in the period represented. Even though there is an implication in the curatorial interpretation that the painterly and non-painterly abstract styles are alternative developments, their placement in a linear sequence emphasizes the order of their chronological appearance. As can be understood from the thematic focus of the galleries in the rest of the sequence, the influence of non-painterly abstraction became more influential in the later decades. To reveal this influence, Room 20 presents the non-painterly works of Johns, Rauschenberg and Twombly. In room 20, a freestanding partition separates some works of Rauschenberg and Johns (20A) from Rauschenberg's other pieces grouped with Twombly's work (20B), expressing the subtle difference between these groups in terms of non-painterly abstract compositions: the work in 20A portrays common signs and symbols, while that in 20B depicts mundane objects and graffiti style scribbling.

Room 20A continues to room 21, which is called Reinventing Abstraction-1960c. This room displays other non-painterly abstract works after Abstract Expressionism that appeared as a reaction to painterliness. Beyond this reactionary approach, these non-painterly works represent crosscurrents, develop new influences, and thus anticipate diverse directions of non-painterly abstraction in the pre-contemporary movements. Within these diverse directions the non-painterly works continue, one strand of which is severely geometrical compositions that are illustrated by the sculptural works of Latin Artists that assemble simplistic forms and displayed in 21A, the first part of the room. In the second part, room 21B, another group of works represents the early appearances of Pop art and Minimalism. Continuing from the display locations of these groups in room 21B, the room proceeds in three other directions: the Pop Art gallery (room 23) towards south, Post-Minimalism (room 25) on the left and Conceptual Art (Focus gallery-room 22) on the right hand side (Fig. 5.8).

The Pop Art gallery (room 23) displays the artwork in two groups: the first group in 23A includes pieces that experimented with the use of media images, i.e. Warhol's, Campbell Soup Cans, Marilyn and the other group in 23B displays other Pop art works that used images of consumer products and everyday objects in deformed and multiplied representations i.e. Warhol's "Orange Car Crash Fourteen Times", Oldenburg's "Giant Soft Fan", Wesselman's "Still Life #30" (a collage of consumer products in a 1950s American kitchen). While the art in 23B is located in a dead-end position in the gallery, the works of Pop art in room 23A are connected to those of Minimalism in room 24A. This connection between 23A to the Minimalism gallery expresses a chronological continuity, while maintaining the flow through the galleries. Adjacent to the Minimalism gallery is room 25 where works of Post-Minimalism are displayed. The close association between Post-Minimalism and Minimalism is expressed via wider doorways between the two rooms. In fact, rooms 24 and 25 are almost like subsets of a larger room, which seems divided only by a large freestanding partition. This organization situates Minimalism and Post-Minimalism in a unified body of movement in pre-contemporary art that shared the motivation of producing art through irreducible forms. Despite this shared motivation, the post-minimalist works place a greater emphasis on the sensory qualities of materials, more amorphous shapes and

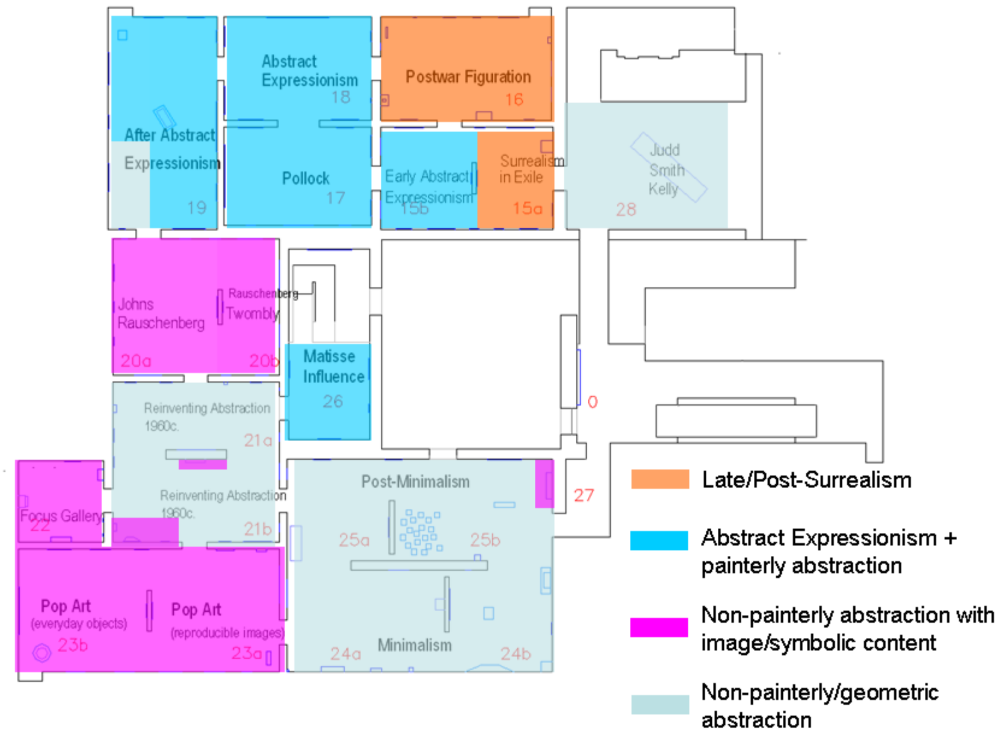


Figure 5.6 Diagram showing the placement of themes on the gallery room organization

Figure 5.7 A view from room 16, Postwar Figuration (photo taken by Rachna Lal)

less regular compositions than is the case among the minimalists. Additionally, the post-minimalist works typically refer to symbolic and sensory meanings of the diverse materials (i.e. fat and felt in Beuys' works). Given this feature, some post-minimalist artists' works are more closely associated with the works displayed under Reinventing Abstraction-1960c (21B) which also used diverse materials and surface elaboration referring to materials' symbolism (i.e. Klein's Blue Monochrome). This association is expressed by the direct connection between these rooms.

Another room that is directly connected to the Reinventing Abstraction-1960c room is the Focus Gallery (22) displaying works of Conceptual Art. These works are distinctive in terms of their experimental approach, ready-made style and text based representation. In the curatorial interpretation, Conceptual Art is considered highly controversial art due to its questioning of the conventional definition of art. Conceptual Art is also viewed as an odd development in that it did not lead to any other movement in the late modern art's history. To reflect its controversial approach, the Conceptual Art works are placed in room 22, situated in a dead-end location in the gallery floor, thus establishing discontinuity. At the same time, this position of the Conceptual Art (room 22) is the opposite the direction of the Post-Minimalist movement, although these two groups are known as chronologically consecutive. This suggests that in positioning the Conceptual Art, the MoMA's curatorial team has prioritized stylistic differences over the chronological order, and thus expressed a closer association with the crosscurrents represented in Reinventing Abstraction-1960c gallery.

An examination of the viewing sequences offered by the MoMA fourth floor layout clarifies how the exhibition narrative might be conveyed to visitors. Although a comparison of the narrative organization with the justified graph representation of the gallery layout (Figs. 5.8 and 5.9) suggests that the displays can be visited by making choices in the viewing sequence, the layout is more likely to be visited predominantly through a directed sequence that includes choices in segregated parts. The reason for this is that the museum signage encourages visitors to start their itinerary from the north galleries where viewers can start viewing the exhibition with chronologically earlier groups. Within this suggested sequence starting from the north and continuing in a counter clockwise direction, visitors can follow two alternative sequences after room 15A (Surrealism in Exile): one continues with Post-war Figuration (16*)* and Abstract Expressionism (18), and the other one departs from Early Abstract Expressionism (15B) and continues through Pollock (17) and Abstract Expressionism (18). After a short directed sequence from After Abstract Expressionism (19) to non-painterly works of Johns and Rauschenberg (20A), the rest of the galleries can be followed through the choices offered at Re-inventing Abstraction (21) proceeding to Pop art (23A), Post-Minimalism (25A) and Conceptual Art (22) in various directions. As confirmed by the museum's current curator, the galleries were planned to be explored in a number of possible routes in order to convey the complex developments in the late modern and pre-contemporary art (Elderfield, 2004, p. 57; Psarra et al., 2007). When considered within this suggested sequence, there seems to be more complexity in the later periods represented in the south galleries, as more choices in viewing sequences are given in that part of the layout.

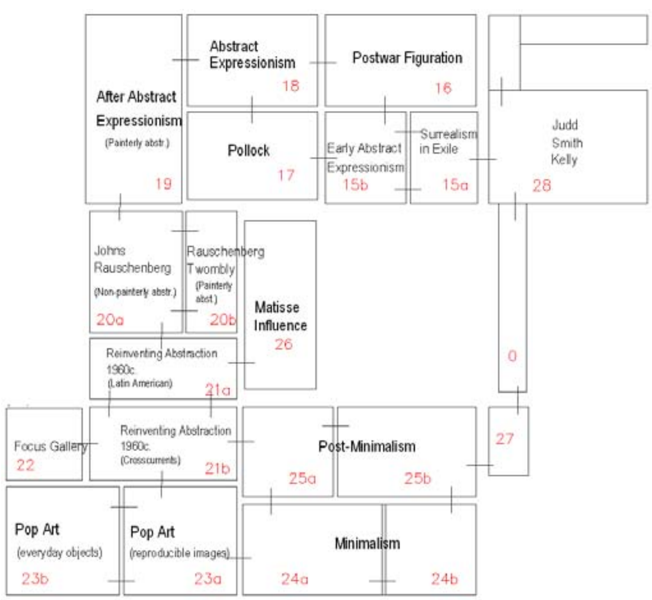


Figure 5.8 Convex space map showing organization of the exhibition concepts in the fourth floor galleries.

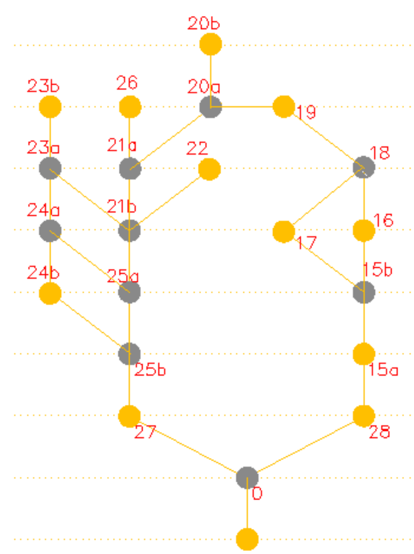


Figure 5.9 Justified graph of the MoMA's fourth floor gallery

Experience of the exhibition through visual connections:

In addition to opportunities provided by the permeability relationships of the gallery along with the suggested sequence, the visibility relationships that are mostly afforded by gallery doorways may bring works of art to view in various combinations. As analyzed by Psarra et al. (2007), some works are placed in the axes of vision through doorways as a device to attract visitors to the adjacent galleries (Psarra et al., 2007). These placements can also be regarded as a part of an effort to present various interpretations of the content, in particular one revealing various relationships between the chronologically consecutive art movements. For instance, when the placement of works in galleries 15 and 17 is examined closely, it can be seen that the works of Pollock displayed in room 17 and the works of Krasner placed in room 15 have a dialogue that is afforded by placement of these artists' works on visual axes. This placement of the works of the two artists is a means to express their artistic influence on each other.[28] Krasner's work is placed in room 15B facing towards the Pollock room, and this brings Pollock's masterpiece of drip-painting "One" and Krasner's work into the same visual axis, facing each other. For an observer standing at the center of room 17, this placement also facilitates viewing Krasner's work in juxtaposition with Pollock's two paintings which were painted a few years after Krasner's (Fig.5.10).

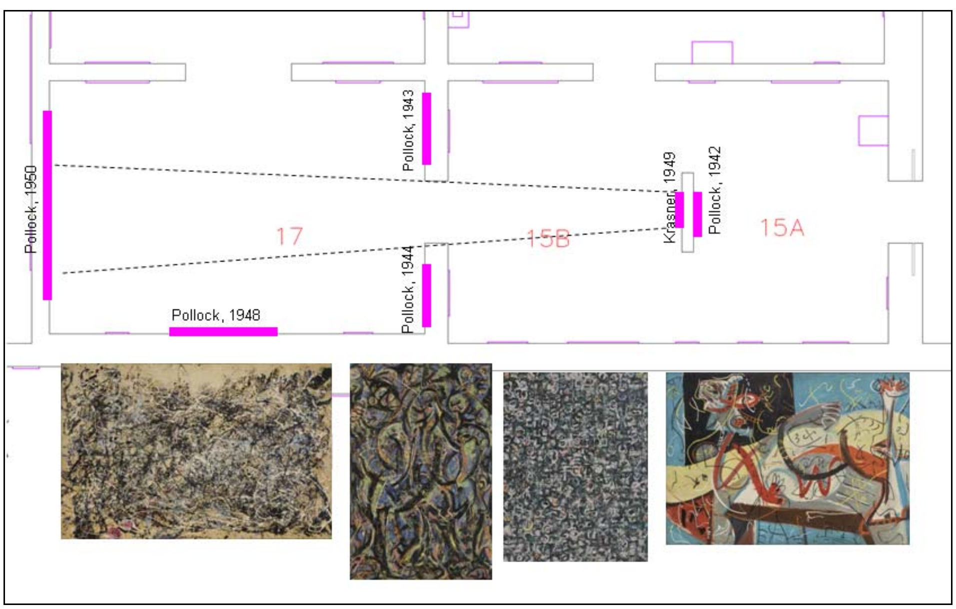


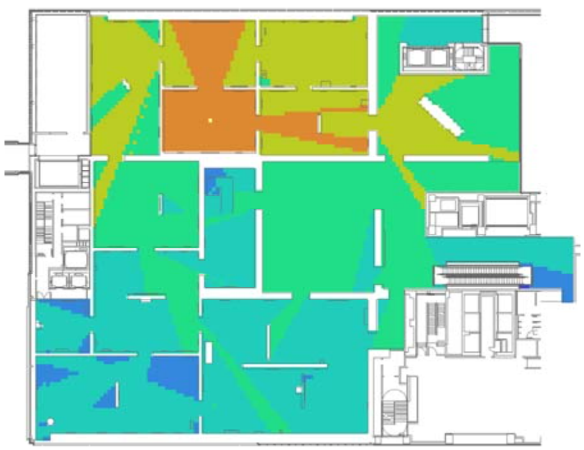
Figure 5.10 Placement of Pollock's and Krasner's work in galleries 15A, 15B, and 17.

[28] It is known that Krasner and Pollock influenced each other with their artistic endeavors and they were life partners (Karmel & Varnedoe, 1999; Harris, 2001).

Figure 5.11: A demonstration of how Krasner's work (1949) in room 15B is seen from room 17, in juxtaposition with Pollock's works dated 1943 and 1944 on the parallel walls of room 17 (by author).

Figure 5.12 Photo view from *Pollock* room to *Abstract Expressionism* in room 18. (source. NYTimes, Fred. R. Conrad. Nov. 19, 2004)

Figure 5.13 View from room 16 towards rooms 18 and 19, seeing Matisse's work on the axis of vision. Source: Lowry, G.(2005) The New Museum of Modern Art



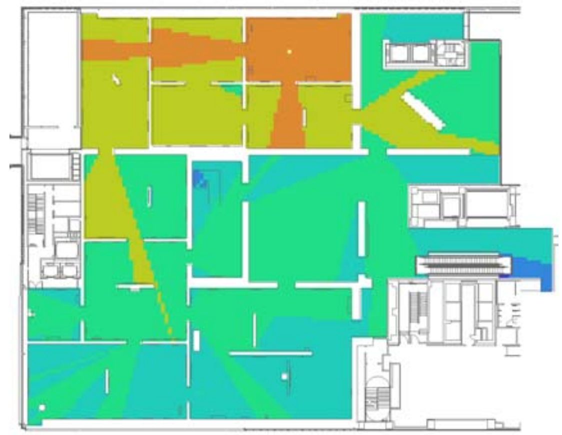


Figure 5.14 Visual field generated from room 17. **Figure 5.15** Visual field generated from room 16.

A similar experience is afforded by the placement of Newman's Abstract Expressionist work in room 18. By standing at a vantage point in the middle of room 17 and looking towards room 18, visitors can see Newman's Abstract Expressionist work at the end of that axis. This juxtaposes Newman's work with two works of Pollock placed in room 17, which is parallel to Newman's work in room 18. As illustrated in Figure 5.14, the wide doorway between the two rooms enables visitors to have a full view of Newman's work from the middle of room 17. This provides an opportunity to compare and contrast synchronously the works of these two prominent Abstract Expressionist artists. Furthermore, if visitors turn 90 degrees, Pollock's work can be viewed in conjunction with the works of either Krasner or Newman, thus providing an opportunity to compare Pollock's art to the art of two other Abstract Expressionist artists (Fig. 5.14). [29]

The MoMA's fourth floor spatial layout offers similar visual experiences in other gallery rooms, as discussed by Psarra et al (Psarra et al., 2007). In fact, placing the works of art on axes of vision is one display strategies the MoMA has long utilized in its gallery arrangements (Newhouse, 2005). As a result of this strategy, visitors are given glimpses of the displays in the

[29] These visual combinations of Pollock's work with Krasner, and with Newman were exercised in the MoMA's previous exhibitions devoted to Pollock and Abstract Expressionist artists, as discussed by Newhouse (2005).

adjacent galleries before their actual visits to those rooms. Given that MoMA arrays the display groups representing movements and styles in a chronological sequence within a genealogical trajectory, the artwork in adjacent rooms usually consists of pieces of chronologically and stylistically subsequent movements. Revealing the pieces in the adjacent rooms through doorways opens up the narrative in each gallery to subsequent themes. This also increases the potential of the layout to convey complex relationships among a number of display groups resulting from visual interconnectivity among their locations.

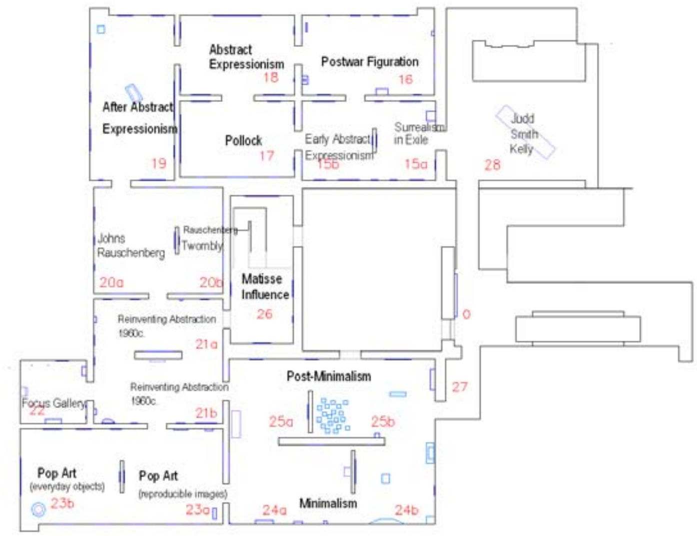
In summary, the MoMA fourth floor layout presents the content of the modern art between the 1940s and 1980s using display groups in separate galleries, so called "chapter rooms" that represent art movements, styles and individual artists' explorations. Their development within a genealogical trajectory that includes contrast, reactions, derivation and other complexities are expressed utilizing physical connections among the gallery rooms. If the layout is examined in terms of its parts, the north gallery rooms are connected to one another shaping a directed sequence. This observation points to the emergence of Abstract Expressionism, and its painterly abstraction, as well as the post-Cubist and late Surrealist movements as a quite linear and steady development. The central galleries presenting non-painterly abstraction (20), crosscurrents in 1960s (21), Pop art, Conceptual Art, Minimalism, and Post-Minimalism are connected to others in multiple directions and mostly to the rooms in staggered positions. This display strategy relates to more complex, reactionary, and multi-directional developments in the pre-contemporary art after the 1960s. These observations suggests that gallery layouts formal and spatial characteristics, characterized by series of rooms and physical and visual relationships between and among them, are utilized to express the curatorial interpretation of the post-war period. However, beyond this direct relationship between the layout and the interpreted content, the spatial structure might be contributing to the creation of some other potential for conveying the narrative, which can be explored through further analysis.

5.3.4 How does the Spatial Layout Present the Exhibition Narratives?

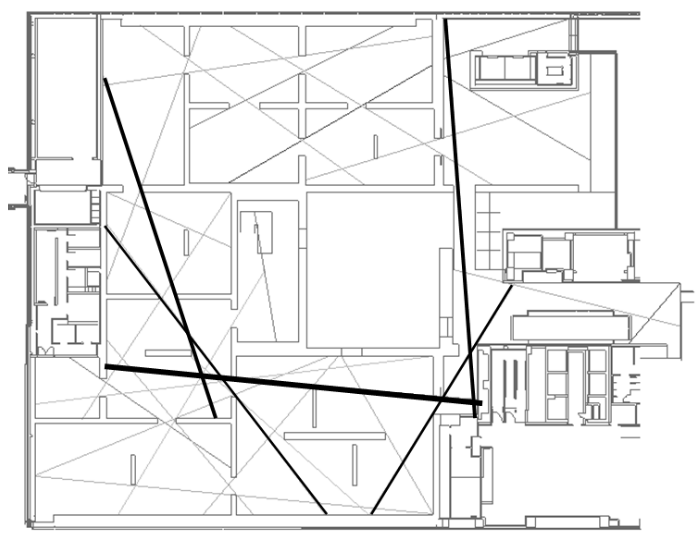
A comparison of the narrative organization with the permeability and visibility structure can demonstrate the parts of the narrative that are more strongly emphasized by the spatial structure of the MoMA's fourth floor gallery.

To compare the narrative and the permeability structures, this section examines the narrative organization in conjunction with the axial line analysis (Fig. 5.16). This examination shows that the most integrated axial lines are through the sequence from rooms 19 through 20 and 21, and from rooms 21 to 25. This suggests that the movement through those rooms (21B, 25A and 25B), called Reinventing Abstraction-1960c and Post-Minimalism galleries is most likely predicted by the layout. The other integrated lines extend from the galleries devoted to Minimalism (24A), through Reinventing Abstraction-1960c (21) and to John-Rauschenberg (20A) and the movement from Reinventing Abstraction-1960c (21) to After Abstract Expressionism (19). This analysis indicates that the visitors most likely make contact with the content along the sequence from the After Abstract Expressionism (19) to Minimalism and Post-Minimalism rooms. As discussed previously, these sequences capture the transition from the influence of painterly abstraction to non-painterly abstraction, which finally led late modern art to Post-Minimalism. The placement of these galleries in integrated sequences suggests that the gallery layout places strongest emphasis on the development of movements associated with non-painterly abstraction leading to post-Minimalism in the entire narrative.

A comparison of the content organization with the visibility structure can elucidate other potentials of the spatial structure to convey the narrative. In particular, an examination of the narrative organization in conjunction with the visual integration and visual connectivity (eye-level graphs) shows that the highest integration values are located in room 25, where Post-Minimalist works are displayed. A close examination of these values closely, reveals that other



(a)



(b)

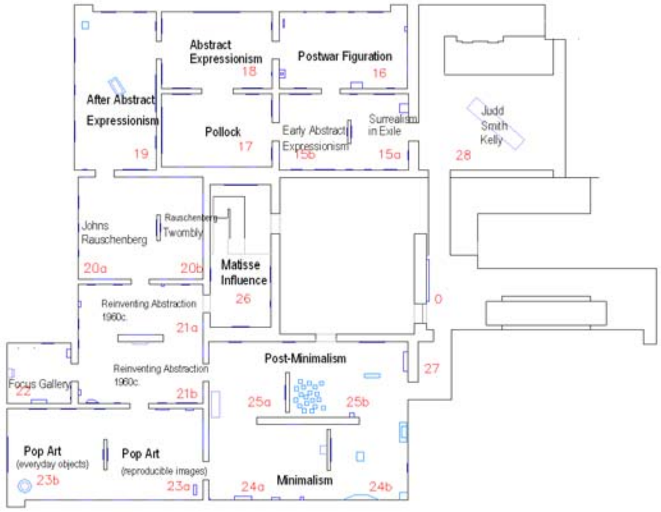
Figure 5.16 a) Exhibition themes on the floor plan. **b)**Axial line analysis, dark-colored lines denote the ones with the highest integration values

integrated values extend longitudinally from room 25 towards room 21, called the Reinventing Abstraction-1960c gallery. As can be seen from the visual integration graphs, the integration values in the Post-Minimalism and Reinventing Abstraction-1960c galleries are formed by room 25's connection to the atrium and the interconnectivities around these galleries. As a result, the Post-Minimalist works and those representing crosscurrents in the 1960s happen to be visually prominent in few visual steps from every other location in the layout. Thus, the visibility structure places a greater emphasis on the Post-Minimalism gallery and its connection to the crosscurrents presented in the Reinventing Abstraction-1960c gallery. On the other hand, the high values of integration also extend towards the north entrance through the atrium openings, which also creates a visual connection between the works of Post-Minimalism with other contemporary works displayed in room 28, near the north entrance. This connection maintains the continuity between the two chronologically consecutive groups of art, the post-minimalist works and other contemporary art dated latest (i.e. works by Judd, and Kelly). The other relatively high integration values are located along the diagonal axis of sequence from room 19 through rooms 20A, 21A, 21B to 24A. As a result, the displays in these galleries presenting works of Post-Abstract Expressionism, of Rauschenberg and Johns, Reinventing Abstraction-1960c, Minimalism can be viewed within the fewest steps from other galleries. These potentials of the visibility structure reinforce the significance of the sequence from rooms 20 to 25A-B, which presents the emergence of non-painterly abstract styles and variations in it leading to prominent movements such as Pop art, Minimalism and Post-Minimalism.

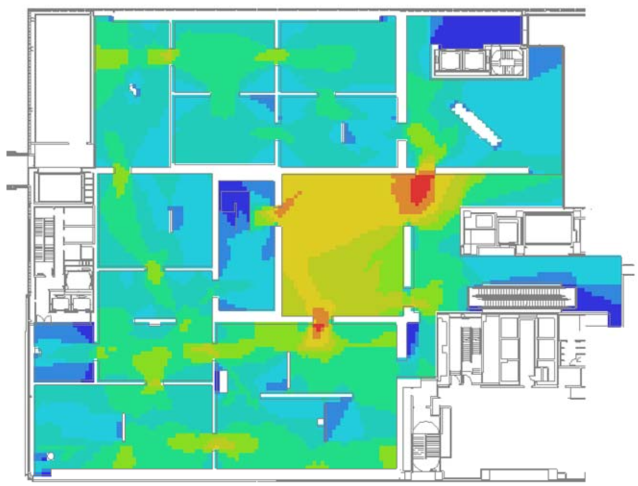
An examination of the segregated parts of the layout reveals that room 22, which displays the works of Conceptual Art, is located at the visually least integrated location and this implies that this group of displays is the least likely to be read in relation to the others. This confirms that among the movements that appear within the crosscurrents, conceptual art is considered peripheral within the entire trajectory of the late modern and pre-contemporary art. Other low values of integration are located in the north galleries where late modern art in the first decades of the postwar period, namely, post-Cubism, late Surrealism, the emergence of Abstract Expressionism are presented. These gallery locations are visually the farthest from all other parts of the layout, and this relegates the exhibited art to a peripheral position in the narrative.

The visual connectivity graph in Figure 5.17b shows that the gallery rooms are locally connected to each other through doorways and these connections are around the same level for most of the gallery rooms. This suggests that the property of seeing the neighboring galleries is evenly distributed in the gallery environment. The only differences are due to the atrium producing a higher degree of connectivity to the north entrance circulation area and gallery 25, but this has a limited effect on the presentation of the narrative because it is outside of the gallery environment, and instead enhances visitors' awareness of the atrium and circulation areas. Inside the gallery area, the doorways connecting rooms 24-23, 21-25, and 21-23 have moderately high values of connectivity extending to a larger area. This means that the relationships between the chronologically and conceptually subsequent movements, Minimalism and Pop art, Reinventing Abstraction-1960c and Post-Minimalism, Reinventing Abstraction-1960c and Pop art, are more likely read in terms of comparison. The MoMA's display strategy is to place paintings on the visual axes and thus to create opportunities of visual comparison between the displays in adjacent rooms. This is achieved by local visibility between the rooms, as observed in the connectivity graph. This suggests, the local level spatial structure is well devised for curatorial purposes. On the other hand, the connectivity graph shows that the lowest connectivity degrees are maintained along the gallery walls. Since these regions are not exposed to visual information in the neighborhood, they have the potential to function as "niches" where visitors can view the works of art without distraction. This may be another aspect of local visibility structure that enhances the interaction between viewer and displays, which can be discussed in detail along with the analysis of visitors' space use.

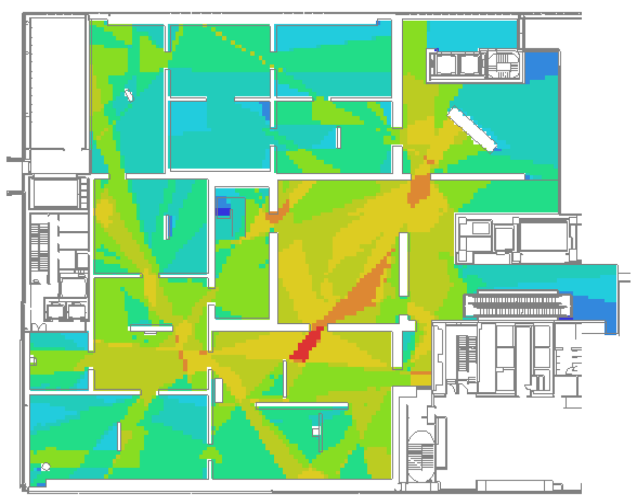
All of these observations reveal several key aspects of how the syntactical spatial properties of the gallery layout contribute to communicating the exhibition narrative. First, as the examination of the spatial structure in conjunction with the narrative suggests, due to the visual integration property the focus of the narrative seem to be the developments after the mid-1950s and 1960s which started with the non-painterly explorations of Johns, Rauschenberg, and Twombly and continuing with crosscurrents, (the reactionary and contrasting movements,



(a)



(b)



(c)

Figure 5.17 A comparison of the exhibition layout with the visibility structure. **a)** the exhibition narrative themes **b)** visual connectivity and **c)** visual integration graphs.

displayed under Reinventing Abstraction-1960c). However, because of the lower levels of integration, post-Cubism, late Surrealism and the influential development of the Abstract Expressionism have a weaker emphasis in the layout, implying that these movements need to be understood individually as they were precursors to the complexity of movements after the 1960s. The emphasis on the relationships between the crosscurrents gallery and adjacent galleries imply that complexity in the movements after 1960s is significant to understand the late modern and pre-contemporary art. While this interpretation is consistent with the curatorial interpretation of the content, the spatial structure has the potential to elaborate this interpretation by acknowledging the increasing complexity in the pre-contemporary art. Another key aspect of spatial layout that contributes to the narrative is related to strong visual integration property in Post-Minimalism gallery by means of the atrium. Although the visibility relationships mostly coincide with the permeability relationships because the atrium has very limited potential to reveal the displays across distance; the visibility relationships afforded by the atrium provides the high values of integration most generously for the Post-Minimalism gallery, and visually connect this gallery to the north entrance. While this connection may help visitors become better oriented in space, it also facilitates visual comparisons between the post-minimalist and other contemporary works dated latest (displayed in room 28), and thus provides continuum between these works (Fig. 5.18). Third, and most importantly, the potentials created by the visibility and permeability relationships, such as the low values of integration in the overall layout and evenly distributed connectivity between the rooms, allow the narrative to be revealed to visitors stepwise (or room by room) along their itineraries. All of these observations suggest that the MoMA fourth floor gallery layout facilitates a didactic presentation by spatially mapping the curatorial interpretation with an emphasis on the crosscurrents and emergence of pre-contemporary movements. In addition to the use of these spatial potentials of the layout, the MoMA's curatorial strategy is characterized by the strategy of revealing the displays at the end of the visual axis and focusing on individual artists' work, thus tempering the strictly chronological presentation.

Therefore, the MoMA seems to have integrated its scholarly interpretation of the content with the strategy of presenting art to be appreciated together with its experiential qualities.

At the end of this chapter the potential of the gallery layout to reproduce and generate the exhibition narrative will be discussed further in relation to the space use patterns predicted by the layout.

Figure 5.18 Visual field from the most integrated point of the layout

5.4 The Spatial Layout and Visitors' Space Use Patterns

This section analyzes the distribution of space use patterns culled from the data on visitors completing an entire tour in the MoMA fourth floor gallery. The in-depth analysis explores the extent to which the gallery layout of the fourth floor may predict visitors' space use patterns.

As in the previous case study analysis, this section first examines the sample visitor data to determine how many visitors visit each gallery room. The aim of this examination is to confirm that the sample consists of randomly picked individuals that show a normal distribution of fast or slow moving visitors. As can be seen in Figure 5.19, the histogram approximates a normal distribution; thus, the data sample consists of randomly picked individuals, and the numbers of slow-moving and fast-moving visitors vary normally in the sample. The mean value of the histogram is 21.36, indicating that the average number of rooms visited in the sample is 21-22 out of a total 22 rooms. Most visitors visited 19 or 21 rooms, while quite few visitors visited more than 22 rooms (including circulation areas as rooms numbered 0, 27, and 28), which suggests that those visitors visited some rooms more than once.

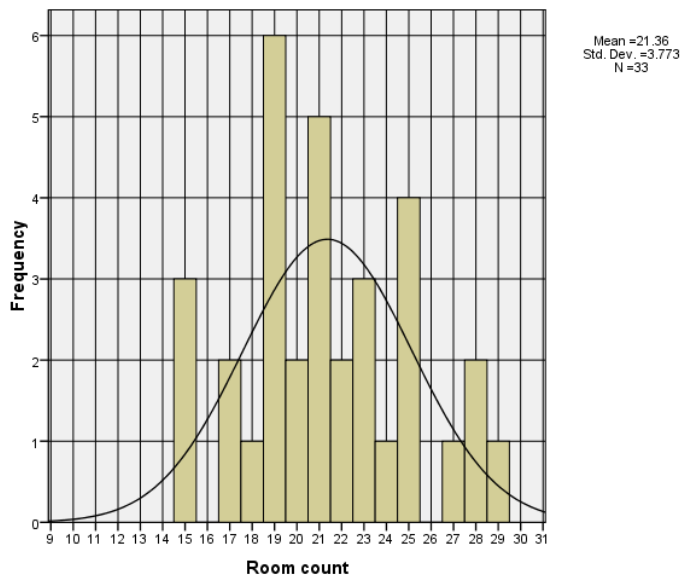


Figure 5.19 Histogram of the number of rooms attended by visitors during the course of tracking.

5.4.1 The Space-Use Patterns and Their Correlation with Visibility Relationships

As in the previous case study chapter, this section first examines the distributions of the three space use patterns throughout the fourth floor gallery: patterns of exploration, patterns of contact with displays, and patterns of contact with layout. Second, the analysis compares the extracted space-use measures with the visibility properties in order to investigate the extent to which the fourth floor gallery layout may predict visitors' space-use patterns.

Patterns of Explorations and Visibility Properties

In order to describe visitors' patterns of exploration and their distribution in the MoMA fourth floor layout, the movement paths are examined. The patterns of explorations were captured from the movement data in two ways: by looking at the number of movement lines crossing each gallery in relation to the number of visitors entering each gallery and by analyzing the distribution of movement into various directions at the spaces offering choice.

In the first step of capturing the exploratory patterns, the movement lines crossing each gallery are examined in relation to the numbers of visitors entering each gallery. This relationship is then comparatively examined for each gallery room to determine which rooms are re-visited most frequently, in order to explain the extent to which gallery rooms are visited many times (with returning visits) and thus spatially explored further.

As shown in Fig. 5.21, on the fourth floor room 16 at the northern side, room 20B in the middle, and rooms 22, 23b, 24b at the southern side were visited by least number of visitors in the sample. The rooms visited by only less then 60% of visitors are 23A, 24A and 25A, as well as exit room 27[30]. The rest of the gallery, which is the majority of the northern side, was visited by 100% of visitors in the sample. Figure 5.21 shows how the movement lines entering the galleries are distributed throughout the MoMA gallery floor. As can be seen from the figure, the movement lines are most frequent in rooms 15 and 18 at the northern side, and in the sequence of rooms from 19, through 20A, 21A, 21B and 23A. Thus, the movement lines are mostly

Figure 5.20 Transcribed data of movement paths

[30] The tracking results may not include data of all visitors who enter room 27 because this room may be entered at the end of 20 min. tracking time

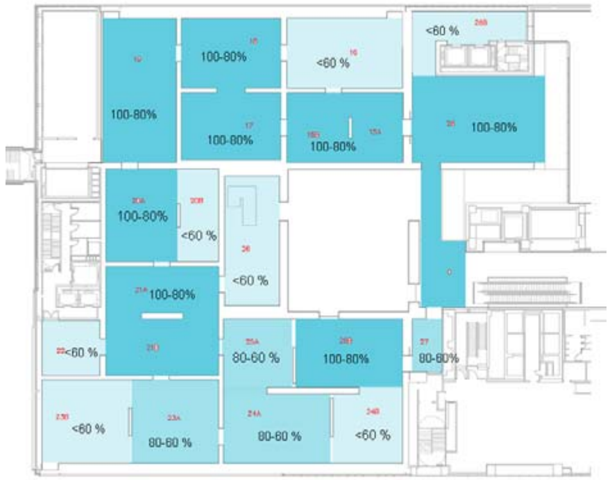


Figure 5.21 Percentage distribution of visitors crossing galleries

Figure 5.22 Distribution of movement lines crossing galleries

Figure 5.23 Percentage of visitors distributed into four directions after entering the Introduction gallery for the first time

distributed through the north-south sequence of the gallery space, and the galleries in that sequence are where exploratory movement accumulates.

The second technique of capturing exploratory behavior examines how movement is distributed into the different directions available at the spaces offering choice. The first space offering choice upon visitors' arrival on the gallery floor is the circulation space adjacent to the atrium, where visitors can move either to the north entrance or south entrance to the galleries. The distribution of movement into the two directions offered by this circulation space is examined by counting the movement lines of visitors who crossed the gallery at the beginning of their exploration. The analysis shows that the larger percentage of visitors who entered the MoMA's fourth floor (78%) moved towards the north side (turning right), while only around one fourth (21%) of visitors went towards the south galleries. This result is comparable to that found by Psarra et al. (2007) in their examination of the exploration patterns in terms of the sequence of rooms. Their study reports that 74% of the visitors followed the sequence of rooms 15, 17, 18, and 19 (Psarra et al., 2007).

In order to investigate the influence of the fourth floor gallery layout on the patterns of exploration, the key measures of exploratory movement are compared with the visibility properties through correlation investigations. To investigate whether the exploratory movement in each room might be predicted by the visibility properties of those rooms, first the number of movement lines per room was correlated with key syntactic and non-syntactic visibility measures of each room. According to the investigation, the number of movement lines is linked with visual connectivity and visual control, while the link with visual integration is less significant (R^2_{conn}= 0.46, p=0.000; R^2_{cont}= 0.44, p=0.001, $R^2_{int\text{-}avg}$= 0.18, p=0.047; Table 5.1). These results indicate that in the MoMA fourth floor gallery, 46% and 44% of the variation in the number of movement lines can be explained by variation in visual connectivity (the capacity of being seen from all neighboring spaces) and control (the capacity of being seen from visually less connected neighboring spaces) respectively. The correlation results also indicate that only 18% of the variation in the movement lines is determined by variation in visual integration, which suggests a trivial effect of the global visibility property on movement distribution. The stronger influence of local visibility properties suggests that during the exploration of galleries, visitor navigation is guided by visual information unfolding sequentially rather than the property of being visually close to all other spaces.

When the number of movement lines is compared with the average non-syntactical visibility (grid isovist) values in the rooms, it is found that the movement lines are associated with the visual field perimeter, area and occlusivity measures of the visual fields in the rooms ($R^2_{perimeter}$= 0.52, p=0.000; R^2_{area}= 0.46, p=0.000, $R^2_{occl.}$= 0.41; Table 5.1). These results point to the aspects of local visual information that may play role in the modulation of movement. As discussed in previous sections, the visual field perimeter denotes the total length of the visual boundary, whereas the occlusivity measure describes the length of the occluding boundary only. Based on these definitions, the correlation results indicate that 52% of the variation in the number of movement lines is explained by variation in total length of the visual field boundary (constituted by exposed surfaces). Forty-one percent of the variation in movement is predicted by the variation in the length of the occluding boundary (indicating hidden regions in view). Since the length of occluding boundaries is part of total length of the visual field boundary, the stronger correlation of the number of movement lines with the perimeter than that with occlusivity indicates a stronger effect of directly visible (exposed) boundaries on movement. Therefore, visitors are likely drawn to the exposed surfaces as well as the hidden regions in view; however, the exposed surfaces have a stronger effect on visitors' movement. At the same time, the correlation found between movement lines and area measure (R^2_{area}= 0.46, p=0.000) means that the size of visible region has also a strong effect on movement. This result is not surprising, given that the number of movement lines was found to be linked with the connectivity measure, as discussed earlier, because both the connectivity and area measures refer to the size of the visually accessible region, and the results indicate that directly visible regions attract visitors. These results suggest that local visibility relationships, in particular visual access to the neighboring locations have a stronger effect on the distribution of visitors' exploratory movement than do global visibility relationships in the layout; and in particular visitors are drawn by the directly visible surfaces as well as hidden information.

Table 5.1 Correlation of movement lines & VGA (syntactic and non-syntactic) measures in each gallery

	Visual Integration (HH)	**Visual Connectivity**	**Visual Control**	
Number of movement lines crossing each gallery	0.43	0.68	0.66	***r***
	0.047	0.000	0.001	***p-value***
	0.18	0.46	0.44	***R^2***
	Isovist Area	**Isovist Perimeter**	**Isovist Occlusivity**	
	0.68	0.72	0.64	r
	0.001	0	0.001	***p-value***
	0.46	0.52	0.41	***R^2***

In the second step in investigating the link between visitor movement and the visibility of the galleries, the relationship between movement lines and visibility properties is investigated in terms of finer grain spatial units, in which movement line counts are extracted from (5-foot) grid cells, which represent the scale of a visitor's individual space. When the movement line counts crossing the grid cells are correlated against the visibility measured at those cells, it is found that in the MoMA fourth floor layout the number of movement lines co-varies with the non-syntactic and syntactic visibility measures. In fact, the number of movement lines is associated with the area, perimeter values of the grid isovist, and linked to the connectivity and control values of the grid cells (Table 5.2). These results indicate that 20% and 23% of the variation in the exploratory movement at the scale of individual space is predicted by variations in visual connectivity and control respectively at that scale. This means that visitors tend to move towards the points where they can see their local environment. The correlations with the perimeter and area indicate that the size of the visible area and the surfaces exposed in the visual field are aspects of local visual information that partially (19%) predict movement. Another aspect of local visual information, measured by drift, has a weak effect on movement (13%). Drift denotes the distance between a visitor's standpoint in a visible region and the geometrical center of that region. The higher the drift measure in a visual field, the more likely the visitor will see regions extending into one direction. A negative correlation between movement lines crossing the grid cells and drift measure indicates that visitors prefer to move while maintaining their central position within the visual field, and keeping the surrounding visible areas at comparable distances. Together these results suggest that visitors are guided by the visual information of their neighboring locations, and but they prefer to access larger visible areas and exposed surfaces by maintaining a central position within their visual field.

Table 5.2 Correlation between movement line counts and grid isovist + VGA (Syntax 2D) values

	Non-syntactic			Syntactic		
	Area	**Perimeter**	**Drift**	**Connectivity**	**Control**	
Movement line counts (5-foot) in grid cells	0.43	0.43	-0.36	0.45	0.48	***r***
	0.000	0.000	0.000	0.000	0.000	***p-value***
	0.19	0.19	0.13	0.20	0.23	R^2

The investigation of the effect of local visibility on choice in the movement direction:

A key step in investigating the effect of layout on exploratory behavior involves considering the effect of local visibility on the movement of visitors in spaces offering choice. As discussed in the methodology and previous case study chapter, this particular investigation aims to explore which of the directions that visitors take are based on the gradual unfolding of visual information in permeable directions. The results of this analysis show that the percentages of movement lines distributed in the available directions at choice locations are somewhat influenced by perimeter and occlusivity measures of the visual field at each of the corresponding directions ($R^2_{peri..}$= 0.20, p= 0.012, $R^2_{occl..}$= 0.15, p= 0.031; Table 5.3). The correlation with the perimeter indicates that 20% of the variation in the percentage of movement lines can be explained by variation in the length of real surfaces, while 15% of the variation in movement is explained by the variation in the length of occluding surfaces. These results demonstrate that exposed wall surfaces and hidden regions have some effect on a visitor's choice to move in a particular direction.

Table 5.3 Correlations between percentage of movement lines and visual field measures in corresponding directions at the choice locations

	Perimeter	Occlusivity	
Movement line ratio in available directions	0.45	0.39	***r***
	0.012	0.031	***p-value***
	0.20	0.15	R^2

Patterns of Contact with Displays and Visibility Properties

The patterns of visitor contact with the displays on the MoMA fourth floor are analyzed through the measures isolated from the stop count data on display viewing. The recorded stop count data indicating display viewing behavior is given in Figure 5.24. As can be seen, the displays in the north side galleries, 15, 17, 18, and 20A, seem to have received a higher number of stops than the displays in the other galleries. To obtain a more precise distribution result, the stop data was examined by calculating the average stop counts received by each display object. As shown in Figure 5.25, the displays in rooms 15A, 17, 18, 20A, 22 and 23B are contacted most frequently. The stop counts were also examined to understand the extent to which visitors made contact with displays in each room. Figure 5.26 gives the percentage of displays that are visited with respect to the total number of available displays in each gallery room. As can be seen from the figure, in some rooms not all displays are visited, although those rooms have the high average number of stops per displays, as shown in the previous figure. For example, in room 17 (Pollock) 87.5% of the displays and in room 22 50% of the displays are visited, despite the high average number of stops received by each display in those rooms. This indicates that in rooms 17 and 22 some works attracted more frequent stops and others none at all.

To investigate the influence of the layout on the patterns of contact with the displays, the key stop count measures describing display viewing behavior were compared to visibility properties. To this end, first the links between stop counts describing display viewing behavior

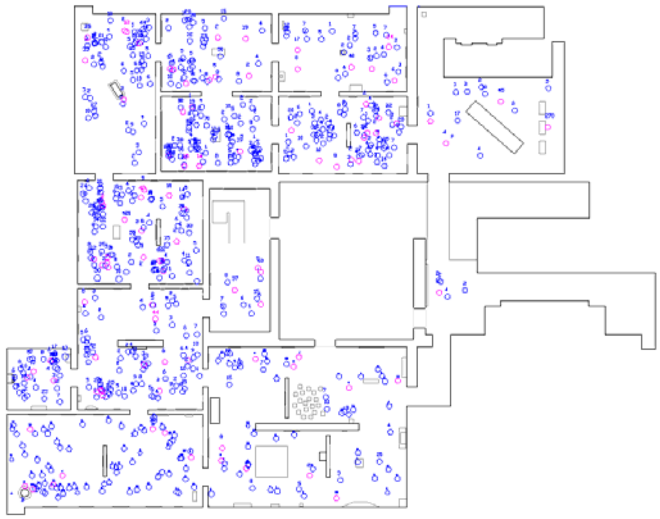


Figure 5.24 Transcribed data of movement paths

Figure 5.25: Distribution of average stop counts per display in the gallery floor. Darker shades show the higher number of stop counts per display.

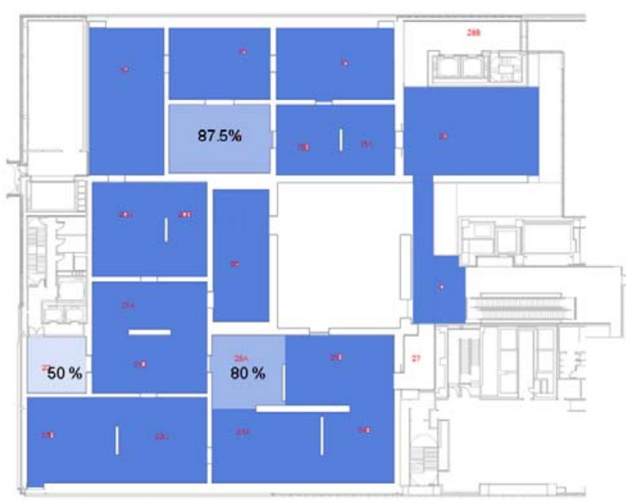


Figure 5.26: Percentage of displays viewed in each gallery room. Darkest shade denotes where 100% of the displays viewed.

and visibility properties of the gallery rooms were investigated. The counts of stops registering visitors' contact with the displays in each room were then correlated with syntactic and non-syntactic visibility measures obtained in each room. This was done first for the gross number of the stop counts, and then for the counts obtained by normalizing the gross counts by room size and the displays available in each room.

The investigation of the correlation between the gross stop counts for display viewing and syntactic and non-syntactic visibility values reveals that the stop counts are only negatively linked to the maximum value of visual integration ($R^2_{integ\text{-}max.}$= 0.26, p= 0.016; Table 5.4). This result suggests that 26% of the variation in the number of display viewing stops is explained by negative variation in the maximum values of visual integration. This means, visitors tend to stop to view displays more frequently in the rooms that include points that are the visually farthest from all other locations. When this investigation is repeated by correlating the stop counts normalized by the by gallery room size with the visibility values, the negative link between stopping frequency and visual integration became stronger, explaining 45% of the variation in the number of stops. The average value of visual integration seems to play a role on the stopping frequency with 26% (Table 5.5). When this investigation is repeated by correlating the stop counts normalized by the number of displays available in the rooms, the frequency of stopping to view displays inversely co-varies with the maximum and average values of visual integration ($R^2_{int\text{-}ave}$= 0.26, p= 0.019; $R^2_{int\text{-}max.}$= 0.20, p= 0.039; Table 5.6). These results indicate that that visitors stop to view displays in locations that are visually farther from all locations in the layout, and this holds true even when the possible interference of gallery size and number of display factors is eliminated.

Table 5.4 Correlations between display stop counts & VGA measures in each gallery

	Visual Integration (HH) Max.	
Stops viewing displays (Gross count each room)	-0.51	***r***
	0.016	***p-value***
	0.26	***R^2***

***** No correlation was found between the gross stops counts and isovist measures.

Table 5.5 Correlations between display stop counts & VGA measures in each gallery

	Visual Integration (HH) Avg	**Visual Integration (Max)**	
Stops viewing displays (Normalized by area)	-0.51	-0.67	***R***
	0.019	0.001	***p-value***
	0.26	0.45	$\boldsymbol{R^2}$

***** No correlation was found between the normalized stops and isovist measures.

Table 5.6 Correlations between display stop counts & VGA measures in each gallery

	Visual Integration (HH) Avg	**Visual Integration (HH) Max.**	
Display stop counts (Normalized by n. of displays)	-0.51	-0.45	***r***
	0.019	0.039	***p-value***
	0.26	0.20	$\boldsymbol{R^2}$

***** No correlation was found between the normalized stops and isovist measures.

The second step in this investigation explores the link between the average stop counts for each display and the visibility properties in the rooms. The average stop counts at each display were obtained by dividing the stop counts (describing display viewing behavior) by the number of displays viewed in each room (Fig. 5.25). This measure obtained for each room was correlated with the key syntactic and non-syntactic visibility measures of the rooms. However, this investigation did not demonstrate any correlation, indicating that the average stopping frequency at each display is not linked to the visibility properties in the galleries.

In another step, the stop counts describing display viewing behavior were examined in terms of the number of displays visited in relation to all of available displays in each gallery. In order to explore whether the degree to which the content is read widely (by stopping at many displays) in each room is associated with the visibility properties of the rooms, the percentage of displays visited in each gallery room was correlated with the key syntactic and non-syntactic visibility measures of the gallery rooms (Fig.5.26). This investigation demonstrates that the percentage of displays viewed in each room is linked with average values of visual connectivity of the rooms ($R^2_{conn.}$= 0.25, p= 0.017; Table 5.7). In fact, 25% of the variation in the percentage of displays visited is predicted by variation in the ability to see neighboring locations. In other words, a higher number of displays is visited in rooms that offer higher degree of visual access to their neighborhood.

Table 5.7 Correlations between percentages of the number of displays viewed in each room & VGA measures

	Connectivity	Visual Control	
Percentage (%) of the number of displays viewed in each room	0.50	0.39	***r***
	0.017	0.077	***p-value***
	0.25	-	R^2

The last step of this investigation takes into account the visibility properties at display object locations and investigates the effects of these locations' visibility properties on the stop counts of those displays. When the stop counts received by all displays are compared to the visibility of all display locations, no link was found. In the previous case study museum (YCBA) gallery, the gallery rooms with lower average connectivity and integration had similar correlation results. To check if the same would be true for the MoMA layout, the correlation between stops received by each display and the visibility properties of the display locations were separately investigated for each gallery room. However, this investigation found no significant correlation between the visibility at display locations and the stops received by displays. These results were also examined to determine whether the stop counts for each display object might be linked to the visibility of display locations in particular galleries that are comparable to each other in terms of number of visitors visiting or in terms of other average visibility properties. However, none of these investigations produced any correlation. This result suggests that in the MoMA fourth floor gallery, a visitor's attraction to display objects is not linked with the visibility of the display locations.

Patterns of Contact with Layout (Scanning stops) and Visibility Properties

As explained in the previous case study, patterns of visitors' contact with the layout were examined using the scanning stop data recorded for visitor pauses not associated with viewing particular displays, but for scanning the layout, looking at the spaces of architectural expression and looking out the windows. The data of the scanning stops recorded for the MoMA fourth floor gallery layout can be seen in the floor plan diagram in Figure 5.27. To obtain a more precise description of the scanning stop distribution, a number of measures were retrieved from the scanning stop data. One of these measures is the percentage of scanning stops among all stop counts, which describes the stopping behavior not associated with display viewing within the general stopping behavior. As can be seen in Fig. 5.28, in rooms 27, 0 (the circulation hall) and 28, the percentage of scanning stops is the highest in relation in all stops rooms. Since these rooms have only a small number of displays or no displays, the high percentage of scanning stops is hardly surprising. Indeed, the results indicate that when visitors stop in those rooms they visually scan the gallery environment, and thus those rooms perhaps function as places where visitors look around to get oriented. Other gallery rooms that have a rather high percentage of scanning stops are 17, 18, 19, 20A, 21B, 23A, 24A, and 25B. When the scanning stop data is analyzed by examining only the stops associated with scanning (not including the stops made to look at the atria), the rooms mentioned above and room 28 have the highest percentage of scanning stops (Fig. 5.29). The high percentage of scanning stops in room 28 might be due to the display of large size works of art, which motivates visitors to stop at a distance from them and to take a restorative break by scanning the environment. The scanning stop data was also examined by examining only the stops associated with looking at the building (mostly the atrium) and looking out the exterior windows. This examination shows that visitors stopped to look at the atrium only in the circulation hall (room 0) and room 25B with the highest percentage of those stops occurring in the circulation hall (room 0). No scanning stops related to looking at the atrium were recorded in room 26. Stops to look at the atrium occurred only in rooms 28, 23B and 16, but not in room 19. Visitors most frequently stopped to look outside in room 28. This result is not surprising as room 28 room has a largest window area facing outside, which also has a potential to motivate visitor to take a restorative break.

Figure 5.27 Distribution of all stops in the gallery

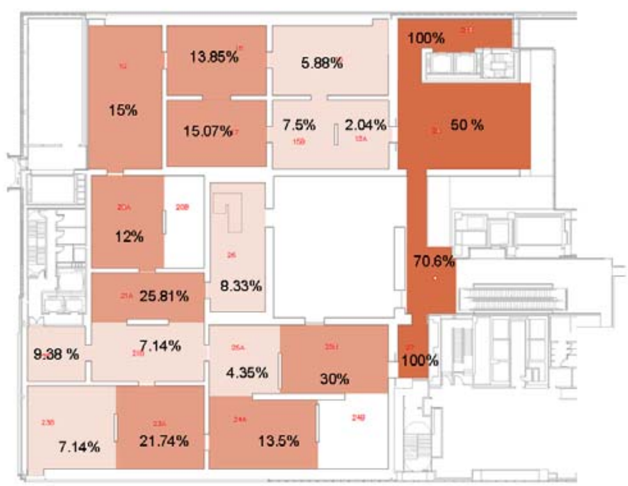


Figure 5.28 Distribution of percentage of scanning stops (scanning, looking at atrium and outside window) in all stops

Figure 5.29 Distribution of percentage of scanning stops-scanning only in all stops

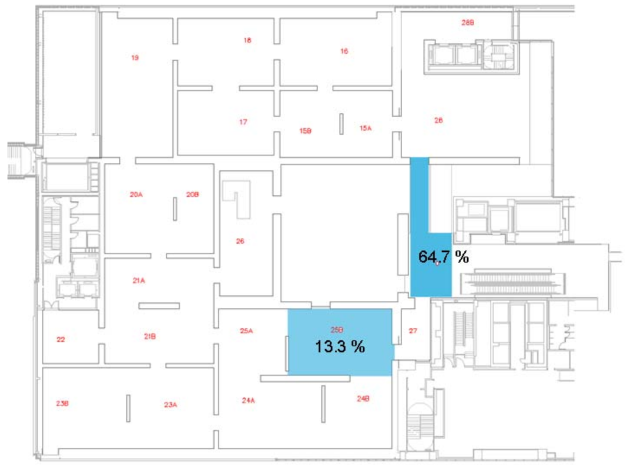


Figure 5.30 Distribution of percentage of scanning stops -looking at atria in all stops

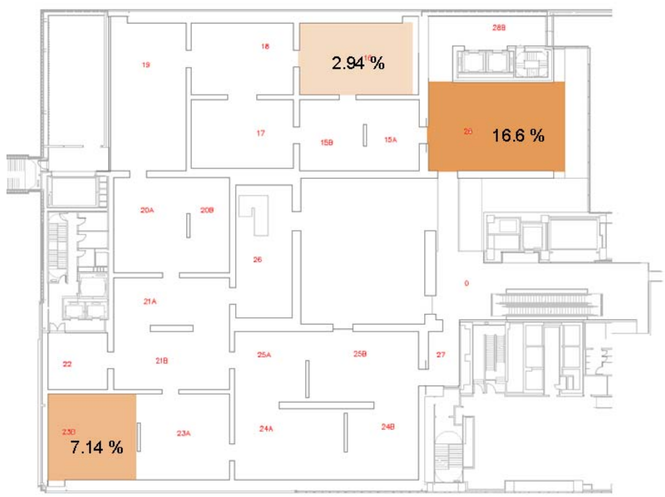


Figure 5.31 Distribution of percentage of scanning stops-looking outside window in all stops

The potential influence of the gallery layout on visitors' patterns of contact with the layout was investigated by correlating the scanning stop counts with syntactic and non-syntactic visibility properties. In the first step of this investigation, the gross counts of scanning stops were correlated with the syntactic visibility measures. In this investigation, the counts recorded in relation to looking out the atrium opening. The stops associated with looking out the exterior windows are excluded from the analyzed data considering that such stops are likely motivated by the availability of windows than the visibility properties of the gallery space. The results show that the scanning stop counts are linked to visual connectivity and control measures (Table 5.8).

When the scanning stop counts that include those for looking at the atrium and scanning the galleries are normalized by room size and then correlated with the syntactic visibility measures, these counts still appear to be linked with visual control and connectivity (Table 5.9). This correlation shows that 41% of the variation in the number of scanning stops is explained by variation in the capacity of the gallery rooms to provide visual access to the less interconnected rooms (control), while only 28% of this variation in the scanning stops is predicted by the capacity to provide visual access to all the neighboring locations. As suggested consistently in the correlation results here, visitors' stops to visually survey the gallery space are linked to local visibility relationships, in particular visual access to neighboring locations and especially those that are less connected to their adjacent locations.

Table 5.8 Correlations between scanning stop counts (gross) & VGA measures in each gallery

	Connectivity	**Visual Control**	
Scanning stops (gross counts, scanning+ atrium)	0.50	0.59	***r***
	0.017	0.004	***p-value***
	0.25	0.35	R^2

***** No correlation was found between scanning stops and isovist measures.

Table 5.9 Correlations between scanning stop counts (norm. by area) & VGA measures in each gallery

	Connectivity	**Visual Control**	
Scanning stops (scanning + atrium; normalized by area)	0.53	0.64	***r***
	0.013	0.002	***p-value***
	0.28	0.41	R^2

***** No correlation was found between scanning stops normalized and isovist measures.

In order to investigate the effect of visibility on visitor scanning behavior within the general stopping behavior, the percentage of scanning stops among all stops was correlated with the average visual graph measures for those rooms. This investigation, which excluded the stops to look out the exterior windows from the analysis, correlated the stops associated with scanning the galleries and looking at the atrium together with the visibility properties of the rooms. The correlation results show that the percentage of scanning stops (scanning and looking at the atrium) among all stops recorded is linked to the average and maximum values of visual integration for the rooms ($R^2_{int\text{-}int}$= 0.23, p=0.025; Table 5.10). Specifically, 25% of the variation in the percentage of scanning stops is predicted by the rooms' property of being visually close to all other locations. In other words, visitors have a stronger tendency to visually scan the gallery environment (including the atrium) than to view displays in the rooms within a few visual steps away from every other location. Interestingly, the percentage of the scanning stops among all stopping behavior is not linked with the local visibility values (connectivity and control). Moreover, when the percentage of the stops for scanning only the gallery environment (not the atrium) is correlated with visibility properties of the rooms, the behavior of scanning only the galleries is not linked to any of the visibility properties. These results indicate that the behavior of scanning the gallery environment only might be predicted by other factors; while the behavior of scanning both the gallery rooms and the building is motivated by integration, i.e. the property of being close to all other spaces. Given that this property is most dominantly engendered by the few atrium openings connecting spaces across a distance, the link between integration and the tendency to scan the gallery environment and building suggests that the atrium greatly contributes to visitors' experience of the building space. This effect of the atrium seems quite different from that observed in the previous case study, the YCBA, and these differences are discussed in Chapter 7 in detail.

Table 5.10 Correlations between scanning stop counts & VGA measures in each gallery

	Visual Integration (HH) Max.	**Visual Integration (HH)**	**Isovist Max Radial**	
Percentage (%) of scanning stops (scanning + atrium) in all stops	0.42	0.48	0.44	***r***
	0.053	0.025	0.042	***p-value***
	-	0.23	0.19	$\boldsymbol{R^2}$

Movement - Stop Counts Relation and Visibility Properties

In addition to examining the three patterns of space-use separately in the MoMA fourth floor, the relationship between explorative movement and stopping behavior was investigated by comparing the distribution of movement lines and stops counts. This comparison was made by calculating the ratios between the number of movement lines and stop counts in each room, as well as correlating these counts with each other. The calculations of the ratios between the movement lines and stop counts help to determine whether visitors would stop in the locations where they move or meander without stopping. A ratio of moving to stopping that is equal to 1 represents a usage where visitors stopped once each time they entered a gallery room; ratios larger than 1 indicate that fewer times visitors stopped along their movement.

Figure 5.32 presents the ratios between the movement lines and stops for viewing displays. As can be seen in the figure, this ratio is highest in room 28 and room 0 (the circulation hall), indicating that in those rooms visitors seldom stop for displays and mostly meander or stop to visually scan the gallery space. When the rooms functioning as circulation and gathering (0, 27, 28, and 28B) are excluded from the analysis, we see that the ratios between the movement lines vary only between 0.26 and 1.57. The mean value of these ratios is 0.84, suggesting that in most of the galleries, visitors stopped more than once to view displays along the same movement line entering the gallery rooms. When the diagram in Fig.5.32 is examined closely, it can be seen that the lowest ratios between the movement lines and stop counts are in room 23B, 22, and 16 (the Pop art, Conceptual Art and Postwar Figuration galleries). This shows that once visitors enter the rooms, they stopped more than once to view displays; in other words they had more frequent contact with displays along their movement. The highest ratios between the movement lines and stop counts in the gallery rooms (excluding rooms 0, 27 and 28), are 1.52 and 1.57 in rooms 21A and 25B, respectively. These ratios indicate that visitors did not stop at displays each time they entered those galleries.

A close examination of Figure 5.32 demonstrates the likelihood that the ratios between movement and stop counts are influenced by some other factors, such as gallery room size and the number of displays available in the galleries. A larger room size would motivate more frequent stopping. Moreover, visitors might stop more often in the galleries that have a higher number of displays. Therefore, in addition to direct correlations, the movement lines and stop counts were compared by partial correlations using the number of displays in each room and

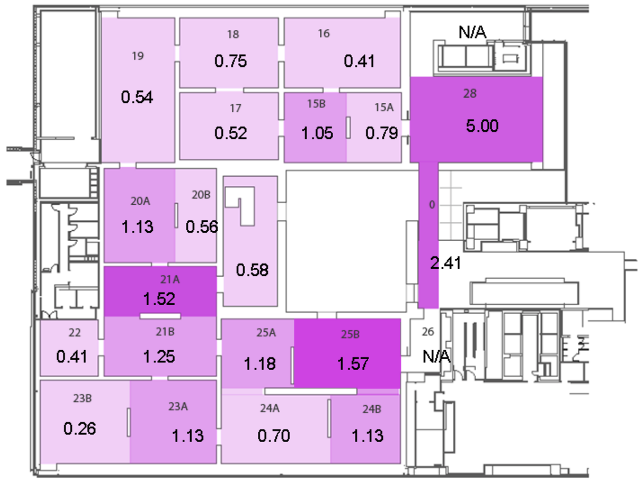


Figure 5.32 Ratio of movement paths crossing galleries to stops at displays in MoMA's layout

room sizes as controlling variables. As explained in the methodology chapter, the partial correlation technique is used to investigate the link between two variables where other variables may interfere with this link. The partial correlation procedure virtually removes the third factor to explore the link between the two variables of interest.

The correlations between the movement line and stop counts can reveal how the relationship between moving and stopping co-varies throughout the layout. For the MoMA fourth floor, direct and partial correlations were conducted separately for stop counts of viewing displays and scanning stops. The direct correlation of movement paths with stops viewing displays and scanning stops (Table 5.11) shows that stops for viewing displays are not significantly associated with moving, whereas scanning stops are linked with movement lines. When these correlations are repeated by taking the number of available displays and room areas as controlling variables separately (Table 5.11), the results are consistent with the direct correlation results: scanning stops are significantly correlated with movement and stops for display viewing do not seem to be associated with movement.

These correlation investigations were also repeated by excluding galleries 0 and 28, which are characterized by a high movement-stopping ratio. In this investigation, the correlation between movement and stops at displays are slightly higher. However, when the normalized values of the stops at displays are used, it is still not possible to demonstrate a significant link between movement and stopping. This implies that in the galleries characterized by frequent display viewing, visitors' movement lines and stop counts do not co-vary; in other words, visitors do not stop at the displays in every space they cross (Table 5.12).

Table 5.11 Movement paths & stop counts comparison with direct correlation

	Correlation type	Stops at displays	Scanning stops	
Number of movement lines crossing each gallery	*Direct Correlation*	0.32	0.55	***r***
		0.14	0.010	***p-value***
		-	0.30	***R^2***
	Partial correlation controlled by n. of displays	0.39	0.51	***r***
		0.093	0.012	***p-value***
		-	0.26	***R2***
	Partial correlation controlled by gallery room areas	0.25	0.52	***r***
		0.29	0.018	***p-value***
		-	0.27	***R^2***

Table 5.12 Movement paths & stop counts comparison with direct correlation (after removing galleries 0, 28, 28B, 27 from the investigation)

	Correlation type	Stops at displays	Scanning stops	
Number of movement lines crossing each gallery	*Direct Correlation*	0.46	0.54	***r***
		0.053	0.022	***p-value***
		0.21	0.29	***R^2***
	Partial correlation controlled by n. of displays	0.43	0.51	*r*
		0.082	0.035	*p-value*
		-	0.26	*R2*
	Partial correlation controlled by gallery room areas	0.40	0.52	*r*
		0.11	0.033	*p-value*
		-	0.27	*R2*

In addition to examining the covariance between movement and stopping behaviors in the gallery rooms, this study also examined to what extent the spatial layout predicts this covariance between exploratory movement and stopping behavior, in other words, whether visibility motivates visitors to explore the galleries by moving instead of stopping more often in each gallery. To this end, the key measures concerning the ratio of movement to stops for display viewing were correlated with syntactic and non-syntactic visibility measures. The first step in this correlation analysis used stops at displays normalized by area for calculating movement line-stop count ratio in each room, and compared this ratio with the visibility properties. No correlation was found between the ratios and visibility measures. However, when the movement line-stop count ratio is used for the counts normalized by displays, these ratios are quite significantly linked with the isovist occlusivity measure of the visual field (Table 5.13). According to this correlation, visitors stopped less often along their movement where the visual fields can potentially reveal hidden information

Table 5.13 Correlations between movement lines/display stops (normalized by number of displays) ratio and VGA + grid isovist values

	Isovist Occlusivity	
Movement lines – Stop at displays ratio normalized by available displays	0.44	***r***
	0.044	***p-value***
	0.19	R^2

5.4.2 To What Extent Does the MoMA's Spatial Layout Predict Space-use Patterns?

These results reveal the extent to which the gallery layout of the MoMA fourth floor influences visitors' space use patterns on the basis of its visibility structure. Most importantly, the correlation between the number of movement lines and visibility properties provides strong evidence that almost half of the variation in the exploratory movement at the gallery room scale is influenced by the visual information on neighboring spaces, including those spaces less connected to their neighborhood; however, a room's property of being visually close to all other locations (visual integration) has a much weaker effect on movement (Table 5.1). These results suggest that visitors have a strong tendency to visit or move through the rooms that can be easily seen from the neighborhood, while the global level visibility of a room, being close to the other locations, has only a peripheral effect on modulating the movement. As can be seen from the visibility graphs of the layout, the MoMA fourth floor gallery rooms are visually interconnected at the local level, but only a few gallery rooms are connected to the entire layout at the global level, in other words visually close to other spaces. Therefore, visitors are mostly able to use the local visual information during their spatial exploration, and the gallery layout is explored using the information revealed through progression. The specific aspects of local visual information that play a role in modulating the movement are revealed by the results obtained from the correlation of the movement lines with non-syntactic visibility. These results provide strong evidence that more than half of the variation in the movement is modulated by the availability of exposed wall surfaces in the visual field. Additionally, almost half of the variation in the exploratory movement seems to be influenced by the size of visible areas and hidden regions in the visual field (Table 5.1). These results illuminate that visitors are guided by the information on the gallery walls, as well as the information contained in the gallery space and the hidden information beyond the visible areas. Because of the greater effect of the exposed wall surfaces the displays on the walls might contribute to modulating the movement. This phenomenon is further discussed in the conclusion of this chapter together with the other results concerning exhibition narratives.

One interesting result emerged from an investigation of the effects of visibility properties on visitor movement at a more local (grid-cell) level. In this analysis, the effects of visibility on movement can be seen at the scale of visitors' individual space. The results suggest that approximately one-fifth of variation in visitor movement is predicted by fine-scale variations in the visual information of neighboring locations With regard to non-syntactic grid isovist measures, information on visible regions and surfaces exposed to view as well as hidden regions play role in modulating movement in the finer grain of space. These findings are consistent with the effect of visibility demonstrated at the room scale and suggest that local visibility relationships modulate exploratory movement at both the room level and the fine grain of space around visitors. This effect of visibility at the fine grain of space can be explained by the fact the large room sizes facilitate some variation in the visibility properties within a room and visitors seem to be guided by these variations.

The analysis concerning the exploratory movement also explored to what extent the movement distribution may be shaped by the visual information that a stationary visitor would obtain at the spaces offering choice. The results obtained by correlating the percentage of movement lines directed into the available locations with visual field measures at the corresponding locations show that approximately one fifth of the variation in the distribution of movement at choice spaces (measured by the percentage of movement lines leaving toward the available directions) is explained by the availability of exposed surfaces as well as potential to explore hidden regions. These results imply, visitors are attracted to move towards exposed wall surfaces and hidden regions.

The analysis investigating the effects of the layout on patterns of display viewing shows that the gallery layout predicts stopping to view displays on the basis of visibility. The results obtained by correlating the gross and normalized stop counts with the visibility properties indicate that the visibility structure predicts stopping behavior in a manner opposite to how it predicts movement. In light of this, exploratory movement and behavior of stopping to view displays are influenced by different aspects of the visibility structure. The analysis yielded a negative correlation between the frequency of stopping and visual integration at the room level, meaning that visitors tend to stop more often in spaces that are 'visually' far from everywhere else in the layout. This effect is consistent when stopping to view displays is considered by normalizing the effect of room size and the effect of the number of available displays in a room.

Considering the potential effects of the layout as well as artwork on visitor behavior, the results have two potential implications. The first is that visitors tend to stop mostly at the visually segregated places because the absence of global visibility creates opportunities for a focused viewing. The second is that the most popular exhibitions may happen to be located at the visually segregated places. Indeed, the second implication is likely the explanation for this result. As the visual integration graph shows, the north side galleries are visually the least integrated; these galleries display Pollock's murals and other Abstract Expressionist works that can be considered the most well-known and popular artwork in the galleries (Fig. 5.32). Also these visually less integrated galleries are visited first in the suggested sequence. As it is known from previous studies in the museum studies field, visitors tend to stop more frequently at the beginning of their explorations, and this tendency may explain the frequent stopping at the north side galleries which also have low visual integration. However, some of the visually segregated galleries that come later in the suggested sequence also have higher number of stops, which can be explained by the placement of popular paintings such as Warhol's work in those locations. Thus, the layout properties and the placement of popular paintings together are likely to have an effect on display viewing behavior. The layout takes visitors through a step-by-step experience and reveals the paintings as visitors arrive at each room. This way of revealing the galleries and paintings has some implications concerning the way in which the exhibition narrative is conveyed to visitors, and these implications are discussed in detail in the chapter conclusion.

The comparison between the percentage of the displays visited in each room and visibility showed that the degree to which the content is read in the galleries is linked to the property of having visual access to (and being visible from) the neighboring locations (Table 5.7). Thus, in the gallery rooms revealing the information of neighboring locations the content is grasped through viewing more displays. This association with a room's property of having visual access to the neighboring locations can be interpreted in relation to the found influence of this same property on the exploratory movement. Accordingly, visitors tend to stop at a higher number of displays in a room during their exploratory movement guided by information of their immediate neighborhood. On the other hand, as no link found between display viewing behavior and visibility of display objects, the displays visitors at which would stop is not linked to the visibility properties of those display locations.

The analysis investigating the prediction of visitor scanning stops reveals the extent to which the gallery layout properties may support the need for visitors to have an awareness of gallery space and exhibits. The correlations found between the scanning stop counts (both gross and normalized counts) in each room and the visibility properties of rooms indicate that visitors tend to stop and visually scan the layout and look at the atria where visual information of neighboring locations is available (Table 5.8). When the room size factor is normalized, the room's capacity to reveal less connected neighboring spaces (the property of controlling visual information) is found slightly more influential on the tendency of visitors to stop to visually scan the galleries or look at the atrium. This suggests that visitors tend to survey the galleries quite frequently at the spaces where they can see visually less connected (i.e. dead-end) rooms. However, when the higher rate of scanning stops among all stops is taken into account and correlated with the visibility properties, it can be concluded that visitors' behavior of scanning and looking at the atrium among all stopping behaviors is motivated by the property of visual integration, but not visibility of the neighboring location (Table 5.10). This implies that when it is possible to capture the visual information of all spaces within a few steps, visitors prefer to stop to scan the galleries and look at the atrium rather than stop to view displays. This result suggests that global level visibility which is released mainly through the atrium facilitates the behavior of experiencing the gallery environment and the architecture as opposed to viewing displays. This result confirms the competing effect of architecture over other museum visit behavior such as looking at displays.

5.5 Interactions among the Spatial Layout, Narratives and Space-use Patterns

The in-depth analysis of the MoMA provides results for two key investigations concerning the ways in which the MoMA gallery layout shapes the exhibition narratives, and the extent to which it predicts the space use patterns. These investigations are based upon top-down and bottom-up characterizations of space described by syntactic and non-syntactic visibility properties. Thus, the results of these investigations can explain the interactions among the gallery layout, exhibition and space-use patterns in the MoMA fourth floor layout in reference to the morphological characteristics of the gallery floor.

Presentation of Exhibition Narrative based on Visibility Properties of the Spatial Layout

With regard to the explorations of how the MoMA gallery layout shapes the exhibition narratives, the MoMA's layout is used to express the development of the late modern and pre-contemporary art in a complex trajectory. The spatial interconnectivity at the local level, which is created by multiple local connections among the gallery rooms, allows for presenting the complex relationships that cannot be expressed in a single directed sequence. The spatial properties of the layout affect and predict exploratory behavior and thus convey the exhibition narrative along the guided exploration. This is largely because the potential of the layout to guide visitors on the basis of information of adjacent locations is in concert with the MoMA's exhibit strategy. The analysis of the organization and placement of the displays shows that the MoMA presents the content through chapter rooms and places the art movements that are chronologically and subsequently related in rooms adjacent to each other. Moreover, the museum places the paintings in adjacent rooms on the visual axis as a device to attract visitors. These strategies seem to exploit the full potential of the spatial properties of the gallery layout, as established by the curatorial team. The availability of local visual information facilitates the reading of the late modern and pre-contemporary art movements through chronologically placed and subsequently related developments that are sequentially unfolding to visitors.

The examination of other spatial properties of the layout reveals that moderately high levels in the property of visual integration (being visually close to all other spaces) are concentrated towards the south galleries. The integration property in these galleries places an emphasis on the crosscurrents in 1960s and subsequently developed movements presented in those galleries. Therefore, the relationships between the 1960s' reactionary crosscurrents and subsequently developed movements such as the Pop art, Minimalism and Post-Minimalism are arguably the main emphases of the narrative. Similarly, the works representing geometrical abstraction in the late modern art, starting with pieces by Kelly and Otero in room 19, sculptural compositions in room 21A, the Minimalist and Post-Minimalist works in rooms 24 and 25, and Judd's large scale sculpture in room 28 (the north entrance) happen to be situated in the visually most integrated galleries in the layout. This creates an opportunity to maintain the visual relations among the geometrically abstract works as well as an opportunity to read the rest of the displays through the lens of the geometrically abstract works. The property of visual integration, however, has a weak effect on explorative movement; thus, it is less likely that visitors' would explore those geometrically abstract works along their movement. On the contrary, the negative influence of visual integration on visitors' display viewing behavior confirms that the visitors less likely made contact with displays in visually integrated locations. Instead, the visitors seem to have more intense contact with the content in the galleries that are visually less integrated, such as in the north galleries. This suggests that although the layout has the potential to emphasize the complex relations between the crosscurrents of 1960s and the Post-Minimalism and Minimalism that emerged from the crosscurrents, this emphasis does not coincide with the visitors' behavior of focused viewing. Given the weak effect of integration and the stronger effect of connectivity and control, the relationships between crosscurrents and preceding and following movements are likely grasped through brief glances at displays along the navigation. In contrast, the Late Modern movements presented in the north galleries, and a number of other movements that emerged from the crosscurrents in 1960s such as Pop art, are likely read and grasped through a focused viewing.

Prediction of Exploration and Viewing Behavior and Its Implications for the Narratives

The most notable results regarding the interaction between the gallery layout and space-use patterns on the MoMA fourth floor were obtained from the correlation between explorative movement measures and visibility properties. The results suggest that visitors explore the galleries by using the most predominant local visibility properties. In other words, visitors are guided by the rooms' capacity to reveal the information of adjacent locations, including those that are visually less connected to their neighborhood. When this capacity is considered together with the MoMA's strategy of exhibiting the late modern and pre-contemporary movements in chapter rooms, it can be seen that the exhibition content is presented as a progressive narrative where the content is revealed by unfolding the information in a room-by-room progression. Other findings concerning the prediction of exploratory movement through non-syntactic properties explain which aspects of morphology play a role in guiding visitor exploration. Specifically, the exposed wall surfaces and regions hidden from view have an effect on modulating visitor movement through the galleries. Visitors are attracted to move towards exposed wall surfaces and hidden regions. Part of this effect may be due to the particular works of art placed on the walls visible through gateways, further suggesting that the displays visible through the galleries modulate the movement. As implied by the effect of hidden regions (represented by occluded surfaces of visible field), what is about to be seen after proceeding through the gallery doorways encourages visitors to move farther. Thus, with regard to local visual information, visitors' exploratory movement seems guided by the morphology of the chapter rooms that reveal the visual information sequentially, as well as the displays that are exposed within this morphology.

The results obtained by correlating the stops for display viewing with rooms' visibility properties suggested a negative effect of the galleries' visual integration property on display viewing behavior. These results have interesting implications. As discussed in section 5.4.2, the effect on stopping behavior might be explained by the tendency of visitors to stop more often at the galleries visited first (which in the MoMA happens to be less integrated) and when the attention level is higher. The placement of popular displays at those visually segregated locations may be another explanation for frequent stopping. In addition to these possible explanations it should be also considered that most spaces in the MoMA layout are visually far from all other spaces and global levels of visibility are seldom available. One can argue that the absence of global levels of visibility creates opportunities for focused viewing and motivates visitors to stop and look at the exhibitions. This potential effect of the gallery layout can be confirmed if similar results are obtained in the other case study examples.

The descriptive analysis of visitors' space use patterns can elucidate the ways in which the exhibition narrative is read by visitors. As discussed in Psarra et al. (2007), at the beginning of the suggested sequence starting from the north galleries, 75% of visitors in the sample skipped room 16 where Post-war Configuration in the European context is presented. These visitors followed the sequence of Surrealism in Exile (15A), Early Abstract Expressionism (15B) -- where Latin American and New York artists' explorations are displayed -- Pollock (17) and Abstract Expressionism (18). Thus, the majority of visitors are likely to grasp the roots of Pollock's and others' Abstract Expressionist art in Latin American artists' Surrealist and New York based artists' early Abstract Expressionist works. The directed sequence from the Pollock gallery through gallery 20A is surely viewed by visitors, and thus the transition from Abstract Expressionism to its painterly and non-painterly alternatives must be grasped within their connections. Dues to the higher rates of stopping at displays in galleries 15, 17, 18, 19 and 20 along with the effect of low visual integration and popularity of the paintings in these galleries, the content presenting the development of Abstract Expressionism and its painterly and non-painterly alternatives are likely read in-depth. The gallery devoted to the crosscurrents, called Reinventing Abstraction-1960c, distributes the movement into various directions. While only a small percentage of visitors (24%) seems distracted from the narrative by turning to the Matisse staircase, the remaining visitors had contact with the few displays in the first part of Reinventing Abstraction-1960c gallery presenting geometrically abstract sculptural compositions of Latin American artists. The displays in the second part of the Reinventing Abstraction-1960c room are visited more intensively. This gallery channels the majority of visitors into Pop art and Post-Minimalism galleries in almost equal numbers, while a few visitors choose to view the works of conceptual art in Focus Gallery before proceeding to these directions. As can be seen from these rates of gallery visits, the content presented in galleries 20A, 21A, 21B and 23A, the transition from the first non-painterly examples of Rauschenberg and Johns to crosscurrents in the Reinventing Abstraction-1960c room and subsequently developed Pop art seems to be more likely read than other sequences in the entire narrative. Given the probable influence of a low degree of visual integration, the displays in the Pop art gallery are viewed more intensively; however, visitors' attention to the Minimalism and Post-Minimalism galleries seems to be lessened along their movement. These observations show that the sequence of non-painterly abstraction (of Rauschenberg and Johns), crosscurrents (Reinventing Abstraction-1960c) and Post-Minimalism is read by visitors mostly on the surface, whereas the Abstract Expressionism, and painterly abstract alternatives, and then Pop art are read more in-depth by visitors. Even though the higher values of visual integration in Reinventing Abstraction-1960c to Post-Minimalism place a central emphasis on this part of the narrative, the descriptive analysis of the stop counts and the negative link of the integration property on the behavior of viewing suggest that visitors seldom had contact with the displays along this sequence

Prediction of Scanning Behavior and Shaping the Museum Visit

The results associated with the scanning stops reveal that visual integration motivates visitors to stop to scan the gallery space and look at the atrium rather than stop to view displays. This shows that the global visibility properties, in particular, the capacity to be visually close to all other locations in the Post-Minimalism gallery motivate the visitors to experience the galleries and the building rather than the displays. Along with the other results, these findings confirm that experiencing the gallery space and the architecture competes with viewing the displays. In other words, these two patterns of space-use experiencing the gallery space and display viewing do not overlap with each other, and this is due to the morphological characteristics of the museum, in particular the poor relationship between the atrium and the gallery space. While the atrium and other parts of the building can be explicitly experienced from either the circulation space at the north entrance to the galleries and from gallery 25 at the end of the suggested viewing sequence, visitors are not given much chance to experience the building inside the galleries. One can argue that the disconnect of the atrium space and limited opportunity to restore the understanding of the building may intensify the experience with the art.

An examination of the MoMA's display strategies as well as its use of gallery formal properties reveals that the MoMA seems to be in control of what can be conveyed through a conventional interpretation of the content and by acknowledging its complexity. For example, the MoMA presents the late modern and pre-contemporary movements in a somewhat chronological sequence of chapter rooms. The room configuration is planned in accordance with the idea that the chapter rooms should help accomplish the museums' interpretive goals. In this chapter room sequence, some display groups placed in the rooms are rotated periodically to facilitate the exploration of alternative relationships between the art movements. At the same time, the permeable connections between the rooms are planned to express chronological as well as stylistic continuum among the art movements. The museum also devotes some of the galleries to the works of individual artists in order to provide a break in the chronological sequence and allow the art to be appreciated with its experiential qualities. This can be seen as an effort to celebrate the experiencing of the works of art rather than to interpret them in a purely chronological analysis, as recognized by Serota in his discussion of contemporary strategies of exhibiting art (Serota, 1997). As can be understood from these observations, the MoMA tries to balance the didactic presentation and a more contemporary presentation technique, taking into account the complexity of the content. In particular, the MoMA expresses the increasing complexity of the late modern and the pre-contemporary art after 1960s by providing multiple connections between the crosscurrents gallery and the other galleries representing the subsequent movements (Pop art, Minimalism, Post-Minimalism and Conceptual Art). Despite these efforts, the visual interconnectivities among the galleries and associated display strategies do not generate alternative narratives beyond those described in the MoMA's curatorial sources. Additionally, the gallery layout separates the experience with content from the experience of the architecture in that the most explicit feature of the morphology, the atrium, barely interacts with the spaces that present the narrative. The MoMA's museum architecture, which is characterized by sheer modernity and spacious galleries accommodating crowds within an urban experience, fulfills the symbolic expression of the MoMA's institutional significance as being modern; however, it barely brings alternative ways of exhibiting art beyond the MoMA's conventional strategies.

The MoMA mission aims to present its artwork through multiple trajectories that can account for derivations and influences of different artistic styles. Although, the narrative of the artwork seems to be shaped around a conventional presentation, it is intense and complex due to the intricate arrangement of gallery rooms that present contrasting and diversified styles side by side. During their exploration of the space, visitors seem to be engaged with locating and viewing art as gallery space unfolds from room to room., but in a few instances and mostly towards the end of their itinerary visitors have a chance to connect to the reference points, namely the atrium and the gallery floor entrance. Thus, the MoMA's architectural design of the fourth floor, fulfills the museum's goal to allow visitors to interact with each artistic style, as well as providing movement opportunities situated in such a way that the relationships among different styles can be uniquely read.

CHAPTER VI

CASE STUDY 3:
THE HIGH MUSEUM OF ART

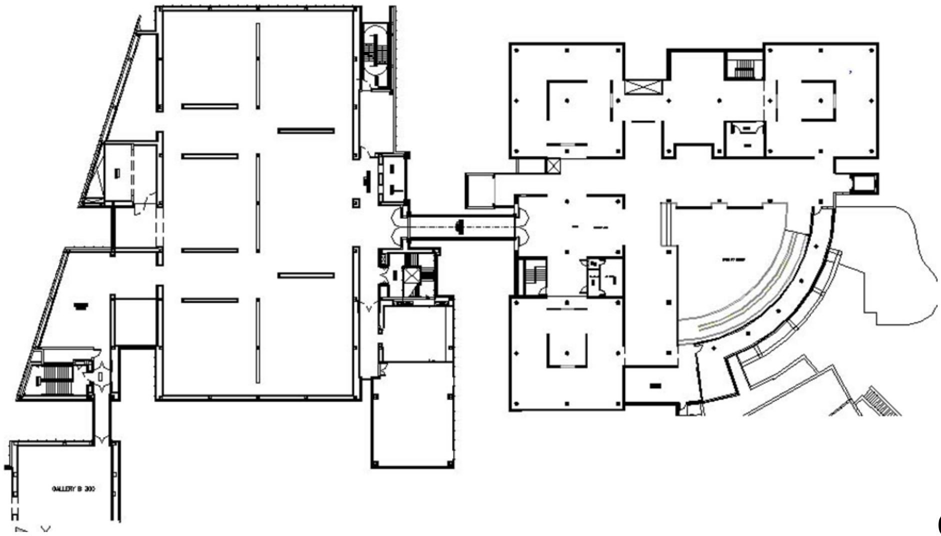
6.1 Chapter Overview

This chapter presents an in-depth analysis of the data collected in the skyway (fourth) floor galleries at the High Museum of Art in Atlanta. Following an introduction of the museum collection and the museum building design characteristics, this chapter presents two analyses. The first examines the exhibition content organization and compares it to the gallery layout characteristics. The second analyzes visitor space use patterns and correlates them with the spatial layout properties.

6.2 The High Museum of Art Collection and the Museum Building

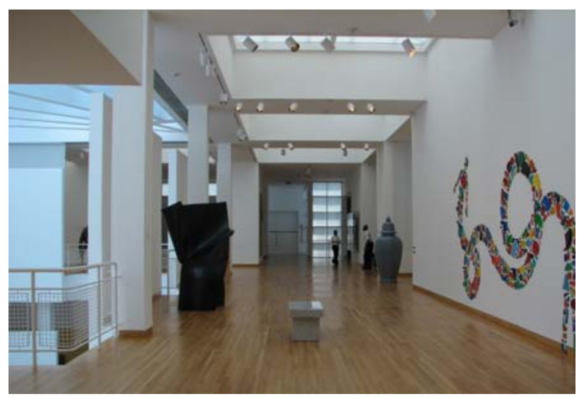
The High Museum of Art (HMA) in Atlanta, Georgia was founded in 1905 as the Atlanta Art Association, and in later expanded its services as a museum. In 1979 the museum's first official museum building was commissioned to architect Richard Meier, who was known for dedication to the arts and craftsmanship in his designs (Vigtel, 1983). The museum building was constructed on its current site located near other major art foundations of Atlanta and opened to the public in 1983.

The museum collection began with pieces of 19th century American Decorative Arts. Over time, the collection has expanded with acquisition of works from other genres including American decorative art, European art, African-American and American self-taught art,



(a)

(b)



(c)

(d)

(e)

Figure 6.1.The High Museum of Art **(a)** skyway galleries of the Stent (by R. Meier) and Wieland (by R. Piano) wings **(b)**, **(c)**, and **(d)**, interior views from the Stent wing **(e)** interior view from the Wieland Wing

as well as modern and contemporary art. The inclusion of pieces of contemporary art has been a recent development in the last ten years, as the museum began working toward becoming known for its contemporary art collection and displays in the Southeast United States (Brenneman, 2006). As works of contemporary art have been added to its diverse collection, the museum needed to expand its gallery space considerably, mainly to accommodate pieces that are mostly large size mural paintings that require larger gallery rooms for installation. The expansion project was designed by Renzo Piano, and opened to public in 2005 (*Renzo Piano's Village for the Arts*, 2005). Piano's design added two wings, namely the Wieland and the Cox wings to the original Meier building, which is now called the Stent wing.

This study analyzes the skyway floor gallery layout formed by upper floors of two wings the Stent wing (designed earlier by Meier) and the Wieland wings (recently designed by Piano). The Stent Wing is composed of an L-shaped gallery block attached to a quarter-circle, whereas the Wieland wing has a rectangular volume partitioned into rectangular galleries; the two wings are connected with a narrow hallway.

6.3 The HMA's Skyway Floor Layout and the Exhibition Narratives

6.3.1 Exhibition Content: American Modern, Contemporary and Self-Taught Art

The skyway galleries of the HMA present the works of the twentieth century American art that can be categorized into three genres: modern art, contemporary art and self-taught (folk) art.[31] The works of modern, contemporary and self-taught (folk) art are displayed in the Stent Wing displays, while the Wieland wing focuses on contemporary art.

The HMA American Modern art collection includes paintings, sculptures and designed objects, and photography produced in North America between 1900 and 1960s. Works created

[31] American self-taught art refers to creations of untrained artists who have worked outside the confines of art schools, galleries and museums in the twentieth century North America, as described by Longhauser (1998).

after the 1960s are categorized as contemporary art, of which the HMA has mostly paintings and sculptures. Self-taught art is interpreted as less connected with these time periods mainly because the self-taught genre refers to the works of untrained artists, whose work is not interpreted in terms the mainstream artistic influences that fall into the time periods mentioned above (Doss, 2002).

As discussed in the art history literature, American modern art has strong links to the developments in the twentieth century and has been shaped by key economic and political events, such as industrialization, the Great Depression and social group struggles that took place in the first half of twentieth century (Doss, 2002). Given this influence, many art historical sources examine the works of American modern art in two key periods: pre-World War II and the post-war decades. The movements and styles of these two periods are further distinguished with reference to their influence from industrialization, and other changes in the social realm as well as formal influences of European art.

A close examination of the pre-war period American paintings shows the influence of the Precisionist movement, which depicts industrial landscapes, floral and natural forms with Cubist shapes. Painting within this movement reflects the mixed influence of European Cubism and American Realism (Baur, 1975). Among the Precisionist works in the collection are floral and natural compositions painted by Stettheimer, Sheeler, Of and Bruce as well as industrial landscapes painted by contemporaries of those artists. The other pre-war period paintings in the collection date from 1915 to 1920 and depict urban landscapes in North America. In this group, paintings of artists like Lawson, Lie, Luks, and Davies present changing scenery in modern cities with their new structures, bridges, and buildings. A group of artists after the First World War, such as Dawson, Hartley and Weber painted natural scenes and figures using geometric and cubic compositions. According to the art historical and curatorial sources, these works are recognized for their stronger influences of the European art movements (i.e. Cubism, de Stijl and Orphism) than is typical of earlier artwork.[32]

In the pre-war period, designed objects reflected influences parallel to those in painting. In the earlier decades designed furniture was primarily characterized by organic shapes, while showing only early influences of cubic and tectonic forms. After the First World War, however, the designed furniture and industrial objects marked a transition to cubic and tectonic forms. Pieces that were influenced by Cubism mimicked mass produced forms using rectangular and angular shapes to represent a technological aesthetic of the machine age. At the same time, these pieces also have visual affinities with pre-war artwork, particularly an influence from paintings (*HMA, Acquisitions, 2000*, 2001; *HMA: selected works from the collection*, 2005).

Another group from the pre-war period in the collection is 1920s and 1930s American photography demonstrating influences of Dadaism, Surrealism and Social Realism. Dadaism and Surrealism challenged social and artistic conventions by creating compositions of arbitrarily juxtaposed forms. Some examples of Dadaist photography utilized the photomontage technique bringing distinct images together to manifest the artists' reactionary political ideals; other Dadaist photographers reflected their fascination with machine age forms. The Surrealist photographers used photography as a medium to convey their subconscious states of mind and dream scenes (*HMA: selected works from the collection*, 2005). In contrast to the latter photographers, those influenced by Social Realism focused on the economic and social struggles of the Great Depression decades.

Parallel to its influence on photography, Social Realism also influenced American painting in 1930s. Such paintings also depicted economic and social struggles of various worker groups in society. These themes predominate in the works of a number of African-American and

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[32] American version of Orphism movement that suggests using colors for abstraction is called Synchronism. Synchronistic artists explored how to create effects through rhythmic color forms, and used color as an abstract medium in order to function significantly, as discussed in Baur, 1975.

emigrant artists such as Woodruff and Shahn (*HMA: selected works from the collection*, 2005) from the same decade.

Among the works of art from the post-war period, early works of late modernism in American painting have focused on formal explorations of geometrical abstract art with some influence of Cubism and Constructivism. In the post-war years, late Surrealism introduced a totally spontaneous approach fueled by the artists' subconscious state of mind, known as automatism. Later, this approach established a theoretical basis for Abstract Expressionism which eliminated figuration from painting (Baur, 1975). Abstract Expressionism is considered the first uniquely American art movement in the twentieth century that had an international influence. For Abstract Expressionist artists, the realities of the post-war era could not be expressed through the conventions of modern art (Cubism and others). Instead these artists seemed encouraged to develop a free-form aesthetic focusing on the intense emotions of their own individual spirit (Doss, 2002, p. 125). Indeed, works of Abstract Expressionism appear to be unique to the particular artists' interpretation of abstraction. Early members of this movement include Pollock and Louis, who explored drip painting and totally abandoned figuration in painting. Some others like Gottlieb captured semi-figurative compositions; for them pure abstraction was neither possible nor desirable (Baur, 1975). The semi-figurative compositions in Abstract Expressionism maintained some associations with late Surrealist figurative paintings of Giacometti and some African American artists of the period.

Among the diverse styles within Abstract Expressionist painting is the painterly abstraction of a group of artists including Motherwell, Guston, and Stamos, who explored the material effects of paint on canvas. Later, a group of others including Rauschenberg adopted an opposite approach seeking to connect art to social and commercial life, and infused the canvas with leftover media images and other materials. Rauschenberg's approach is considered to be Neo-Dada as it exhibits randomness and chance on a picture plane (Doss, 2002, p. 142), and also considered as a non-painterly alternative to abstraction (Elderfield, 2004). Together with Rauschenberg, Bluhm is considered second generation Abstract Expressionist painter who sought to create paintings that express his spiritual vision in the most profoundly human way possible with style and high drama (Harithas, 2008).

The HMA's contemporary art collection includes pieces from the 1960s to the present. Within this genre, the earliest dated works belong to the second generation Abstract Expressionist artists, such as Louis, Jensen and Smith from the late 1960s. While Louis is compared to the earlier generation of Abstract Expressionists due to his paint-dripping technique, his intensely colored surfaces have an affinity with Smith's and Jensen's colored canvases that depict geometrical patterns (Herskovic, 2003). Smith's geometrical compositions that use biomorphic forms with an underlying homogenous pattern are associated with the minimalist sculptors Andre, Judd and Morris (*HMA: selected works from the collection*, 2005, p. 129).

Minimalist artists captured extremely reductive forms and used flat surfaces with rectilinear stripes and grayish colors (Doss, 2002, p. 164). Among the Minimalist painters, Martin introduced geometry in her paintings as a vehicle for spiritual content. Mangold deformed the rectangular shape of the picture canvas. Likewise, Kelly created a new visual experience shaping the canvas in various geometrical forms and treating it like a "figure" on the gallery wall (*HMA: selected works from the collection*, 2005, p. 136).

Another contemporary art movement in the HMA exhibition is Pop art. As reviewed in the art historical sources and discussed in Chapter 5, Pop art artists aimed to question the status of art in the age of consumerism, by experimenting with various media and cut-out forms of products or widely known images. For example, Pop artist Wesselman, who used cut-outs of celebrity images, (i.e. Marilyn Monroe), while Lichtenstein created landscape pictures using plastic materials, billboard images, or reproducible printout material. Having a similar attitude towards the consumerism, a group of contemporary artists from the 1980s painted with vivid colors to refer to product packaging or encoding information in consumer culture. His motivation was to explore the relationship between modernist abstraction and post-modern consumer culture (*HMA, Acquisitions, 2000*, 2001).

As discussed in the curatorial sources, a number of contemporary artists in the 1970s followed the critical approach pioneered by Pop art, and incorporated photographical techniques in their work. This approach can be recognized in the American Photorealist movement exemplified by Estes's works. Estes photographed urban landscapes by eliminating all signs of human presence and concentrating on the exterior appearance of the human environment (*HMA, Acquisitions, 2000*, 2001). A living contemporary artist Richter seeks replicating qualities of photography in painting by treating paint on canvas to give the effect of blurred or unfocused photography. In doing so, Richter captures a transient moment in painting establishing a link to another movement, Photo-conceptualism. A Photo-conceptualist artist, Kiefer, focuses on reflecting cultural references in collective memories found in legends and mythological stories (Taylor, 2005, p. 104). Another Photo-conceptualist, Wall, captures scenes from harsh urban landscapes representing feelings with suspense, irony and deprivation in the age of global economy (*HMA: selected works from the collection*, 2005).

The most recent pieces of contemporary art in the collection present diverse ideas and experimental compositions by American artists. For example, a wall relief by Cragg is formed out of an array of found objects; another artist, McCollum, uses surrogate objects at mass scale, and this is contrasted with explorations in organic and torque forms of vertical sculptures typical of Youngerman. A notable contemporary artist, Butterfield, created a sculpture made up of scrap metal and depicting a horse with its neck extended, head lowered and ears flattered in a posture suggesting submission. Her work is considered representing empathy between horse and human (*HMA, Acquisitions, 2000*, 2001).

The HMA collection of self-taught art has pieces from the early and late twentieth century. As discussed in the curatorial and art historical literature, American self-taught art is art created by untrained artists. Given those artists' naïve and often idiosyncratic visions, works of self-taught artists are considered totally authentic and outside of mainstream art (Russell, 2001). Untrained artists have often used found objects and scrap materials, their compositions ignited by inner feelings (Doss, 2002). As discussed widely in American art history, at times art critics and museums have paid some attention to the self-taught art appreciating its authentic quality. As the HMA acknowledges, some works of self-taught art have demonstrated that the distinctions between it and modern-contemporary art can disappear (Doss, 2002, pp. 154, 232; Brenneman, 2006).

Among the self-taught artists whose works are displayed in the HMA, Tim Shores and Felipe Benito Archuletta are known for figurative compositions created from metal pieces and found material assemblages.[33] Lonnie Holley also used found metal and scrap material to depict human and animal silhouettes from his West African, Egyptian, and Pre-Columbian roots. Along with Holley, other artists such as William L. Hawkins, Thornton Dial and Ned Cartledge, have reflected the struggles of the African American community (*HMA: selected works from the collection*, 2005). As discussed in the art history literature, the high quality works of Dial and Holley have gained the attention of art critics and museums, again demonstrating that distinctions between self-taught and fine art are blurred (Doss, 2002). Despite focusing on a different subject matter, another self-taught artist, Howard Finster has also been widely acclaimed amongst art critics. His art is noted for its assemblages of reflective materials, earth, and other objects in a highly decorative manner as well as its religious content (Cove, 2006).

[33] Although only this study uses only last names of the artists whose work displayed in the case study museums, in this section uses both first and last names of the artists, this is because this is how they are known in the literature.

Some other self-taught artists have used wood carving techniques to depict figures from collective memory and religion. For instance, Elijah Pierce, Leroy Almond, Sam Doyle and Herbert Singleton have depicted figures and scenes from street life, black oppression, and funerals in their community. An earlier artist from the 1930s, Ulysses Davis, carved religious and political figures in simplistic, but expressive forms. Bill Traylor from the 1930s created single animal figures and human compositions utilizing simplified forms with dynamic curves to express tension in his scenes. In the HMA curatorial interpretation, his art resonates with late modern works of art, particularly those known for semi-figurative compositions (*HMA: selected works from the collection*, 2005). In addition to these early artists inspired by collective memory, a group of others from the 1970s, also known as memory painters, extensively painted scenes from their past memories or fantasy worlds. In their memory paintings, Mattie Lou O'Kelley and Linda Andersen have utilized vivid colors, detailed figures and bird's-eye view perspectives. An artist with African American roots, Joseph Yoakum, revealed his visionary scenes on a picture plane, conceptualizing painting as a spiritual process (*HMA, Acquisitions, 2000*, 2001). Another memory painter, Nellie Mae Rowe captured her childhood memories in spontaneous acts of drawing. A fantasy painter Mose Tolliver is recognized with for his paintings of primitive figures with disproportioned body parts and their playful compositions. In art historical sources, his work has been noted for its similarity to the power and drama of Picasso's work (Johnson, 1983).

As described in this overview, the HMA collection includes the works representing three genres from twentieth century American art: modern, contemporary and self-taught art. Based upon key historical periods, the works of modern art (including late modern) represent the artistic explorations as well as reflections of social and political developments in twentieth century America. The works of the contemporary art also reveal the contribution of American artists to contemporary movements known worldwide, and these are displayed through the lens of the HMA. The works of self-taught art in the collection, on the other hand, represent artistic production outside mainstream art that cannot be classified under any of the modern or contemporary movements or styles. Although they defy classification, the works of self-taught art exhibit the richness and variety of the individual artist and diverse interpretations of social and personal values, community life, socially and politically significant events, and developments in the twentieth century. Given this diversity, these works are organized and displayed in groups consisting of individual artists with similar inspirations. The entire exhibition in the HMA skywalk galleries focuses on these three genres of the twentieth century American art by exploring the dialogues between mainstream modernist traditions (modern and contemporary) as well as the work of trained artists and outsider self-taught artists.

6.3.2 Layout Characteristics and Spatial Layout Properties of the HMA's Skyway Floor

The morphology of the HMA's skyway (fourth) floor is formed by the spatial geometries of the Stent and Wieland wings. The Stent wing is characterized by an atrium of with a curved end and galleries that are wrapped around the orthogonal corner of that atrium. The Stent wing galleries are of various sizes; the largest galleries are adjacent to the atrium, smaller galleries are situated at the outer edge of the L-shape, the remaining isolated from the atrium area except for a few connections. The gallery space at the back side is formed by square galleries (situated at the corners of the L-shape), and other spaces between them. The Stent wing is bridged to the Wieland Wing by a narrow connector, where visitors can see outside through its glass envelope. The Wieland wing gallery space is shaped like a slanted rectangle and partitioned by symmetrically situated walls. The partitions form a series of rectangular galleries interrelated in a matrix organization.

In addition to these characteristics, the HMA skyway floor gallery layout can be examined in terms of its spatial properties, namely permeability and visibility relationships, using justified graphs, convex maps, axial line analysis and visibility graph techniques, as described in the Methodology chapter.

Permeability Relationships

An examination of the permeability relationships of the HMA skyway layout using justified graph and convex map techniques together reveals that the layout consists of spaces of very different sizes along with a complex pattern of connections. However, when the two wings, Stent and Wieland (which starts with gallery 12) are examined separately from each other in the justified graphs, this complexity is more obvious in the Stent wing. The justified graph analysis suggests that the permeability structure of the Stent wing comprises several rings of various sizes and often larger ones consisting of other more compact (smaller) rings. For example, in the square shaped corner galleries of the Stent wing, the insertion of an inner room within a larger room partitions the space into smaller spaces forming one large and smaller rings. Other large rings in the layout are formed in the arms of the L-shape geometry, for example between rooms 10A and 1A. Part of these rings, the Stent wing contains several spaces offering choice (Figs 6.2 and 6.3). Specifically, while the largest galleries, 10 and 8A, are open to the primary movement directions in the layout, some other galleries such as 1A, 2A and 4A offer choice at a more local level. One of the most critical locations that offer choices in the movement direction is gallery 5 where visitors may decide whether to skip and entire section of the Stent wing and continue

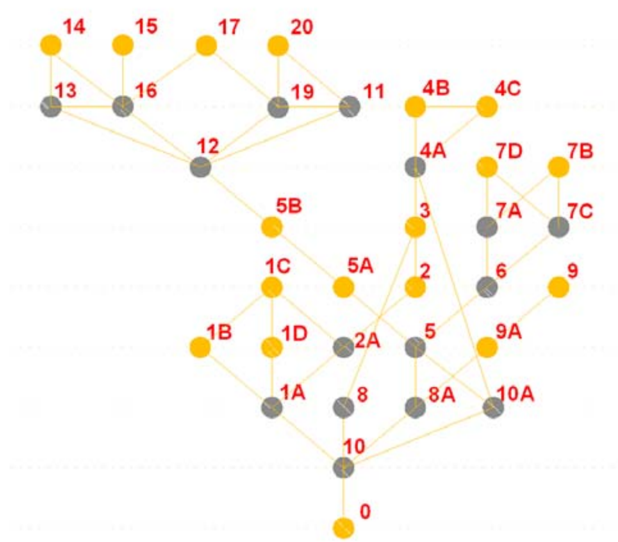

Figure 6.2: Justified graph of the HMA's fourth floor. Nodes of path-choice are with darker color.

Figure 6.3: Convex space map of the HMA's fourth floor. Spaces of path-choice are denoted with darker color.

to the new Wieland wing. In the Wieland wing, the permeability structure has a simpler spatial structure than the Stent wing. This is evident in the wing's spatial organization that consists of larger gallery spaces symmetrically situated in a rectangular volume. Located at the center of this symmetry, gallery 12 offers a choice to proceed to the either sides of the wing. The two other galleries, 19 and 16 offer choice to other corners of the wing.

An examination of the axial line maps of the HMA the skyway floor shows that there is an uninterrupted permeability on the east-west axis from the central part of the Stent wing through the end of the Wieland wing (Figs. 6.4a and 6.4b). On this axis, the axial lines connecting the Stent wing to Wieland have the highest degree of connectivity. Other lines with a relatively high degree of connectivity are through the transverse direction of (north-south direction on the map) of the Wieland wing. In the Stent wing, the axial lines with a relatively high degree of connectivity are through the galleries adjacent to the atrium (galleries 10 and 8A). These observations indicate that visitor movement is likely to be predicted by the local properties of the east-west axis crossing both wings. When this property is examined separately at the two wings, the local properties seem to be predicting movement in the Wieland and the Stent wing through transverse axes (in the north and south direction). In addition to the potential effects of the local properties, the axial line map of integration suggests that the axial line connecting the Stent and Wieland wings (the one projected from the atrium wall to the mid-section of the Wieland wing) has the highest degree of integration, indicating that movement is likely to be predicted along this axis. When the degree of integration is examined within each wing separately, the axes in the north-south direction seem to be more integrated than those in the east-west direction of both wings. These observations reveal that how potential movement might be distributed in the HMA's skyway floor with the influence of the spatial layout. First, because the axis connecting both wings is both highly connected and integrated, the dominant movement is through this axis as predicted by both global and local properties. Second, a moderately high degree of

a)

b)

Figure 6.4 Axial line maps of the HMA's layout floor, **a)** degree of connectivity, **b)** degree of integration.

connectivity coincides with a moderate level of integration only in the transverse axes of the Wieland and Stent wings, indicating that the potential movement within each wing is more likely to be predicted in the north-south direction of the wings than their east-west direction.

Visibility Relations

As in the previous case study chapters, the visibility relationships of the HMA skyway gallery layout were examined through visual connectivity, control and integration graphs generated at eye level (Fig. 6.5). The visual connectivity graph shows that the most visually connected gallery room is gallery 12, which is the first room visitors enter in the Wieland wing. The high degrees of visual connectivity are located at the corners where gallery 12 opens to galleries 16 and 19. Other relatively high degrees of connectivity are located in the Stent wing in gallery 10 adjacent to the atrium. In particular, in the Stent wing, the corner of the L-shape in galleries 10 and 8A has relatively high degrees of connectivity (Fig. 6.5a). These observations suggest that when visitors pass through the L-shape corner of the Stent wing they would experience a fairly high degree of visibility with regard to the adjacent galleries, but a larger amount of space would be visible to visitors once they arrive in gallery 12 of the Wieland wing at. At the corners connecting gallery 12 to galleries 16 and 19, visitors again seem to have visual access to fairly large area. However, as indicated in the connectivity graph, in the Stent wing the lowest degrees of connectivity are located in the square galleries at the corners as well as gallery 9 in the south edge, while the other least connected spaces are on the western end of the Wieland wing (galleries 15, 18 and 21).

The visual control graph generated at eye level (Fig. 6.5c) show that the spaces with the highest degrees of connectivity also have the highest degrees of control. The highest degree control values are located at the corners of gallery 12 connecting to galleries 16 and 19 in the Wieland wing. Relatively high degrees of control are located in the Stent wing at the intersection of galleries 8A and 10, which are located adjacent to the atrium. This implies that visitors situated in those spaces would mostly see spaces that are less connected to their neighborhood. Other relatively high degrees of control are located in gallery 17 (the west-side neighbor of gallery 12), despite the lower degrees of connectivity found in that gallery. The effect of high control, but low connectivity is that within the capacity of the gallery to provide visual access to neighboring locations, most of the locations that can be seen are in fact isolated from their neighborhood.

As can be seen in the HMA visual integration graph generated at eye level (Fig. 6.5e), the high degrees of visual integration are located along the axial core connecting the Stent wing to the Wieland wing. Within this core, the highest degree of integration is located in gallery 12, while another highly integrated area degree is at the corner side of the atrium in the Stent wing, in gallery 8A. The high degree of integration at this core extends towards the either end of the layout. This suggests that visitors who are situated in or move through this core are most likely to be aware of all other locations in the entire layout within the fewest visual steps and thus be able to establish connections between this core and the other spaces. The least integrated locations, however, are gallery 15 in the Wieland, galleries 1C and 9 in the Stent wing, which are located at the farther ends of the layout. In these spaces, visitors are least likely to establish connections to the rest of the layout. When the visual integration graph is compared to its knee-level counterpart, it can be seen that the atria has very little effect on the distribution of the visual integration values (Fig. 6.5f).

A comparison of the eye level and knee level representations of the visual connectivity, control and integration graphs (Fig. 6.5) indicates that the distribution of visibility levels at the knee level differs little from the eye-level version. In the Wieland wing, the atrium and other non-permeable spaces have almost no effect on the visibility relationships in the Wieland. In contrast, in the Stent wing, the atrium space and other non-permeable spaces enhance visual access through the galleries adjacent to the atrium (galleries 10 and 8A).

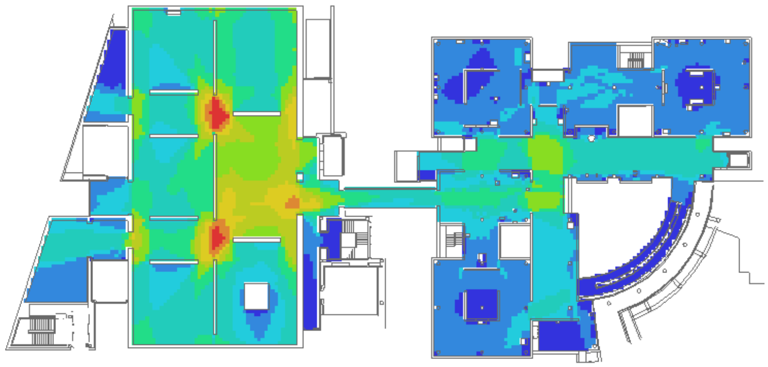

Figure 6.5a Visual Connectivity, knee-level

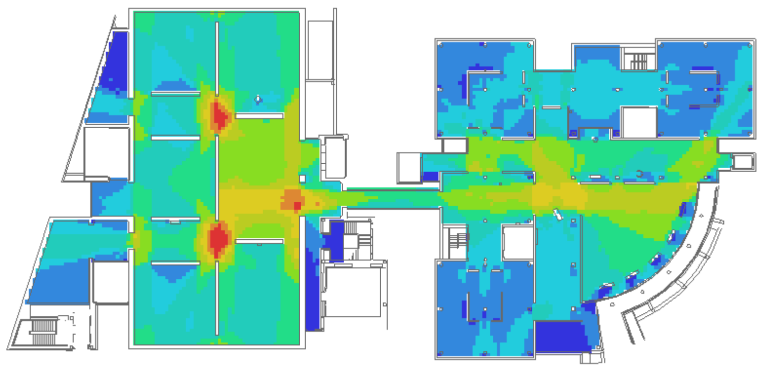

Figure 6.5b Visual Connectivity- eye-level

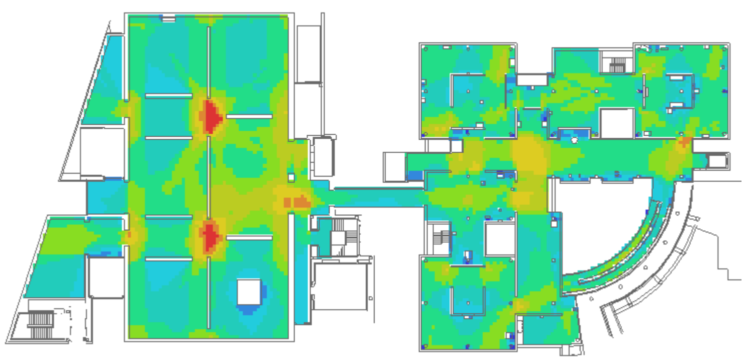

Figure 6.5c Visual Control, knee-level

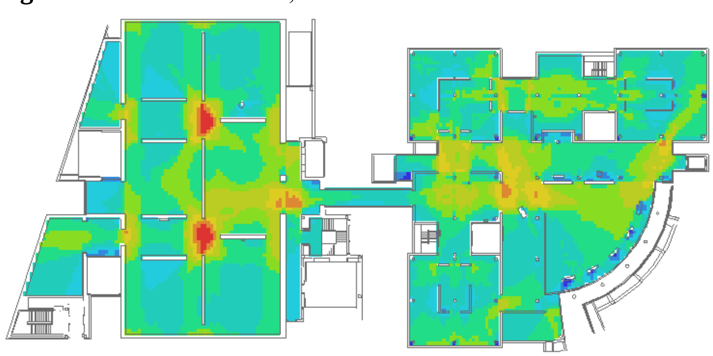

Figure 6.5d Visual Control, eye-level

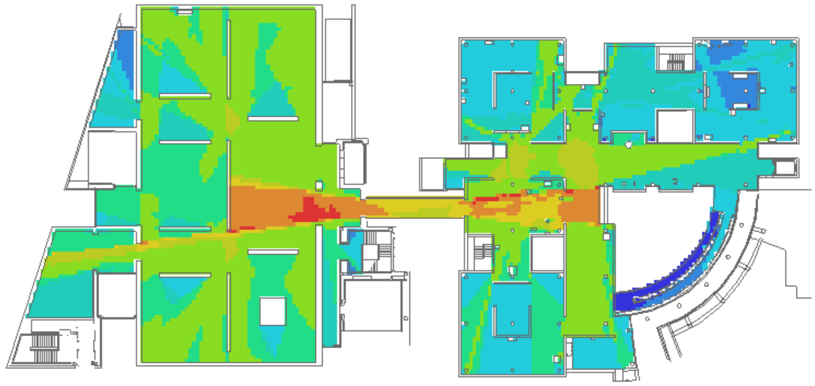

Figure 6.5e Visual integration-knee level

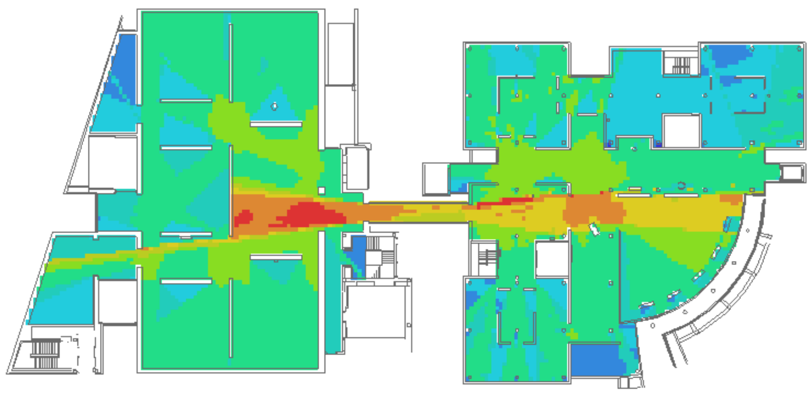

Figure 6.5f Visual integration-eye level

6.3.3. Organization of the Exhibition Content in the HMA's Skyway Floor Layout

This section discusses how the spatial layout of the HMA fourth floor relates to the exhibition narratives. More specifically, this discussion examines how the formal characteristics of the gallery layout are used to express thematic relationships among the display groups. Before comparing the exhibition content with the formal and spatial properties of the layout, this section summarizes the curatorial intentions revealed in the interviews with curators and in the museum's publications interpreting the collection.

The conversations with curators confirmed the observation that the HMA exhibition in the skyway galleries aims to maintain a humanistic perspective in presenting the exhibition content to broad and diverse groups of visitors in the Atlanta region. Additionally, the curatorial team stated that the modern painting and sculpture collection of the museum alone has not been sufficient to provide a complete and scholarly overview of the modern American movements in the twentieth century (Brenneman, 2006; Cove, 2006). Indeed, the museum collection appears stronger in decorative arts including works of furniture, industrial design and photography dated the first half of the twentieth century in the collection. Utilizing that strength in the collection and curatorial expertise in the decorative arts, the curatorial team created displays combining the works of American modern painting and sculpture with the works of furniture, industrial design and photography based upon their visual affinities and historic periods. In doing so, the display groups reflect artistic taste and influences that characterized the American modern art in certain periods.

In addition to these display strategies, the HMA's curatorial team followed different principles in organizing the three genres of the twentieth century American art. While organizing the works of modern art based upon historical periods, the works of self-taught art are grouped and placed on the basis of individual artists who share similar inspirations. As explained by the curatorial team, the works of self-taught art are stylistically very diverse and thus can be best understood through individual artist categories (Brenneman, 2006; Cove, 2006). In displaying the works of contemporary art, on the other hand, the HMA used mixed strategies, grouping the artwork on the basis of movements and styles as well as works of individual artists. Although the contemporary art has been primarily presented in reference to the style of artistic explorations in the late modern period, such as Minimalism, Pop art, and Post-Minimalism, the these works are highly diversified in terms style as artists developed their individual techniques. Therefore HMA relied less on well-known style names in displaying the contemporary dated later works (Brenneman, 2006). Indeed, the works dated latest are installed with a less clear categorization, which also reflects the museum's newly growing contemporary art collection.

Organization and placement of displays using the HMA's layout characteristics:

On the basis of these various display strategies, the works of modern, self-taught and contemporary art are placed in different sections of the skyway gallery floor (Fig. 6.6). The works of American modern art from 1900 to 1940s are installed in the north galleries of the Stent wing, (the north edge of the L- shaped layout). In the south side galleries of the Stent wing are the works of self-taught art. The works of contemporary are displayed in both the Stent and Wieland wings; the latest acquisitions located in the entrance gallery (room 10) of the Stent wing, and other works of contemporary art displayed according to style or artist in the Wieland wing.

As can be seen in Figure 6.6, in the Stent wing, the galleries isolated from the atrium are arranged linearly along the L-shaped geometry, where corners of the L-shape have square galleries partitioned further inside. In the galleries at the northern part of the L-shape, the works of American modern art are placed on the basis of an implicitly chronological order from the pre-war art to the post-war periods, while the art from these two key periods are installed in square galleries at the corners. The installment strategy here takes advantage of the formal properties of

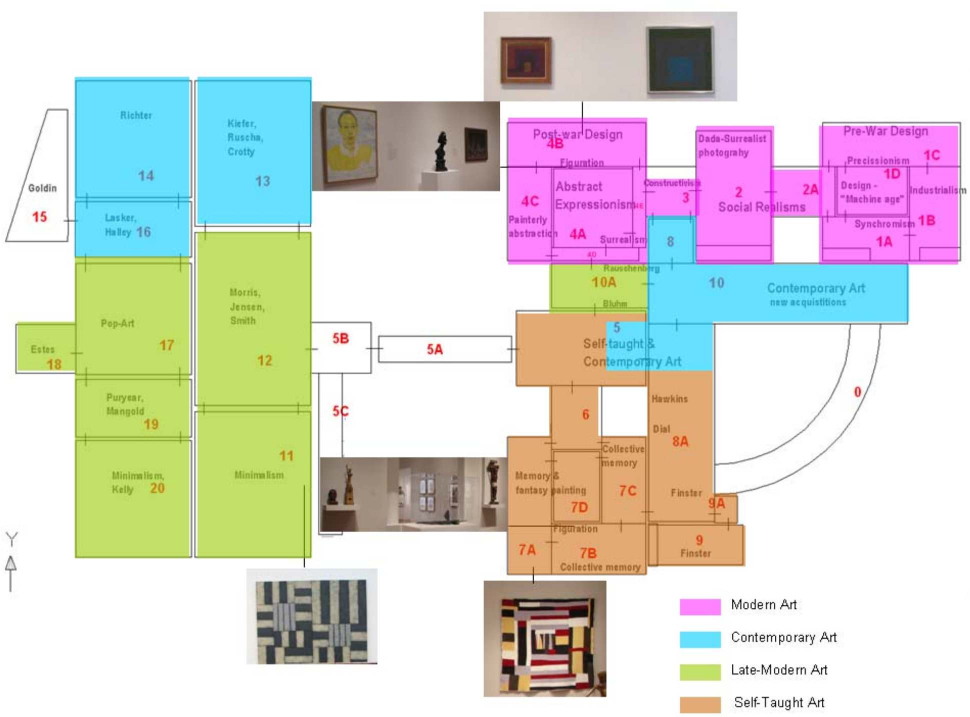

Figure 6.6 Exhibition narrative organization on the HMA's skyway floor

the gallery. Specifically, the northeast square gallery focusing on the pre-war period contains an inner room which divides the gallery into smaller convex spaces (1A, 1B, 1C and 1D). This division delineates various movements and influences that characterize the American pre-war art. Room 1B exhibits paintings that capture industrialization in American urban scenes, grouping them with pieces of furniture from the same period based on visual affinity (Fig. 6.7). For example, paintings depicting urban industrial scenes and furniture reminiscent of the buildings of the American metropolis are displayed together in this part to highlight their connections. Room 1C exhibits pieces of furniture in an array demonstrating a transition from organic to tectonic and cubic forms, again by combining them with Cubist paintings with similar features (Fig. 6.8). These furniture pieces are placed opposite the paintings with floral motives in order to emphasize their contrasting shapes. The inner room at the center (1D) displays industrial design objects and a 1920s sculpture reflecting the machine age aesthetic (Fig.6.10). This placement in the inner

Figure 6.7 Display group in room 1B, including Frankl's furniture

Figure 6.8 Display group in unit 1C, furniture pieces from Pre-war period

room highlights these objects in particular. At the same time, this room is physically and visually connected to 1C, which includes Cubist furniture, and to 1A, which is devoted to the use of primary colors in Rietveld's de Stijl chair and F. L. Wright's window design (Figs. 6.10 and 6.11). This circular arrangement of the galleries 1A, 1B and 1C around 1D serves to express the organic and complex relationships between movements and influences that characterized the pre-war period American art.

Figure 6.9 View of displays in 1C from 1D

Figure 6.10 Industrial design objects exhibited in room 1D

Figure 6.11 Rietveld's and Wright's work exhibited in room 1A

The gallery space situated between the two square-shaped galleries (2A and 2) displays the works of American Social Realism from the 1930s to 1940s. Room 2A is reserved for Woodruff's paintings of heightened social consciousness depicting "good and bad housing conditions available to the black community" (Fig. 6.12). Following this, the south side of room 2 is devoted to other examples of socially conscious art, such as Shahn's paintings representing the struggles of the worker class. In this part, the paintings of Shahn and others are combined with office furniture designed by F. L. Wright as means for reflection on the relationships between blue collar and white collar workers (Fig. 6.13). On the north side of room 2 is a series of photographs that reveal the influence of Dada, Surrealism and Social Realism in that genre.

Figure 6.12 Hale Woodruff's paintings in room 2A

Figure 6.13 Display group at the south of room 2

This organization continues with a few displays in room 3 representing visual and formal language influenced by European Cubist and constructivist abstraction. Here, Rozsak's geometric sculpture with a crescent shape exemplifies the constructivist influence while anticipating the transition to organic forms. This anticipation is expressed in the directly accessible galleries in the sequence, 4E and 4D, which display the works painted by Gorky and von Wiegand with their organic forms representing the late Surrealism. Indeed, all of gallery 4 is devoted to post-war art, which includes late Surrealism, Abstract Expressionism, post-Cubist figuration as well as painterly and non-painterly reactions to Abstract Expressionism. Facing the late Surrealist works of Gorky and von Wiegand (room 4E) is room 4A where various Abstract Expressionist works are brought to view (Fig. 6.14). This direct transition to Room 4A expresses the transformation from Late Surrealism in the postwar years to Abstract Expressionism. Room 4A includes Surrealist collages along with semi-figurative and non-figurative Abstract Expressionist paintings. The works of Abstract Expressionism illustrate diverse versions of Abstract Expressionist painting, including a semi-figurative painting by Gottlieb, an earlier piece by Pollock, a non-figurative piece by Rothko, and a painterly abstract work by Motherwell. A bust of a black man sculpted by an African American artist is placed at the center of the room as an anti-thesis to the predominantly non-figurative works in the space. This bust connects the semi-figurative works of Abstract Expressionism to Post-war Figuration presented in the adjacent space, 4B. This placement of the post-war semi-figurative works suggests an indirect transition from the Surrealist works of Gorky and von Wiegand. The works of post-war figuration in room 4B include a bust sculpted by Giacometti and paintings by African American artists depicting issues of identity in society. In 4B, these figurative works are placed facing a display of furniture design and severely abstract paintings that demonstrate the aesthetic taste of the post-war middle class (Fig. 6.15). This opposite positioning seems to contrast the class struggles penetrating into post-war figuration and the indifference of the post-war middle class as expressed in geometric abstract art and design. At the other side, the furniture in room 4B has a visual affinity with the paintings in room 4C showing painterly Abstract Expressionism (Fig. 6.16). In sum, square shaped gallery 4 overall presents the movements and

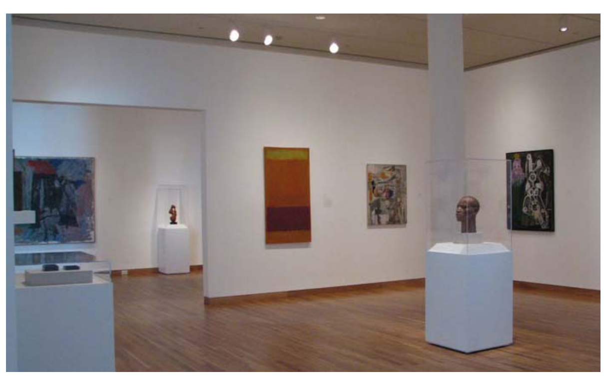

Figure 6.14 Abstract Expressionist painting and bust sculpture in room 4A.

Figure 6.15: Furniture pieces representing Post-war abstraction, placed opposite of works representing Postwar figuration, and in juxtaposition with Gottlieb's painting in room 4C.

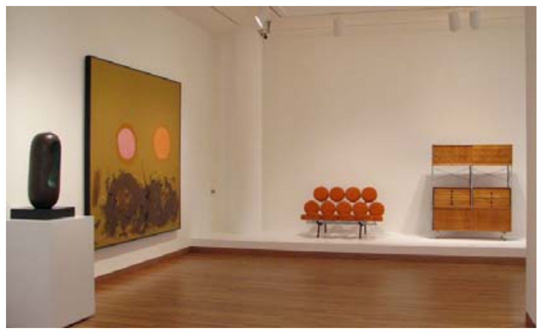

Figure 6.16 Visual affinity between Post-war furniture and Gottlieb's painting in room 4C.

influences in the post-war period expressing their complex relationships through the circular arrangement of rooms 4B, 4C, and 4E around room 4A.

At the outer side of gallery 4, gallery 10A exhibits two key works from second generation Abstract Expressionist artists, Rauschenberg and Bluhm. While these two pieces represent the diverse directions after Abstract Expressionism moving towards Pop art and Minimalism, the placement of these works at this location, in room 10A at the intersection of the L-shape (Fig. 6.17) aims to establish a link to contemporary and self-taught art exhibited in the Stent wing. Indeed, share some characteristics of self-taught art are reflected in Rauschenberg's Neo-Dada approach and Bluhm's spiritual vision with respect to the use of recycled or found objects and the interpretation of spirituality. Adjacent to this location, room 5A contributes to the narrative in a similar way. Here the pieces of contemporary art and self-taught art are displayed together so as to reveal the possible dialogues between those two genres. The works of self-taught art displayed in room 5A have simplistic animal and human figures that can be associated with contemporary works using similar artistic language. On the other hand, the position of Room 5A in the layout points to viewing sequences in various directions and thus reinforces the potential for visitors to explore dialogues between the works of different genres displayed in different sections of the layout. This room is important for viewing sequences since it connects the Stent wing to the Wieland wing, opens into the atrium, and continues towards the south side of the Stent wing where the works of self-taught art is displayed (Fig. 6.18).

Figure 6.17 Rauschenberg's and Bluhm's work in room 10.

Figure 6.18 A view from room 5A

At the south corner of the L-shape, square gallery 7 is devoted to the self-taught artists known as memory and fantasy painters. As in other square galleries in the Stent wing, this gallery space has an inner room, 7D, that partitions the square gallery space into smaller spaces, 7A, 7B, and 7C. Room 7A juxtaposes two groups facing each other: one group consisting of works of O'Kelley, and of Anderson depicting their childhood memories and the other including works of Yoakum, Evans and Darger picturing a fantasy world (Fig. 6.19). The inner room, 7D, is reserved for Rowe's paintings of her childhood memories (Johnson, 1983, p. 271). Other works in gallery 7 include those in room 7B demonstrating figurative wood sculptures and reliefs making reference to religious symbols, scenes from collective memory, street life, black oppression and community events. Again, the circular arrangement of gallery 7 expresses the organic connections between the memory paintings, automatism, paintings depicting childhood memories and collective memory.

Figure 6.19 Memory paintings in room 7A

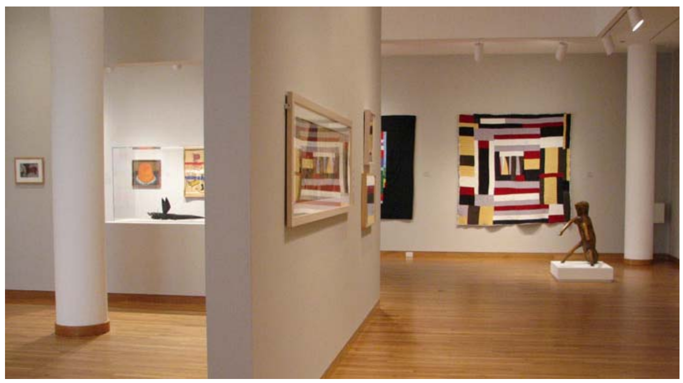

Figure 6.20 View towards the end of room 7.

The placement of the memory paintings of self-taught art in gallery 7 suggests a correspondence between these paintings and Abstract Expressionist paintings of the post-war period art displayed in gallery 4, due to the symmetric position and identical shape of these galleries. Indeed, the works of self-taught and post-war art displayed in galleries 7 and 4 demonstrate a similar artistic motivation, namely automatism. More specifically, in gallery 7, Rooms 7B and 7C include works that presents geometric designs very comparable to post-war geometric abstraction in room 4B (Fig. 6.20); in 7B the figurative sculptures referring to religious symbols establish a parallel to the post-war figurative art displayed in 4B.

The larger galleries adjacent to the atrium, 10 and 8A, provide space for more free arrangements of display groups. Gallery 8A is reserved for works of the most widely acclaimed self-taught artists together with a number works from contemporary art. One well-known piece at the north end of this space is Butterfields' sculpture of a horse in a submissive and cautious pose.

This work is juxtaposed with Lonnie Holley's bent metal figures, as well as Hawkings' and Dial's paintings that depict the struggles of the African American community (Fig. 6.21). This juxtaposition establishes an affinity between Butterfield's horse sculpture and of the self-taught art in terms of depicting human struggles. The south end of room 8A displays works of the widely acclaimed self-taught artist, Finster. The placement of Finster's work at the farther end of room 8A still maintains its connection to other works of self-taught art in gallery 7; however, it does suggest that his art has a more idiosyncratic quality. The most visually isolated room of the entire gallery layout, room 9A is arranged to recreate Finster's "Paradise Garden," which is a fantasy world created out of his sculptures and found objects (Johnson, 1983). This placement at the deepest end of the gallery establishes a connection to his highly eccentric, authentic art that exists outside the confines of mainstream art.

In the Stent wing, gallery 10 (adjacent to the atrium) presents the latest acquisitions of the museum from contemporary art. In this gallery, a wall relief, created by Cragg from an array of found objects, has a remote affinity to the self-taught art works displayed in the other galleries of the same wing. In this gallery, another work, McCollum's surrogate object at a mass scale, is placed in juxtaposition with Youngerman's sculpture with an organic and torque form (Fig. 6.22). Despite these comparisons established between the diverse contemporary approaches of the artists, the works displayed in this gallery are quite loosely connected with each other.

As can be seen from these placements, the L-shape geometry of the Stent wing is utilized to interpret two primary genres in the HMA's collection, modern-contemporary and self-taught art. The L-shape geometry of the wing establishes a connection to a sequence in which the origins of two different genres start from different directions and meet at the corner. Indeed, the galleries at the corner of the L-shape seem to be conceived as places where the aspirations and language of contemporary and self-taught art coalesce. Within this conceptualization, gallery 5, which displays contemporary and self-taught art, establishes a link to the contemporary works

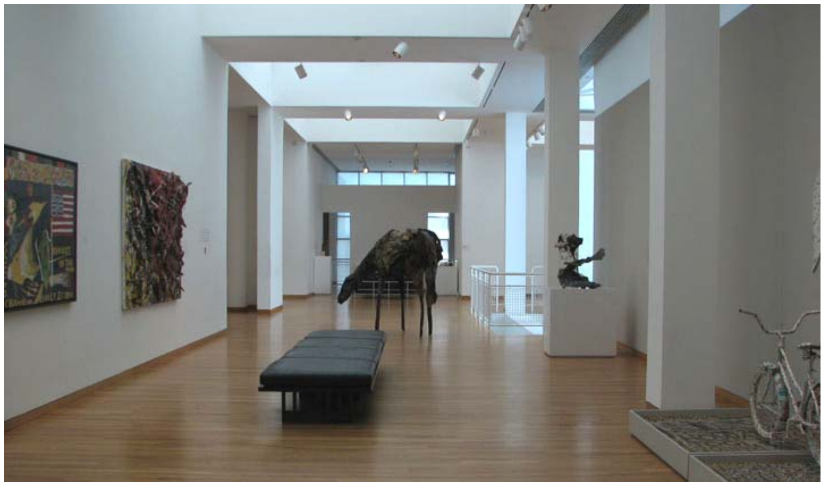

Figure 6.21 A view to gallery 8A

Figure 6.22 A view to gallery 10

in the Wieland wing. The inner side of the L-shape, galleries 8A and 10, presents pieces of modern, contemporary and self-taught art that have somewhat close affinities with each other. However, the outer sides of the L-shape that are withdrawn from the atrium area are reserved for the works representing the origins of modern and self-taught art.

The galleries of the Wieland wing, connected to the Stent wing by a bridge from gallery 5A, exhibit the works of contemporary art after the 1970s. This part of the layout is composed of a series of rectangular rooms interconnected in a matrix organization. Within this spatial organization, the regular geometry of particular galleries, namely 11, 12, 13, 14, 17 and 20 can convey the display content autonomously. The first room that visitors enter in the Wieland wing, room 12, presents large size contemporary paintings of late Abstract Expressionists like Morris, Jensen and Smith, who employed vivid colors within geometrical shapes. Among these paintings, Smith's work is placed adjacent to room 11 to emphasize his association with Minimalist sculpture (Figs. 6.23 and 6.24). In room 11, Minimalist painting and sculpture are placed to establish the visual affinities of each work with the abstract geometries of each other work (Fig. 6.24). This group is thematically connected to the abstractly shaped canvases of Kelly displayed in the adjacent room, 20. Kelly's abstractly shaped canvasses are stylistically connected to Stella's canvas shape with curvilinear forms (Fig. 6.25) placed in the Pop art gallery (room 17), which has a central location between room 12 and 19. This room also displays Wesselman's cut-outs of media images of celebrities. The location of the Pop art room establishes its association with contemporary photography, including Photorealism and Photo-journalism in rooms 15 and 21, and other paintings of consumer culture using vivid colors in galleries 18, 15 and 16. Within the continuity of the photographic content in those rooms, galleries 14 and 13 display works of Gerald Richter and others seeking an ephemeral feeling in photographic representation. As can be understood from these relationships, the content in the Wieland wing is sequenced linearly in the counter clockwise direction starting from gallery 12, continuing through 11, 20, 19 and others. Gallery 13, which displays the photographic works of Kiefer, Crotty and Ruscha, is the last venue in the linear sequence.

In sum, while the narratives in the Wieland wing are structured more linearly in the clockwise direction, the layout still allows visitors to explore these themes via interchangeable routes. The adjacencies between the rooms correspond to subsequent developments or close associations between the movements of contemporary art. Within this sequence, rooms 16 and 19, which have an elongated shape within less strict wall boundaries, facilitate fluid connections to other galleries. These characteristics of rooms 16 and 19 provide the potential to represent works that may not be clearly associated with a certain movement.[34]

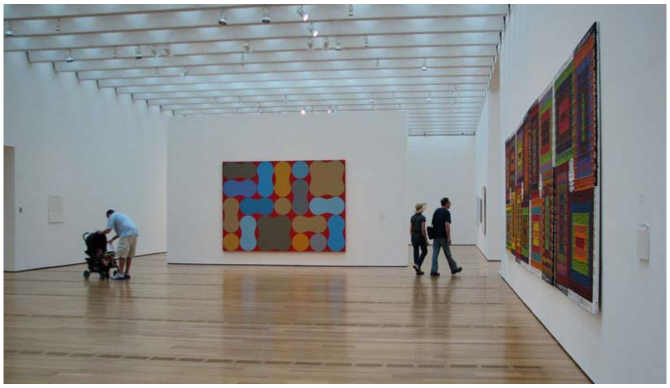

Figure 6.23 A view from gallery 12, with Tony Smith's painting

Figure 6.24 A view from the Minimalism gallery

Figure 6.25 A view from the Pop Art gallery, with Frank Stella's work on the right.

[34] Room 19 displays Mangold's other work with a shaped canvas paired with Martin Puryear's huge metal ring showing his skills learned from African craftsmen. In room 16, the works of Halley's and Lasker's abstract work painted with vivid colors used in consumer products, which explore the relationship between modernist abstraction and consumer culture

Experience of the exhibition through visual connections:

In addition to the physical relationships, the interpretation of the content is reinforced through the visual connections between the galleries. In the Stent wing, the inner rooms at the center of the square galleries maintain the axes of sight through the window openings, and thus visually connect the displays in the longitudinal (east-west) direction. For example, openings in the longitudinal axis of gallery 1D visually connect the industrial design displays to the objects in gallery 1B, which have organic forms with Cubist influence. This axis of sight continues from gallery 1B through 1D and 2A, reaching 4D at the other end of the gallery floor. As can be seen in Figure 6.26 this axis seems to provide a reference for placing a Cubistic vase and an organically abstract figurative sculpture. Interestingly, the visual axis overlaps with the structural axis on which building columns are arrayed. The visual obstruction created by columns requires that visitors situate themselves in an oblique position in order in order to see the displays on the axis synchronously (Fig. 6.26).

Figure 6.26 View from room 1B, through 1D (left); and view from 1D towards 1B (right)

The openings of the inner rooms also reveal the works on the parallel gallery walls and enable displays on the inner and outer walls to be seen synchronously. As can be seen in Figure 6.27, a visitor in gallery 4D can see Rothko's non-figurative Abstract Expressionist painting in juxtaposition with Guston's painterly abstract work at the back. The window opening on the left side also brings Stamos's painterly abstract painting into the frame of vision and enables a visitor to momentarily compare Stamos and Guston at the outer core together with Motherwell (at the corner in Fig.6.27) and Rothko in the inner. At the opposite side of gallery 4D, an early work of Pollock that includes curvilinear forms can be seen in juxtaposition with von Wiegand's painting with amoebic forms. This juxtaposition can reveal the commonalities between Pollock's earlier work and von Wiegand's Surrealist painting (Fig.6.27). A similar experience is offered at the south end gallery (gallery 7) displaying self-taught art. The openings of inner room (7D) connect the memory paintings of Nellie Mae Rowe to paintings of childhood memories by O'Kelley on one side and the works depicting collective memory in woodwork, on the other. This inner room also has window openings that maintain an axis of vision in between gallery 6 and 7B. As can be seen in figure 6.28, the opening at gallery 6 side frames one of O'Kelley's paintings so that it can be viewed in juxtaposition with other work in the inner core. When looked at from the other side, two of Doyles's works similarly come to view through an opening (Fig.6.28). These

Figure 6.27 View from room 4D to 4C (left); and view from room 4D to 4E (right)

Figure 6.28 View from room 7D to 7C (left); and view from room 7D to 7A (right).

juxtapositions provide glimpses to the other pieces of art that have aspects in common with Nellie Mae Rowe's memory paintings displayed in the inner core.

In the Wieland wing, the configuration of the gallery partitions also provides synchronous views to the displays placed in separate rooms. A number of displays in separate rooms are revealed at the intersection of galleries 16 and 19. As can be seen in Figure 6.29, at the corner of gallery 16 visitors can simultaneously view one of Kelley's shaped canvas works with a piece from Mangold, which extends the shaped canvas idea further to the framing of a void. At the opposite side, Jensen's and Morris's late Abstract Expressionist works, which infused color with geometric forms and segments on canvas, can be viewed along with Lasker's work painted in the 1980s. This juxtaposition compares Lasker's work that contrasts the figure and ground relationships on canvas using color with the earlier explorations of Jensen and Morris (Fig.6.29).

Figure 6.29 Views from room 12 towards rooms 20 and 19 (left); and towards room 16 (right).

The exhibition content focusing American modern, self-taught and contemporary art is presented by utilizing various formal characteristics in the HMA's layout. One clear conclusion from the review of the display groups above is that the HMA's skyway floor presents twentieth century American art in a piecemeal approach, bringing three genres and their production objects together. This approach results largely from the lack of completeness in the HMA collection of art of a single genre or types of artistic production. The HMA seems to embrace this diversity in its collection to create an exhibition that can be understood in terms of visual affinities among the various artistic production from the same time periods, as well as the possible dialogues and continuities among the works of different genres. The HMA's installation of various display groups from the three different genres seems to capitalize on the complex characteristics the gallery layout, namely the different gallery room sizes, subdivisions of the gallery rooms along with the room within a room organization which repeats at every corners and the room sequence around the quarter-circle atrium. The room within a room organization creates smaller but fluidly connected spaces and thus provides convenient places to display the styles of the larger categories (i.e. pre-war and post-war periods in modern art as well as memory painting in the self-taught art). The gallery room sequences segregated from the atrium area establish strong narratives (focusing on modern and self-taught art) where display groups and represented themes are connected to each other in both physically and visually multiple ways. The larger galleries that offer choices for exploring the galleries at the backside of the L-shape as well as to the Wieland wing also combine the displays of the various genres. This strategy facilitates visitor exploration of the dialogues among the different works of art, which follows a separate reading of the narratives of each genre.

These relations between the gallery layout and the displays groups together with the ways in which narratives are presented is explored further in this next section that examines the spatial structure in conjunction with the narrative organization.

6.3.4 How Does the Spatial Layout Present the Exhibition Narratives?

This section compares the narrative organization with permeability and visibility structure, with a view toward demonstrating the parts of the narrative that are emphasized more strongly within the spatial structure of the HMA skyway gallery.

In order to compare the narrative organization with the permeability relationships in the HMA skyway layout, the narrative is examined in conjunction with the axial line analysis. The axial line analysis shows that the most integrated sequences in the permeability structure coincide with a sequence from the Stent wing to the Wieland wing (through galleries 5, 5A, 5B, 12 and 19) and suggests that visitor movement that is most likely to be predicted by global properties of the layout is on the longitudinal direction and through the bridge connecting the two wings. When examined in relation to the narrative organization, this sequence does not entirely overlap with a centrally important theme in the narrative. Instead, the sequence from room 5 of the Stent wing offers visitors an opportunity to pass by the works of self-taught art and proceed to contemporary art. The axial line analysis also shows that in both the Wieland and the Stent wings moderately integrated axial lines run in the north-south direction, and thus visitor movement can secondarily be predicted by the layout in those directions. The sequences in the north-south reveal the

Figure 6.30 Comparison of axial line analysis and narrative organization within the convex map

connections between the Abstract Expressionist works and the self-taught works in the Stent wing, and convey a transition from Minimalism to explorations with photographic media in the Wieland wing.

A comparison of the content organization with the visibility structure can elucidate the potentials of the spatial structure in conveying the narrative. The visual integration graphs show that the galleries at the intersection of the Stent wing L-shape geometry are visually closest to all other locations in the layout. This location is where the works of late modern (in room 10A), self-taught (in rooms 5 and 6) and contemporary art (in room 10 or Wieland wing) are open to view in various directions. The property of being visually close to all other spaces enables visitors to have an awareness of the displays of all three genres and thus recognize visual affinities and possible dialogues among them. In particular, the highest integration value is located at the north side of gallery 8A, which displays Butterfield's contemporary horse sculpture depicting submissive and cautious pose along with the works representing struggles of African American community. The property of being visually close to other parts facilitates visitor viewing of these displays from every other part of the gallery and places an emphasis on these displays in the space. This emphasis brings visitors' attention to the content these displays represent, which conveys issues related to underserved groups in society such as the black community. In the Wieland wing, the most visually integrated location is also the gallery (room 12). This property offers visitors an opportunity to relate the late Abstract Expressionism presented in this room to the other contemporary movements. The establishment of such a relationship presents the narrative of the contemporary movements through the lens of a more fundamental art movement, (late Abstract Expressionism).

The least integrated locations in each wing coincide with content that visitors could understand separately before relating it to other content. The moderately integrated locations in the Stent wing present the narrative of modern art in the pre-war and post-war periods, and memory painting in self-taught art. The moderate level of integration allows visitors to relate these displays to those in some other locations, without exposing too many of these locations. In the Wieland wing, the moderate levels of integration are located in gallery rooms 13, 14, 11 and 20, and the integration at this level reinforces what their physical boundaries suggest, namely the displays here should be read autonomously.

The visual connectivity graph (Fig. 6.31b) demonstrates that in the Wieland wing, the intersection of galleries 16 and 19 with galleries 13, 12, and 11 provides visitors visual access to the largest area possible in their neighborhood. As suggested in the previous section that reviewed the role of visual relationships on visitors' experience of displays, the intersections of rooms 16, 19, with rooms 13, 12, and 11 synchronously offer visual access to the adjacent galleries and provide opportunities to compare and contrast the late Abstract Expressionist works in room 12 with other contemporary works in rooms 16 and 19. In the Stent wing, the visual connectivity values are only moderately high in gallery 8A (adjacent to the atrium) and gallery 5 where the Stent wing is connected to the Wieland wing. At these locations, the property of having visual access to the adjacent locations can motivate visitors to explore the commonalities among the works of modern, contemporary and self-taught. The moderately high degree of visual access offered at this point enhances the ability of visitors to visually connect the displays here – a mix of self-taught art and contemporary works of art -- to others in the adjacent galleries separately representing modern, contemporary and self-taught art genres.

Moderately low connectivity values in the square galleries at the L-shape corners of the Stent-wing motivate visitors to read the content, the pre-war period and post-war period art, and memory-fantasy paintings of self-taught art, quite independently from the rest of exhibition. These themes are not necessarily peripheral to the narrative, but essential themes that need to be conveyed separately before being unified with the others. With regard to the lowest visual connectivity and integration, the graphs (Figs. 6.31b and 6.31c) show that least connected and integrated location in the Stent wing is gallery 9 where Finster's Paradise Garden is represented. Indeed, the "Paradise Garden" work demonstrates the eccentricity of Finster's art, and therefore remains quite peripheral even to the common artistic language that can be shared among self-taught, contemporary and modern art. Therefore, the visual (and physical) disconnectedness of this location in the visual structure is consistent with the interpretation of the displayed works role in the narrative as outside the mainstream art world.

All these observations reveal a number of key aspects of how the syntactic spatial properties of the HMA skyway gallery layout contribute to the transmission of the exhibition narrative on twentieth century American art. First, both the permeability and visibility structures indicate that the longitudinal sequence connecting the Stent Wing to the Wieland wing is strongly emphasized by the spatial structure, because visitors can access and view this sequence within the fewest steps from all other spaces. This sequence brings visitor into contact with the works of American contemporary and self-taught art along with a glimpse at late modern art. Second, the moderately low levels of visual integration and connectivity at the backside galleries of the Stent wing sets up modern art and self-taught art to be read quite independently from other art in the layout. Third, both the permeability and visibility relationships defined by the position of the Wieland wing more strongly motivate visitors to explore American contemporary art separately than to explore the two other two genres. However, the free placement of the latest works of contemporary art in the Stent wing maintains a relaxed connection to the other artwork in the Wieland wing. In the Wieland wing, the works of contemporary art are presented in terms of styles and individual artists sequenced in a clockwise direction based on an implicit chronology. However, the symmetrical shape of the gallery layout and in particular the visual and physical connections between gallery 12 and other rooms offer another layer of reading the narrative in addition to chronological order. This may facilitate understanding of the contemporary works through the lens of the late Abstract Expressionist works in gallery 12 and based on visual affinities betweem those works.

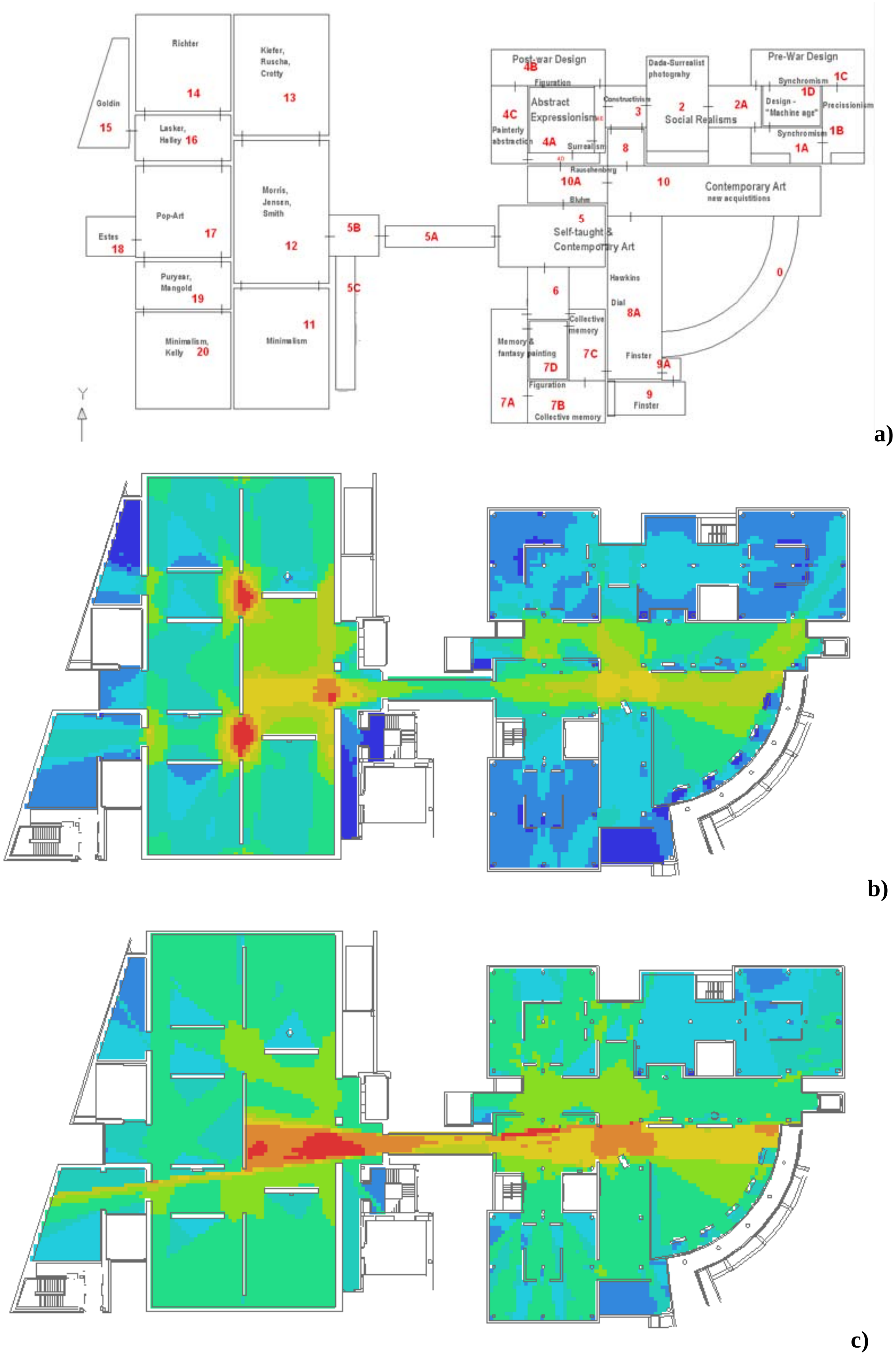

Figure 6.31 a) Narrative organization, **b)** Visual connectivity graph, **c)** Visual integration graph.

This comparison of the narrative organization with the spatial structure reveals that the presentation of the three genres is quite consistent with their interpretations in museum and other sources. This is most evident in the placement of display groups of each genre based on the categories that are often used to study those works of art (i.e. display of modern works based on chronological order referring to the key historical developments). As far as the presentation of the entire narrative is concerned, the HMA's narrative on the twentieth century American art emphasizes the dialogues, interactions, and affinities between the works of modern, contemporary and self-taught art. Although these dialogues and interactions are somewhat acknowledged in the art historical sources, the HMA's approach to interpreting its collection places an even stronger emphasis on the interactions and dialogues among the different genres and thus renders self-taught art as significant as the scholarly and mainstream artwork. The spatial layout of the HMA, in particular the L-shaped geometry with repeating square galleries at the corners seems to effectively reflect the HMA's curatorial interpretation juxtaposing self-taught art with the other two genres. At the same time, the HMA's complex spatial organization (created by the room within a room arrangement as well as the intersections of gallery sequences in the L-shape and matrix organization) offers visual interconnectivities at the local level and thus gives visitors opportunities to compare display groups at the room scale. Therefore, the HMA spatial layout has more generative potential at the room scale than in the larger scale. These potentials of the spatial layout to convey the narrative will be discussed further in relation to the space use patterns predicted by the layout at the end of this chapter

6.4 The Spatial Layout and the Space-Use Patterns

This section analyzes the distribution of space use patterns culled from the data on visitors completing a tour of the HMA skyway fourth floor, and explores the extent to which the gallery layout may predict visitors' space use patterns.

Before discussing the in-depth analysis of the space use patterns, the sample data of visitors is examined to determine the number of visitors in each gallery room. As explained in the previous case studies, slow moving visitors would visit fewer rooms, and fast moving ones would explore a higher number of rooms within the course of tracking, and a random sample would include both kinds as would be demonstrated in a normal distribution. As can be seen in Figure 6.32, the histogram demonstrating how many rooms are viewed by visitors has a bi-polar shape. This indicates that the visitor sample consists of two groups of random distribution with two peak values at 16 and 37. These values represent the number of rooms visited by the highest number of visitors in the sample. Given that there are 38 convex rooms in the entire layout, this result shows that one visitor group visited only half of the rooms, and the other group visited almost all of the rooms. This comports with the two part layout consisting if two wings connected by a bridge and indicates that the sample includes both slow visitors and fast visitors with some visitors directly going to the Wieland wing by passing through the Stent wing and others navigating both wings, as observed during the data collection. The histogram shows that the mean value of room frequency distribution is 27, the average room visit frequency in the sample. A lower frequency for the visitation of more than 38 rooms suggests that only a few visitors went to some rooms more than once.

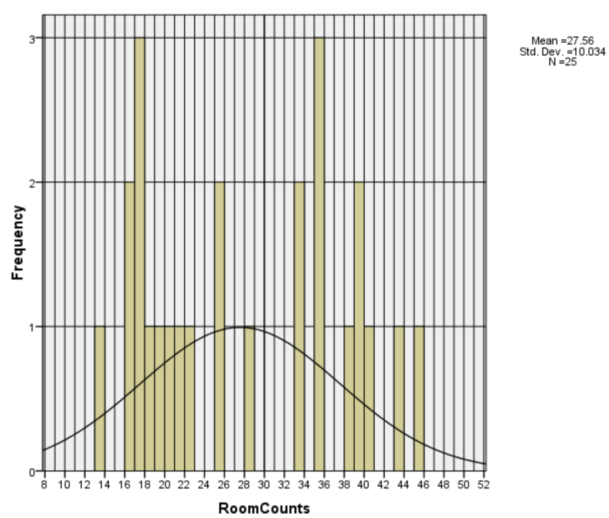

Figure 6.32 Histogram showing the room visit frequency

6.4.1 The Space-Use Patterns of Visitors and Their Correlation with Visibility Relationships

As in the previous case studies, the sample data of visitors were used to examine three groups of space-use patterns: patterns of exploration, patterns of contact with displays, and patterns of contact with layout. The space-use patterns are first examined descriptively using the measures extracted from the data; and these measures were then correlated with visibility properties of the gallery space.

Patterns of Exploration and Visibility Properties

As explained in the previous case study investigations, this study describes the visitors' patterns of exploration and the distribution of these patterns in the analysis of the movement path data. This analysis captures the patterns of exploration first by looking at the number of movement lines crossing each gallery in relation to the number of visitors entering each gallery; and second by looking at the distribution of movement into various directions at the spaces offering choice.

In the first step of capturing the exploratory patterns, the number of movement lines crossing each gallery was examined in relation to the number of visitors entering each gallery. This relationship was then comparatively examined for each gallery room to determine which rooms are re-visited most frequently. This examination aims to explain the extent to which gallery rooms are visited many times (with returning visits) and thus spatially explored further. As shown in 6.24, on the skyway floor, the rooms are arrayed along spine connecting the Stent and the Wieland wings, namely rooms 10, 5A, 5B, 12 and 19 are visited by 80% to 100% of visitors in the sample. Gallery 8A in the Stent wing and galleries 14, 16, and 18 in the Wieland wing are visited by 60% to 80% to of the visitors. Figure 6.35 illustrates how the movement lines entering to the gallery rooms are distributed throughout the HMA gallery floor. As can be seen from the figure, again the galleries along the spine on the east west axis are visited most 1A, 1C, frequently. When this figure is compared to Figure 6.34, it can be seen that some galleries (rooms

2A, 2, 3 and 7D in the Stent wing) have a very high number of movement lines, although these rooms appear to be visited by fewer visitors. This indicates that these galleries are visited several times by some visitors.

Figure 6.33 Transcribed data of movement paths.

Figure 6.34 Percentage distribution of visitors crossing galleries

Figure 6.35 Distribution of movement lines crossing galleries

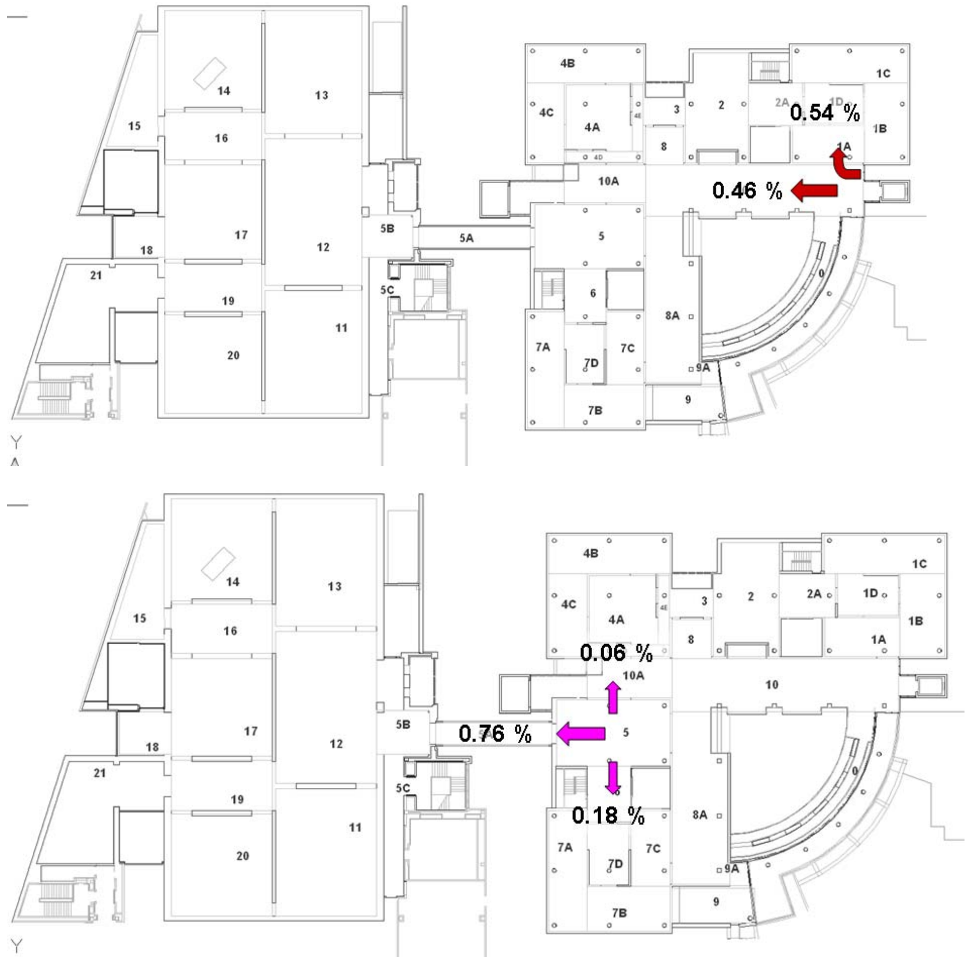

Figure 6.36 Percentage distribution of movement paths into the available directions, **a)** after entering the Stent wing for the first time, **b)** before entering the Wieland wing.

The second technique of capturing exploratory behavior examined how movement is distributed into the different directions available at the spaces offering choice. The first space offering choice upon visitors' arrival on the Stent wing is the eastern part of gallery 10, where visitors can continue moving in 10 and thus move along the central spine, or turn to the northern side galleries (room 1A) located at the edge of the L-shaped gallery space. The distribution of movement into the directions offered by this circulation space was examined by counting the movement lines of visitors who cross this space at the beginning of their exploration. The analysis shows that slightly more than the half of the visitors (54%) chose to go to gallery 1A, and less than half (46%) continued in gallery 10. Regardless of the effect of gallery layout, this choice may be explained by the tendency of visitors to turn right, as discussed earlier in the literature review.

Another gallery that offers choice in movement at a critical point is gallery 5, where visitors either proceed to the Wieland wing, or turn in other directions in the Stent wing. The analysis of movement at this location shows that among the visitors who visited gallery 5, the majority of them (76%) moved towards Wieland wing, while a very small percentage moved gallery 6 to explore the south side of Stent wing, and only a few of them turned right and went to gallery 6 towards the north corner. This result can be explained by several factors identified in previous studies such as the tendency of visitors to be attracted to exit gateways, which would apply to the connector of the Wieland wing.

In order to investigate the influence of the HMA gallery layout on the patterns of exploration, the key measures of exploratory movement explained above are compared with the visibility properties. To investigate whether the exploratory behavior in each room might be predicted by the visibility properties of those rooms, first the number of movement lines entering galleries was correlated with key syntactic and non-syntactic visibility measures of those rooms. According to the investigation, the number of movement lines is linked with visual connectivity, control and integration measures (R^2_{conn}= 0.41, p=0.000; R^2_{cont}= 0.29, p=0.001, $R^2_{int\text{-}avg}$= 0.32, p=0.000; Table 6.1). These results indicate that in the HMA skyway galleries, visitors tend to move through the gallery rooms where they can obtain visual information of the neighboring locations, and they can be visually close to all other locations. More specifically, this result indicates that 41% of the variation in the exploratory movement is explained by variation in visual connectivity, while 32% of the variation in the movement is predicted by variation in visual integration. The results show that the property of visual control has the weakest effect on exploratory movement, explaining only 29% of the variation in the movement and suggesting that the visual information of less connected spaces has little effect on movement. These results also indicate that in predicting exploratory movement the capacity of a room to allow visitors to see neighboring locations plays a greater role than the capacity to be visually close to other locations.

To understand which aspects of local visibility may have an effect on movement, the number of movement lines was also correlated with the (non-syntactical) grid isovist values of the rooms. The investigation shows that the movement lines are associated with the visual field area, perimeter and isovist maximum radial measures of visual fields in each room (R^2_{area}= 0.42, p=0.000; $R^2_{peri.}$= 0.24, p=0.002, $R^2_{max\text{-}rad..}$= 0.16, p=0.014, $R^2_{occl.}$= 0.14, p=0.017; Table 6.1). As discussed in the previous sections, the visual field area refers to the size of the visible region; perimeter refers to the length of the visible boundary; occlusivity denotes the length of the occluding boundary; and the isovist maximum radial refers to the longest lines of sight in visual field. Accordingly, the results indicate that 42% of variation in the number of movement lines is explained by variation in the size of visible regions, while 24% of this variation is influenced by the degree to which exposed wall surfaces can be seen. Only 16% and 14% of the variation in the exploratory movement is explained by the capacity to project the longest lines of sight and the potential to explore hidden information behind corners. These results suggest that visitors are mostly drawn to larger visible regions as well as to exposed wall surfaces, the longest lines of sight and hidden regions, all of which influence exploratory movement.

Table 6.1 Correlation of movement lines & VGA measures (syntactic and non-syntactic) in each gallery

	Connectivity	**Visual Control**	**Visual Integration (HH) Max.**	**Visual Integration (HH)**	
Number of movement lines crossing each gallery	0.64	0.54	0.44	0.57	***r***
	0.000	0.001	0.006	0.000	***p-value***
	0.41	0.29	0.19	0.32	***R^2***
	Isovist Area	**Isovist Max Radial**	**Isovist Occlusivity**	**Isovist Perimeter**	
	0.65	0.40	0.38	0.49	***r***
	0.000	0.014	0.017	0.002	***p-value***
	0.42	0.16	0.14	0.24	***R^2***

In the second step of investigating the link between visitor movement and visibility of the galleries the relationship between movement lines and visibility properties was examined in terms of a finer grain analysis, in which movement line counts were obtained from (5-foot) grid cells, representing the scale of a visitor's individual space. The movement line counts crossing the grid cells were correlated against the visibility graph values of those cells. A correlation was found with only the visual control measure ($R^2_{control}$= 0.12, p=0.000), indicating that the property of seeing less connected locations explains 12% of variation in movement throughout the gallery space. This result suggests that the property of visual control has a marginal effect on the modulation of visitor movement; minor variations in the visibility relationships do not influence movement. In sum, according to the correlation of movement lines with visibility at the room scale, only the effect of visual control on movement is maintained at the scale of the individual space of a visitor.

Table 6.2 Correlation between movement line counts and grid isovist + VGA (Syntax 2D) values

	Visual Control	
Movement line counts in (5-foot) grid cell in visibility graphs	0.34	***r***
	0.000	***p-value***
	0.12	***R^2***

The investigation of the effect of local visibility on choice in the movement direction:

A key step in investigating the effect of layout on exploratory behavior involves considering the effect of local visibility on the movement of visitors in spaces offering choice. As discussed in the methodology and previous case study chapters, this particular investigation explored which of the directions that visitors take are based on the gradual unfolding of visual information in permeable directions. To this end, the movement lines leaving those spaces in each of the offered directions were counted; further, the percentage values of these lines among all movement lines leaving those spaces were correlated with (point-isovist) visual field measures in the corresponding directions at the permeable level. The result of this correlation shows that the percentage of movement lines is linked with the visual field area, perimeter, drift, compactness and occlusivity measures (R^2_{area}= 0.32, p=0.000, $R^2_{perimeter}$= 0.31, p=0.000, R^2_{drift}= 0.40, p=0.000, $R^2_{compactness}$= 0.34, p=0.000, $R^2_{occlusivity}$= 0.16, p=0.013; Table 6.3). The correlations with area and perimeter indicate that the size of the visible area and exposed surfaces attract visitors. The correlation with the drift measure implies that visitors move in the directions that situate them away from the center of the visible region. When the correlations with area and drift are considered together, it can be seen that visitors choose to move towards the directions where visible areas are larger and extend away from their vantage location. Another measure found correlated with movement direction is compactness (the ratio of the area to the perimeter of a visual field). This measure describes the degree to which the boundary of a visual field is defined by a compact shape and does not meander, and thus indicates consistency in the depth of regions visible from a vantage point. The correlation with the compactness measure suggests that visitors move towards the directions where the depth of the visual field remains quite consistent with respect to a visitor's vantage point. Within the demonstrated effect of all of these attributes, the weakest correlation with occlusivity implies that hidden regions in the visual field have very little effect on attracting visitors.

Table 6.3 Correlations between Path Ratio and Isovist Division Ratios in the Available Movement Directions at the Choice Locations (both Stent and Wieland Wings)

	Area	Perimeter	Drift	Occlusivity	Compactness	
Movement line ratio in different directions	0.57	0.56	0.63	0.40	0.57	***r***
	0.000	0.000	0.000	0.013	0.000	***p-value***
	0.32	0.31	0.40	0.16	0.34	$\boldsymbol{R^2}$

Patterns of Contact with Displays and Visibility Properties

The patterns of visitors' contact with the displays in the HMA skyway (fourth floor) galleries were analyzed using a number of measures extracted from the stop count data on viewing displays. The recorded stop count data indicating display-viewing behavior is provided in Figure 6.37. As can be seen, the displays in the north and south side galleries of the Stent wing and the north side galleries of the Wieland wing received a higher number of stops than the displays in the other galleries. More precise results for the display viewing behavior were obtained by calculating the percentage of displays viewed in each gallery. As shown in Figure 6.38, the displays in galleries 13, 14, 10A and 17 received the highest number of stops. The stop counts were also analyzed to understand the extent to which visitors made contact with displays in each room. Figure 6.39 provides the percentage of displays that were visited with respect to the total number of available displays in each gallery room. As can be seen in the figure, in most of the gallery rooms located at the northern edges of both the Stent wing and the Wieland wings 100% percent of displays were viewed by visitors. This percentage is the lowest in rooms 20 and 7A, approximately 57% and 66%, respectively, while the percentages are also low in the galleries located along the central spine. Figures 6.38 and 6.39 demonstrate that, even though almost all of displays in the north and south side galleries in the Stent wing were viewed by visitors, the display objects themselves in those galleries were not visited more frequently. This indicate that the content in the north side galleries of the Stent wing was read by contacting a higher number of displays rather than making frequent visits to the same display objects.

To investigate the influence of the layout on the patterns of contact with the displays, the key stop count measures describing display viewing were compared to visibility properties. To this end, first the links between the stop counts describing display viewing behavior in each room and visibility properties in those rooms were investigated. The counts of visitor stops to have contact with the displays in each room were then correlated with the syntactic and non-syntactic visibility measures obtained in each room. This was done first for the gross number of stop counts, and then for the counts obtained by normalizing the gross counts by room size and the displays available in each room, but no correlation was found. The correlation of the counts normalized by area, however, revealed that the display viewing behavior is reversely linked to visual connectivity, integration, and visual field area measures ($R^2_{int\text{-}ave}$= 0.32, p= 0.000; $R^2_{conn.}$= 0.25, p= 0.002, $R^2_{iso\text{-}area.}$= 0.30, p= 0.001; Table 6.4). Accordingly, 32% of the variation in the number of stops (normalized by area) is explained by negative variation in the visual integration of a room, while the 25% of the variation in stopping is explained by negative variation in the visual connectivity property. These negative correlations suggest that visitors stop to view

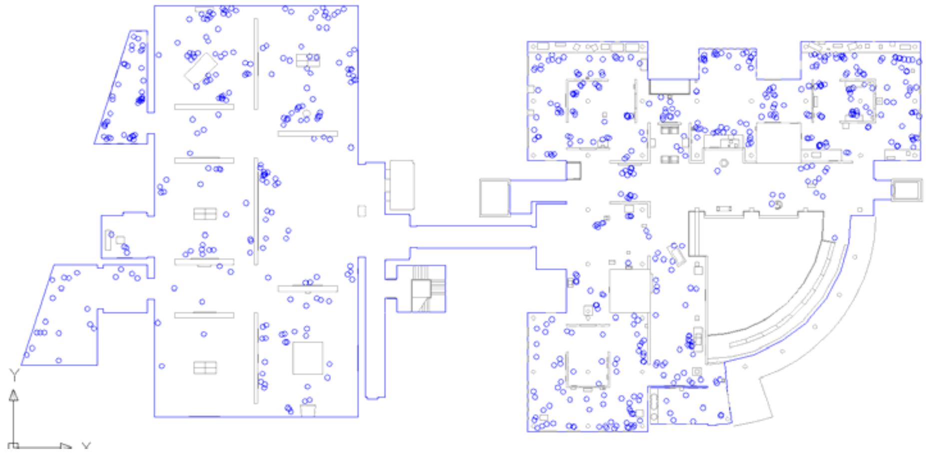

Figure 6.37 Transcribed data of movement paths

Figure 6.38: Distribution of average stop counts per display in the gallery floor. Darker shades show the higher number of stop counts per display.

Figure 6.39: Percentage of displays viewed in each gallery room. Darkest shade denotes where 100% of the displays viewed.

displays in locations that are visually isolated from neighboring spaces and in locations visually farther from all spaces in the layout, but these results are evident only when the possible interference of gallery size is eliminated.

Table 6.4 Correlations between all stop counts & VGA measures in each gallery room

	Connectivity	Visual Integ. (HH) Avg	Visual Integ. (HH) Max	Isovist Area	
Stops viewing displays –(normalized by area)	-0.50	-0.57	-0.54	-0.55	***r***
	0.002	0.000	0.001	0.001	***p-value***
	0.25	0.32	0.29	0.30	R^2

The second step in this investigation explores the link between the average stop counts for each display and the visibility properties in the rooms. The average stop counts at each display were obtained by dividing the stop counts (describing display viewing behavior) by the number of displays viewed in each room (Fig. 6.38). The measure obtained for each room was correlated with the key visibility measures of the rooms. This investigation demonstrates that there is only a marginally significant link between the average number of stops made at a display and visual connectivity property of the rooms where the display is located (Table 6.5). This indicates that in the visually connected rooms, visitors tend to stop more often at certain displays, rather than all available displays in those rooms. This result is seemingly in conflict with the results of a previous investigation showing that, in visually connected rooms visitors would stop to view displays fewer times. When considered together, these results actually suggest that, in the visually more connected spaces, even though visitors stop less often overall, they may perhaps stop at certain display objects, during a return visit to a room.

Another step of this investigation explored whether the number of displays viewed in a room might be related to the visibility properties of that room. To this end, the number of displays visited in each gallery (normalized by calculating the percentage of displays contacted) is correlated with the visibility properties of each room. However, this investigation found no link, suggesting that visibility properties are not associated with the amount of content that visitors read as a result of viewing a higher number of displays in each room.

Table 6.5 Correlations between frequency of stopping for displays in each gallery & VGA measures

	Connectivity	
Average number of stops at displays	0.34	***r***
	0.048	***p-value***
	0.12	R^2

The last step in this investigation takes into account the visibility properties of display object locations and investigates the effect of these visibility properties on the stop counts of those displays. A comparison of the stop counts received by all displays and the visibility of all display locations yielded no link. In the analysis of the first case study museum (the YCBA), the gallery rooms with lower average connectivity and integration had similar correlation results. To determine if the same would be true for the HMA layout, the correlation between the stops received by each display and the visibility properties of the display locations were separately investigated for each gallery room. This investigation was also repeated for particular galleries that are comparable to each other in terms of the number of visitors or in terms of other average visibility properties. However, no significant correlation was found between the visibility at a display location and the stops received by a display. These results confirm that, as in the second case study (MoMA), in the HMA layout a visitor's attraction to display objects is not linked with the visibility of the display locations.

Patterns of Contact with Layout (Scanning stops) and Visibility Properties

As explained in the previous case study, patterns of contact with the layout were examined using the scanning stop data recorded for pauses not associated with viewing particular displays, but for scanning the layout, looking at the architectural expression of the space (i.e. the atria) and looking out the exterior windows. In the HMA very few stops were noted for visitors looking at the atrium and it was not possible to distinguish these stops from when visitors visually scanned the galleries and displays. Therefore, for this case study, the scanning stops are examined in two groups, stops visually scanning the galleries and looking out the window. The scanning stop data recorded for the HMA skyway floor is given in Figure 6.40. As can be seen in the figure, the scanning stops are mostly scattered in the Stent wing, whereas they occurred at only certain locations in the Wieland wing galleries. To obtain a more precise description of the scanning stop behavior, a number of measures were retrieved from the data. One of these measures is the percentage of scanning stops among all stops, which is indicative of stopping behavior not associated with display viewing within the general stopping behavior. These percentages were calculated only for the galleries that have displays. The other circulation spaces, where visitors obviously stop only to look outside, were excluded from the analysis. As can be seen in Figure 6.41, visitors seem to have had a greater tendency to stop to scan the gallery

Figure 6.40 Distribution of all scanning stops in the gallery

Figure 6.41 Distribution of percentage of scanning stops (scanning and outside window) in all stops

environment in the spaces along the central spine, namely in galleries 10, 5, 12, 19 and 16. The high percentage of scanning stops in spaces like room 12 and 5 can be explained by the fact that these galleries offer choice to move in a different direction. Thus, the tendency to scan the environment might be related to visitors choosing a direction. On the other hand, the stops noted in other galleries of the Wieland wing, such as galleries 20, 13 and 14, can be explained by the larger displays in these rooms, which may require visitors to gain an awareness of the environment by looking around.

The influence of gallery layout on visitors' patterns of contact with the layout was investigated by correlating the scanning stop counts with syntactic and non-syntactic visibility properties. In this investigation, the scanning stop counts recorded in relation to looking at atria and surveying galleries were examined together. In the first step of this investigation, the gross counts of scanning stops recorded in each room were correlated with the syntactic and non-syntactic visibility measures of the rooms. The results of this correlation show that the scanning stop counts are linked with the visual connectivity and integration properties of the rooms (R^2_{conn}= 0.35, p=0.025; $R^2_{int.avg}$= 0.14, p=0.032; $R^2_{int.max}$= 0.36, p=0.000; Table 6.6). More specifically, the correlation results indicate that 35% and 36% of the variation in the gross number of scanning stops is explained by, respectively, the capacity of a room to allow visitors to see (or the capacity of a room to be seen from) neighboring locations (visual connectivity), and the highest capacity to be visually close to all other locations the (maximum value of integration in the rooms). Only 14% of the variation in the scanning stops is predicted by a room's average capacity to be visually close to all other locations (integration). The counts of scanning stops were correlated with the visibility measures after being normalized by area; however, no correlation was found. This inconsistency between the results obtained using the gross and normalized counts of scanning stops suggests that room size may influence the number of scanning stops in such a way that visitors seem to stop to visually scan galleries more often in rooms of a certain size.

Table 6.6 Correlations between the number of scanning stops & VGA measures in each gallery

	Connectivity	Visual Integration (Avg)	Visual Integration (Max)	
Scanning stops (scanning + looking at atria) in each gallery room	0.59	0.37	0.60	***r***
	0.000	0.032	0.000	***p-value***
	0.35	0.14	0.36	R^2

* No correlation was found between percentage of scanning stops and visibility measures

In order to investigate the effect of visibility on the tendency of scanning within general stopping behavior, the percentage of scanning stops among all stops was correlated with the visibility properties of those rooms. This investigation yielded no correlation, which is consistent with the results obtained in the previous step of this investigation. Thus, scanning stops occur only in certain locations and are not consistently linked with visibility properties.

Movement – Stop Counts Relation and Visibility Properties

The previous section analyzed the three space use patterns and the prediction of those patterns on the basis of visibility properties. In this section, the relationship between explorative movement and stopping behavior was investigated by comparing the distribution of movement lines and stops counts. This comparison was made by calculating the ratios between the number of movement lines and stop counts in each room, as well as correlating these counts with each other. The correlations are useful for understanding whether visitors would stop in the space where they move, or would meander without stopping. A ratio of moving to stopping that is equal to 1, indicates that visitors stopped once each time they entered a gallery room; the ratios larger than 1, indicate that visitors stopped fewer times along their movement.

Figure 6.42 demonstrates the calculated ratios between the movement lines and stops for display viewing in the HMA galleries. As shown in the figure, the ratios vary widely ranging between 10.75 (gallery 19 in the Wieland wing) and 0.36 (gallery 2 in the Stent wing). When these ratios are examined closely, it can be seen that the variation in the movement line-stop count ratios might be affected by room size. This is possible because although each movement line entering or crossing a gallery is counted once regardless of the area it covers, a larger area or greater number of displays available in a rooms may motivate visitors to stop more during their navigation. Therefore, in addition to the direct correlation of the number of movement lines and stop counts, a partial correlation was also done by using the number of displays in each room and room size as controlling variables. As explained in the Methodology chapter, the partial correlation technique is used to investigate the link between two variables where other variables may interfere with this link. The partial correlation procedure virtually removes the third factor to explore the link between the two variables of interest. The partial correlation investigations were conducted separately by first using the number of displays and then using the gallery room sizes as controlling variables. For this analysis, the direct and partial correlations were done separately for stops counts for display viewing and for the scanning stops.

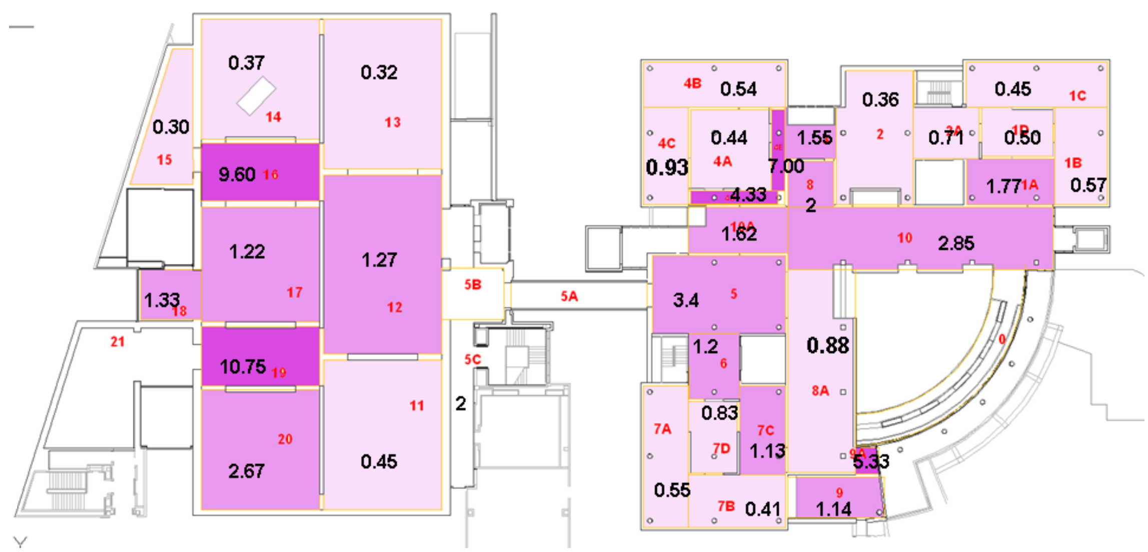

Figure 6.42 Ratio of movement paths crossing galleries to stops at displays

These correlation results demonstrate that movement is significantly linked with scanning stops (including scanning the galleries and looking out the windows), but not with the stops for display viewing. When the association of movement with the stop counts for viewing and those for scanning was investigated by using room sizes as a controlling variable in the partial correlations, movement was found more weakly linked with scanning stops; however, no significant link was demonstrated for the stop counts describing display viewing. This suggests that the association between movement and scanning stops is somewhat influenced by room size; more specifically, visitors seem to stop to scan the layout in the galleries of a certain size, but do not have a significant tendency to stop to view displays in every space they move.

Table 6.7 Comparison of movement lines and stop counts using direct and partial correlation techniques (including all galleries)

	Correlation type	**Stops at displays**	**Scanning stops**	
Number of movement lines crossing each gallery	*Direct Correlation*	-0.62	0.63	***r***
		0.727	0.000	***p-value***
		-	0.40	R^2
	Partial correlation controlled by n. of displays	0.046	0.62	***r***
		0.800	0.000	***p-value***
		-	0.38	R^2
	Partial correlation controlled by gallery room areas	-0.29	0.54	***r***
		0.082	0.001	***p-value***
		-	0.29	R^2

In addition to these descriptive analyses of movement and stopping behaviors in the gallery rooms, this study also examined the influence of the gallery layout on the covariance between exploratory movement and stopping behavior, in other words whether visibility motivates visitors to explore the galleries by moving instead of stopping more often. To this end, the key measures concerning the ratio of movement to stops for display viewing were correlated with syntactic and non-syntactic visibility measures. The first step in this correlation analysis used stops at displays normalized by area to calculate the movement line-stop count ratio in each room, and compared this ratio with the visibility properties of each room. The results show a close association of the movement line-stop count ratio with connectivity and the maximum values of visual integration. Accordingly, 36% of the variation in the movement-stop ratio in a room of any size is explained by variation the room's capacity to "see" neighboring spaces. Thirty percent of the variation in the movement-stop ratio is influenced by rooms with the maximum capacity to be visually close to all other locations, and this proportion is 20% for the average potential of the same property. The correlations also indicate that variation in the longest lines of sight that can be projected from those rooms also had an effect on visitors' stopping to view displays. These correlation results indicate that, regardless of the room size, visitors tend to move instead of stopping to view displays in the rooms that can be seen from neighboring locations. This tendency seems to be influenced by the visual closeness of a room to all other locations and the longest lines of sight that can be projected from those rooms. This investigation was repeated by using the ratios of movement lines to stops for viewing displays and normalizing the stops with the number of displays. When those ratios are correlated with visibility properties, the isovist maximum radial (longest lines of sight) no longer has an influence on visitors' tendency of moving instead of stopping, and the variation in connectivity appears to explain only 14% of the variation in the movement-stop ratio. This result again suggests that visitors prefer to move rather than stop-to view displays regardless of the available displays in those galleries.

Table 6.8 Correlations between Movement Line and Display Stops Normalized by Area

	Connectivity	**Visual Integration (HH)**	**Visual Integration Max. (HH)**	**Isovist Max Radial**	
Movement line/Display Stop Ratio normalized by Room areas	0.60	0.45	0.55	0.43	***r***
	0.00	0.008	0.001	0.012	***p-value***
	0.36	0.20	0.30	0.18	R^2

Table 6.9 Correlations between Movement Line and Display Stops Normalized by Display Stops

	Connectivity	**V. Integration (HH)**	**V. Integration Max (HH)**	**Isovist Area**	
Movement line-Stops viewing displays normalized by n. of displays	0.37	0.37	0.55	0.41	***r***
	0.032	0.030	0.001	0.016	***p-value***
	0.14	0.14	0.30	0.17	R^2

6.4.2 To What Extent Does the Spatial Layout Predict Space-use Patterns?

The results obtained from correlating visitors' space use patterns with the visibility properties, presented in the previous section, reveal to what extent the visibility structure of the HMA fourth floor gallery layout influences visitors' space use patterns. Most notably, the correlation results found between the number of movement lines and the visibility properties indicate that almost half of the variation in the exploratory movement at the gallery room scale is influenced by the rooms' capacities to provide visual access to their neighboring locations, while one third of this variation is influenced by the rooms' capacity to be visually close to all other location as well as the property of "seeing" less connected locations (Table 6.1). This result suggests that visual information of neighboring locations seems to be more influential than global visibility in guiding visitors in their explorations. At a finer grain of space, only the variations in the degree of seeing less connected neighboring locations has an effect on exploratory movement. According to the results obtained from the correlation investigation of the number of movement lines and non-syntactic properties of the room, the size of the visible area seem to play an important role in modulating movement, predicting almost half of the variation in the movement (Table 6.1). Other non-syntactic properties, exposed surfaces, the availability of hidden regions and the longest lines of sight in the visual fields have much less influential on visitor movement.

The analysis concerning the exploratory movement investigated to what extent visitors' choices to move in a particular direction might be shaped by the extent of visibility in the permeable directions. The results obtained by correlating the percentage of movement lines directed toward a particular locations with the percentage of visual field measures at those locations show that around one third of the variation in the distribution of movement is influenced by size of the visible area and the degree to which this information extends away from the vantage location (Table 6.3). In other words, visitors are drawn to the directions where large visible areas open up in the direction extending away from their vantage point. The correlations with the perimeter and compactness properties also indicate that visitors tend to move towards places where they can see wall surfaces and where this information is coherent. Within the effect of these aspects, the potential to discover hidden information seems to be much less important.

The analysis investigating the influence of layout on the patterns of visitor contact with displays shows that the gallery layout influences stopping to view displays due to visibility. When the correlation results obtained from this analysis is compared to the results indicating the prediction of movement, it can be concluded that the visibility structure predicts stopping behavior in a manner opposite to that of predicting movement (Tables 6.4 and 6.1). In other words, whether visitors engage in exploratory movement or stop to view displays is influenced by different aspects of the visibility structure. The results obtained by correlating the stop counts in each room with the rooms' visibility properties demonstrate that regardless of the room size, visitors are likely to stop to view displays more often in the galleries that are visually segregated from the entire layout. In addition, the longer lines of sight that visitors can project from the gallery rooms negatively affect visitor stops to view displays. Indeed, when the distribution of the stops in figure 6.37 and the visibility graphs are examined closely, it can be seen that stops are accumulated in the pavilion galleries of the Stent wing and the corner galleries of the Wieland wing, where visual connectivity and integration values are lower. This result may be explained in a number of ways. First, a room's lower capacity to reveal visual information of neighboring locations along with its visual segregation from all other spaces may create opportunities for visitors to focus on display viewing. Indeed, fewer stops are recorded in the galleries adjacent to the atrium in the Stent wing and the entrance galleries of the Wieland wing, which are visually connected and integrated. As can be seen in the distribution of movement paths (Fig. 6.33), the space usage in those galleries is characterized by meandering paths as opposed to frequent stopping. These observations indicate that the galleries occupied by moving visitors are different from the galleries occupied by visitors who are predominantly stopping and viewing displays.

The galleries that are located around the central axis of both wings have dense exploratory movement paths. According to the correlations, these paths are guided by visibility at both the local and global level. The galleries located at the periphery of the gallery floor are spaces where visitors stop, view and read the displays. In addition to the different effects of visibility on visitors' exploration and display viewing, another reason for the difference in the galleries in terms of space use might be related to the displays and their narrative structure. This point is further elaborated in the chapter conclusion, which discusses the interactions between spatial structure, space use and narrative.

The analysis investigating the influence of layout on patterns of visitor contact with the gallery space shows that the visibility properties of the gallery layout motivates visitors to stop to visually scan the gallery environment. The analysis investigating the links between scanning stops and visibility properties reveals that visitors tend to stop to visually scan their environment in the rooms that open up to adjacent locations and in the locations that are few visual steps away from other spaces (Table 6.6). However, the results obtained from analysis using normalized counts of scanning stops suggest visitors do not consistently stop to scan the galleries in all galleries. As might be expected, in addition to the effect of visibility, visitors may stop to scan galleries at certain locations such as those where they need to choose their direction of movement. Indeed, the distribution of scanning stop counts indicates that visitors tend to stop to look around in the galleries located at the central axis. This observation confirms again the differences among the galleries in terms of space use patterns. This is not surprising given that the galleries on the central axis of the longitudinal direction are where visitors look around and get oriented during their exploratory movement.

Additionally, when the percentage of scanning stops among all stopping behavior is correlated with visibility properties, no correlation was found and thus it can be concluded that these properties have no effect on whether visitors more often stop to look around rather than view displays. This motivation may be explained by other factors such as the displays themselves and their narrative organization. In fact, certain space-use patterns may be motivated by the narrative organization together with the effects of the gallery layout. Also, the prediction of space-use patterns on the basis of the layout may have some implications for how the exhibition narrative is conveyed. These relationships between space-use patterns and exhibition narrative presentation are discussed below in detail.

6.5 Interactions among the Spatial Layout, Narratives and Space Use Patterns

The in-depth analysis of the HMA skyway gallery floor provides results for two key investigations comparing layout properties with exhibition narratives and space use patterns. As outlined in the Introduction chapter, this study is based upon both a top-down and bottom-up characterization of space, as described by syntactic and non-syntactic visibility properties. The results of this study can help us understand how gallery layout properties, exhibition narratives and space-use patterns interact. They may also reveal the morphological characteristics that potentially shape those interactions on the HMA skyway floor.

Presentation of Exhibition Narrative based on the Visibility Properties

An examination of the potential visibility properties to contribute to presenting the narrative reveals that high values of visual integration and connectivity values were concentrated on the longitudinal axis connecting the Stent and the Wieland wings, in particular the L-shape corner of the Stent wing. These high values indicate the emphasis placed on the dialogues among the works of contemporary art, the self-taught art and the late modern art. With the high integration and connectivity values extending towards the Wieland wing entrance, additional emphasis in the narrative is also placed on late Abstract Expressionism. This is because visual integration and connectivity create an opportunity for visitors to relate the works representing these genres to the works in all other spaces.

To illustrate the effect of visual connectivity on the narrative presentation, thematic connections between Late Abstract Expressionism and other contemporary movements can be grasped through visual interrelationships among rooms 12, 16 and 19 in the Wieland wing. These interrelationships indeed provide a layer for reading the narrative on top of the chronological sequence afforded by the physical placement of the display groups. As another example, the visual interconnectivity among galleries 10A and 8A in the Stent wing creates opportunities for visitors to compare and contrast the works of self-taught art with those of contemporary art.

These opportunities help visitors read and understand self-taught art through the lens of the contemporary works, which are relatively better known in the scholarly context due to their connections to Modernist conventions. These potentials created by visual connectivity to visually compare display groups in the neighboring locations suggest that the HMA's layout allow for visitors to notice the dialogues among the works of art at the room scale, and thus the layout has a potential to generate alternative narratives at the local scale. Based on these observations, it can be concluded that the entire narrative on the twentieth century American art is represented primarily through thematic connections noticeable through local relationships among the works of art.

Prediction of Exploration and Viewing Behavior and Its Implications for the Narratives

The most important results of this analysis suggest that visitors are more predominantly guided by the visual information of neighboring locations in their exploration than the property of being visually close to the spaces in the entire layout. These results might be explained by the fact that the visibility structure in the entire gallery is in fact more strongly characterized by visual interconnectivity between neighboring locations (local visibility), than visual proximities among the spaces (global levels of visibility). When this characterization is considered in terms of conveying the exhibition narratives, the exhibition content seems to be viewed in visually less connected rooms, although visually more connected rooms are likely visited a higher number of visitors. These findings suggest that the visitors might be aware of the displays mostly in the visually connected rooms, while their focused viewing of displays takes place in the visually less connected rooms.

In terms of predicting visitors' exploratory movement, the results concerning the effect of non-syntactic visibility properties show that size of the visible area is among the aspects that guide visitors in their navigation. This result might be related to the fact that the HMA skyway galleries display sculptures in the central parts of (almost half of) the galleries and these displays are part of the visual information available to visitors. Another aspect that is found to play an important role in predicting exploratory movement is exposed wall surfaces, which may be related to the effect of displays hung on the gallery walls. Among other aspects of local visual information, the longest lines of sight is seems to motivate visitors to move in exploratory manner, as confirmed with the correlations found between isovist maximum radial and number of movement lines. The influence of this aspect might be related to the fact that the gallery morphology formed in the longitudinal direction exposes displays and other information through the openings of inner partitions. All these results concerning the effect of non-syntactic visibility properties on exploratory behavior suggest that visible area, several aspects of local visual information, exposed walls and longest lines of sight, guide visitors in their navigation and their effect is synergized with the effect of displays contained in the visual fields.

The results confirming the effect of local properties on visitors' exploration can reveal how narratives are likely read by visitors. The demonstrated influence of local visibility properties on visitor's exploratory behavior confirms that visitors navigate mostly through the visually connected spaces and thus be able to make visual comparisons among the display groups at the neighboring locations. This means visitors are likely be aware of the alternative dialogues among the displays along their predicted pattern of exploration. As understood from the analysis, by juxtaposing scholarly unrelated works, the HMA employs a display strategy that seems to be shaped around interpreting the twentieth century American art in a less scholarly, but more populist manner. This intention is strengthened by the layout, which facilitate reading these works in conjunction. In addition, the weak but still significant effect of visual integration on the exploration helps to convey the themes that are emphasized by the layout due to their location in the integrated parts. For example, Late Abstract Expressionism, (in room 12) and the interactions among the late modern, self-taught and contemporary art (room 5A, 10A) can be conveyed effectively because visitors move through a more integrated location. Although the property of integration is less influential on exploratory behavior, visitors are motivated to move through the display locations intersecting the self-taught, late modern and contemporary art, which can support the curatorial intent discussed above.

The effect of the gallery layouts on visitor display viewing can reveal the parts of the narrative that are conveyed more in depth, motivating visitors to have more intensive contact with the art. As discussed elsewhere, visual connectivity and visual integration have a negative impact on visitor stops to view displays; thus, the themes represented in the visually segregated areas are likely grasped more in-depth. Since the peripherally located galleries present American modern art, and the self-taught art, and contemporary movements independently of the connections among them, visitors likely read these themes are more deeply.

Another important result of this study reveals the differences between the spatial layout properties that contribute to predictions of exploratory movement and stopping to view displays. While exploratory movement is predicted by information available at a local level, visitor stops to view displays are influenced by the absence of visual information at both the global and local levels. Since gallery rooms cannot be both visually connected and isolated (or integrated and segregated) at the same time, visitors explore the galleries and view displays in different parts of the gallery layout. More specifically, visitors' space use in visually connected locations is characterized by moving and meandering, while in visually segregated spaces visitors' space use is primarily characterized by stopping and viewing displays (a more static use pattern). Indeed, the transcribed data on movement paths and display viewing stops demonstrate that visitors do not necessarily stop to view displays in the galleries on the central spine (in the longitudinal direction), where contemporary and self-taught art can be seen together, but they pass through these galleries with a brief survey of the exhibitions. This result might be partially explained by the fact that a number of visitors in the sample proceeded directly to the Wieland gallery without seeing all sections of the Stent wing. However, it is also conceivable that the narrative organization would contribute to the differentiation in space-use. As discussed in section 6.4.3, gallery 10 on the central longitudinal axis exhibits the newest works of contemporary art that are installed based on less salient thematic connections among them (Fig. 6.24), and thus the narrative established is weaker here than in the other parts of the fourth floor. The weaker narrative may be considered by visitors to be less engaging than the narrative established by tighter connections such as chronology and thematic continuity in the American modern art displays in the north galleries of the Stent wing. Thus, the weak narrative may fail to motivate visitors to view the display. This explanation can be confirmed by further study investigating the direct effects of the narrative on visitors' spatial behavior.

The mixed effect of the visibility structure on exploratory and viewing behavior can be confirmed by the descriptive statistics of the movement lines and stop counts. These statistics identify the parts of the narrative were actually viewed by visitors in the sample. The movement line data shows that the exploratory movement is mostly concentrated in galleries 10, 10A, 8A, 5, 12, 19, 14, 16, and 17, indicating that the content in these galleries, in particular examples of contemporary art and widely acclaimed examples of self-taught art displayed in 8A, is most likely viewed by visitors. However, the descriptive data and the results concerning the prediction of movement and stopping indicate that in the galleries with the highest rates of movement not all displays are read. However, all displays are viewed in galleries 1B, 1D, 2A, 2, 3, 4A, 4B, 4C, 4D and 10A at the north side of the Stent wing, and 6, 7A and 7B on the south, even though these galleries are visited by few people. Thus, visitors who explored this north side, read the narrative on modern art is more thoroughly. The stopping frequency in galleries 6 and 7 on the south side of the Stent wing shows that although few visitors explored this part, the memory paintings and animal figures received greater attention than other displays in the Stent wing. In the Wieland wing, galleries 11, 13, 16 and 17 have high rates of stopping and movement, and therefore a large number of visitors view the Pop art content and later developments such as Richter's and others' explorations with the photographic medium and do so thoroughly.

Visitor contact with displays can also be revealed by movement distribution at the choice points. Specifically, movement distribution can indicate the percentage of visitors that come in contact with the narrative themes presented in various parts of the gallery. At the beginning of their explorations, visitors can move in one of two directions and in the sample approximately half (54%) turned toward gallery 1 and explored the north galleries of the Stent wing, while the remainder (46%) continued to gallery 10. As a result, half of the visitors in the sample are likely to have skipped the content on the modern art, but viewed the works of contemporary art first within the first part of their visit. At another choice point, gallery 5, the majority of visitors (76%) continued to the Wieland wing, while 18% went to the southern end of the Stent and only few of them turned to gallery 4 on the north side.

The Museum Visit in the HMA's Skyway Floor

Together these observations suggest that the HMA skyway gallery layout conveys the exhibition narrative on twentieth century American art by separately presenting the key genres, modern, self-taught and contemporary art, and then reiterating their meanings by strategically using the layout to highlight the interactions among them. The effect of local visual information motivates the majority of visitors to view the dialogues and interactions among modern, self-taught and contemporary, at least on the surface. However, the autonomous presentation of themes in the peripheral galleries causes their dialogues to be seldom read. The spatial structure of the gallery also influences how the exhibition narrative is read by distinguishing the spaces where visitors are motivated to move, meander and get oriented from the spaces from where visitors stop and view the displays. The large galleries along the longitudinal axis and adjacent to the atrium are characterized by visitor exploratory movement and stopping to get oriented as well as function as a gathering place; however, in the galleries on the periphery of the Stent Wing and the Wieland wing visitors stop and view the displays in depth and thus these spaces function as exhibition rooms (which they are). This differentiation in the space use patterns and the resulting presentation of the narrative is largely to be due to the bi-polar and elongated shape of the entire layout. While the atrium itself plays a much less significant role in predicting the space use patterns and presenting the narratives, the central spine connecting the Stent and the Wieland wings attracts the higher levels of visual integration and connectivity. With the effect of the connectivity property, the central spine functions as an alley where visitors show exploratory behavior, get oriented and perhaps be aware of the dialogues among the modern, contemporary and self-taught art with a brief overview.

The findings discussed in this chapter illustrate that the layout of the fourth floor encourages visitors to have a spatial experience that promotes appreciation and various interpretations of its unique collection. The visitors' spatial experience of the skyway floor includes both highly exploratory space use along the central spine and focused display viewing in the peripheral galleries. The visibility of neighboring spaces and revealing visual comparisons among displays mostly at the room scale facilitates in many ways visitors' ability to formulate various interpretations of the exhibition narrative as they explore the galleries (a bottom-up understanding). In this way, the HMA's architectural design, as analyzed within the scope of the skywalk floor, reinforces the museum's goals to provide an inclusive experience for its diverse community.

CHAPTER VII

A COMPARISON OF THE CASE STUDY RESULTS

7.1 Chapter Overview

This chapter discusses the results of three case studies comparatively. The first part compares the layouts of the case study museums in terms of their spatial structure along with their morphological characteristics. The second and third parts discuss respectively the aspects of spatial structure and morphology that shape the exhibition narratives and the space-use patterns.

7.2 Morphology and Spatial Structure of the YCBA, the MoMA and the HMA

As discussed in Chapter III, the spatial organizations of the main gallery layouts of the YCBA, the MoMA and the HMA are comparable in principle characterized by an enfilade configuration around an atrium. In the case study chapters, to understand the layouts in greater detail the permeability and visibility structures of each were analyzed by using graphs and diagrams. In the cross-comparative analysis presented here, a brief examination of these graphs and diagrams help understand how morphologies of the three galleries form their permeability and visibility properties. This first step aims to provide a foundation to compare the results obtained from the key investigations in each case study.

7.2.1 Morphological Characteristics and Permeability Relations

As can be seen in the floor plans provided in Fig. 7.1, the three museum layouts differ in terms of the location of atria, the gallery configuration and the relationship of the atria to the gallery spaces. As shown by the permeability and visibility graphs, the differences in the configuration shape the spatial structures of the three museums. First, in the YCBA and the MoMA, the central location of the atria forms a permeability structure within large rings, whereas in the HMA the off-centered atrium has a minimal effect on the permeability structure. Second, the room configurations in the layouts play an important role in determining the directions of permeability and define possible axes of potential movement in the layouts. In the YCBA, the partitions are positioned at the center of the gallery span and thus open up gallery rooms at the corners (Fig. 7.1). These openings maintain an uninterrupted permeability along the axial lines parallel to the shape of the floor plan and atria voids. Thus, movement can be directed straight from one corner to another, but movement between corners on the diagonal is also possible. In the MoMA, however, the rooms are connected through doorways situated at the central parts of the partitions in opposing or staggering positions to each other. Thus, permeability is allowed through the central parts of the gallery rooms, and movement can occur uninterruptedly in axial directions through a few rooms and in straight or shifting directions through others (Fig. 7.1). The HMA has a composite room configuration resulting from the different organization principles in the two gallery wings. In the Stent wing, the larger galleries on the inner side of the L-shape adjacent to the atrium together with the smaller galleries at the outer side allow movement in parallel directions along the L-shape. While larger galleries provide continuous permeability along the inner side of the L-shape, the smaller galleries in the room-within-a room configuration allow for a meandering movement through cyclically situated partitions. In the Wieland wing, the rooms are connected on the basis of a matrix organization and permeability is maintained through doorways connecting the rooms at their corners.

7.2.2 Morphological Characteristics and Visibility Relations

Each atria void in the layout uniquely shapes the visibility relationships in the three galleries. In the YCBA, the two centrally located atria have openings at their four sides and therefore create a dense network of interconnectivity between the galleries. In contrast, the

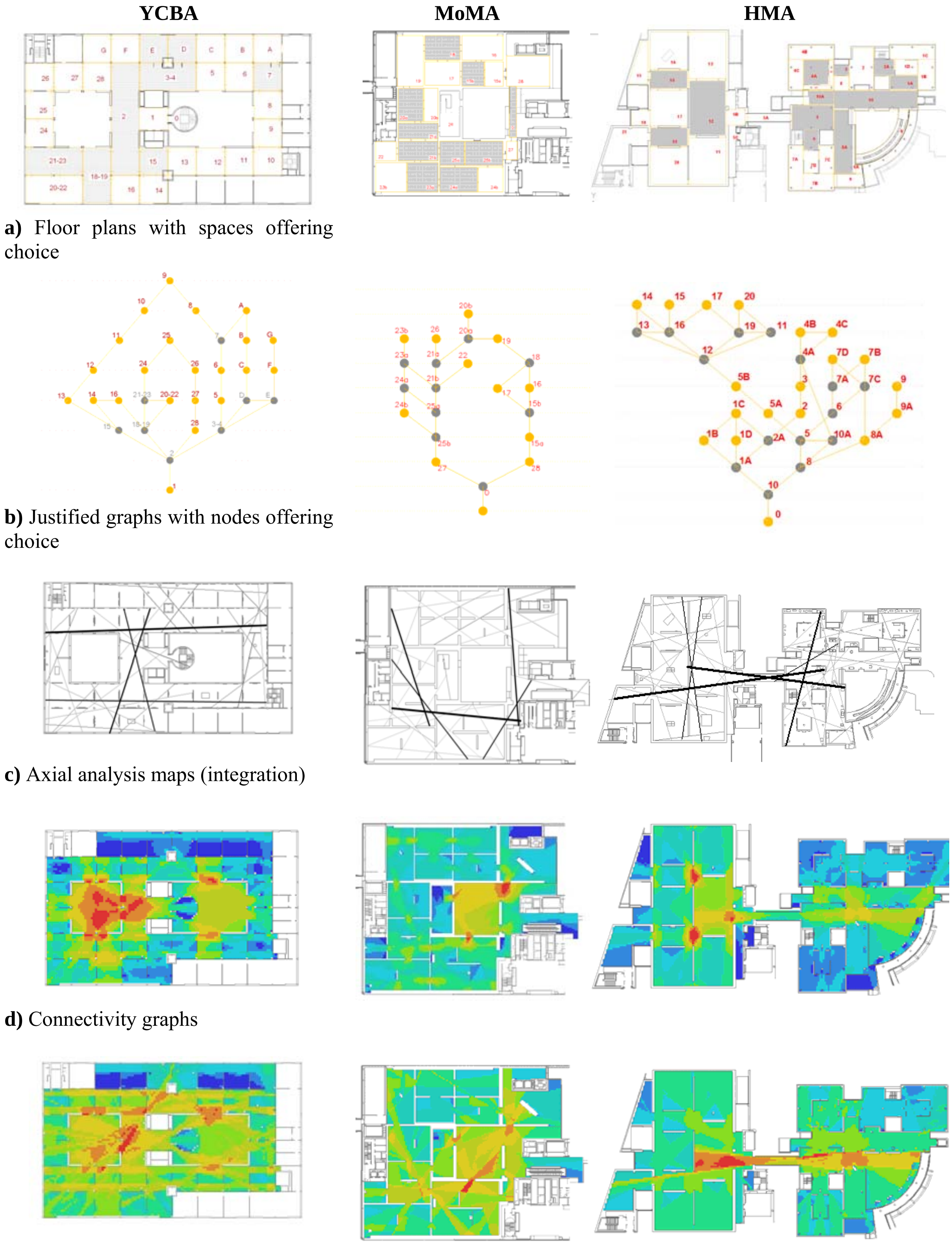

Figure 7.1 Comparison of Gallery Layout in terms of their Spatial Layout Properties

MoMA atrium is generously open to the circulation space at the gallery floor entry, but it has few openings to the galleries and thus a limited relation connection to the galleries. Because of this limited connection, the atrium void only minimally contributes to improving the visual integration and connectivity properties in the gallery space. Finally, in the HMA, although the atrium void is quite open to the gallery spaces, its off-centered location does not help increase the visibility levels throughout the layout (Fig. 7.1).

An examination of the atria and room configuration together reveals how visibility relationships are formed the three layouts. Further, a comparison of the atria location and room configuration can also illustrate to what extent permeability and visibility relationships overlap, or the network of visibility deviates from permeable axes.

For example, in the YCBA the room configuration connecting the galleries at their corners establishes both permeability and visibility along the axes parallel to the rectangular geometry of atria core and gallery layout. Together with the atria openings, the gallery room doorways create visually highly integrated regions extending also in the diagonal directions. Due to the dense network of visibility through the atria voids, of the three layouts, the YCBA layout is the one where visibility relationships deviate from permeability relationships to the greatest extent. Because of these shape properties, the YCBA layout is the most visually integrated of the three case studies. However, in the YCBA, connectivity values are higher only for the galleries adjacent to the atria openings. The reason for this is that the atria establish connectivity to the central core leaving the galleries at the periphery relatively less connected.

In the MoMA, the opposing and staggering doorways and few atria openings connect the rooms and define highly integrated spaces in diagonal directions going through the south galleries. The atrium openings minimally contribute to the interconnectivity among the spaces and doorways allow only a few rooms farther ahead to be seen. Thus, in the MoMA, visually connected spaces are located around the doorways extending towards the central parts of each gallery. These visually connected areas are evenly distributed throughout the layout, and the atrium does not substantially differentiate the evenly distributed visual connectivity of the gallery rooms; thus visibility and permeability relations mostly coincide.

In the HMA's composite room configuration and its quite open atrium situated at the west end (the Stent wing), visibility relationships mostly coincide with the permeability relationships. Since the longitudinally situated core space is visually close to all other galleries at the periphery, the visually integrated locations are concentrated along the central core. At the same time, visual access from the central core towards the peripheral locations defines this core as visually highly connected. Further, within the peripheral galleries of the Stent wing, axially continuous visibility is also afforded through openings in the room partitions. This property enhances the visibility between neighboring locations and leads to higher visual connectivity in those spaces. In the Wieland wing, visibility among the galleries is maintained by doorways at the corners of the galleries.

These observations can be confirmed by the distribution of visual integration and connectivity values in the visibility graphs. The levels of visual integration and connectivity values can be compared by examining the mean integration and mean connectivity values in Table 7.1, which will be discussed in the following section.

7.2.3 Morphological Characteristics and Visual Intelligibility

In addition to permeability and visibility relationships, the spatial structure of the three museum layouts can be comparatively examined in terms of visual intelligibility. As explained in the Chapter III, the intelligibility of a layout refers to the degree to which its global spatial properties (described by the integration measure) can be grasped by a visitor as a result of local spatial properties. For instance, an unintelligible system is one where well-connected spaces are not well-integrated, so that "what is seen of their connection is misleading in relation to the status of the space in the system as a whole" (Hillier, 1996, p. 129). By this definition, the intelligibility value can be obtained from investigating the link between local and global spatial properties; more specifically, the visual intelligibility of a layout can be obtained by correlating visual integration and connectivity values.

The visual intelligibility values of the three gallery layouts are provided in Table 7.1. These values indicate that the YCBA has the strongest level of intelligibility; the intelligibility values in the HMA and the MoMA are closer to each other, but much lower than that of the YCBA (Table 7.1). As indicated by high level of visual intelligibility in the YCBA, the highest numbers of visually integrated grid cells are also visually connected to the neighboring locations. The low visual intelligibility of the MoMA and the HMA suggests that fewer visually connected spaces are also visually integrated, and thus visitors are less likely to grasp the entire layout through local visual information. Given the larger spaces and lower visual intelligibility values in the MoMA and the HMA, visitors to those museums would need to cover a larger area in order to grasp the entire layout through local visual cues, whereas in the YCBA, visitors can more easily comprehend the entire gallery using the available local visual information.[35]

Similar to the way in which visibility properties in general are shaped with the room and atria configuration, the visual intelligibility property of the museum layouts, which is the link between local and global visibility properties, is engendered by the room configuration and the relationship between the atria voids and gallery space. This is because the room and atria configurations determine the extent to which the layouts can be understood by a visitor as she/he moves in the spatial units. For example, in the YCBA interrelationships among the atria openings and gallery doorways create locally connected spaces, while also rendering many spaces visually close to every other space. In the MoMA, the atrium area has high integration values. However, there also are spaces around the gallery doorways that are visually connected to their neighboring

[35] In fact, the smaller gallery layout size plays role in obtaining high mean integration and high visual intelligibility measures; because *Depthmap* uses isovist areas, the visual integration measure itself is not independent of the layout size. In the YCBA, the fact that the aforementioned morphological characteristics exist in a smaller layout than others is also the reason why this layout has higher mean integration values.

locations at good levels, but most of these spaces are not integrated. Similarly, in the HMA the central core connecting the Stent and the Wieland wings along the longitudinal axis creates be visual closeness to all other spaces, and thus attracts visual integration, while the room configurations play a role in increasing the visual connectivity at the peripheral locations. These mismatches between visually connected and integrated areas can explain the lower visual intelligibility values in the MoMA and the HMA.

Table 7.1 Comparison of Visual Intelligibility, Mean Connectivity and Mean Integration measures along with the gallery areas measured by number of grid cells

Intelligiblity	YCBA	MoMA	HMA
r value	**0.82**	**0.75**	**0.77**
R^2 value	**0.67**	**0.56**	**0.59**

YCBA MoMA HMA

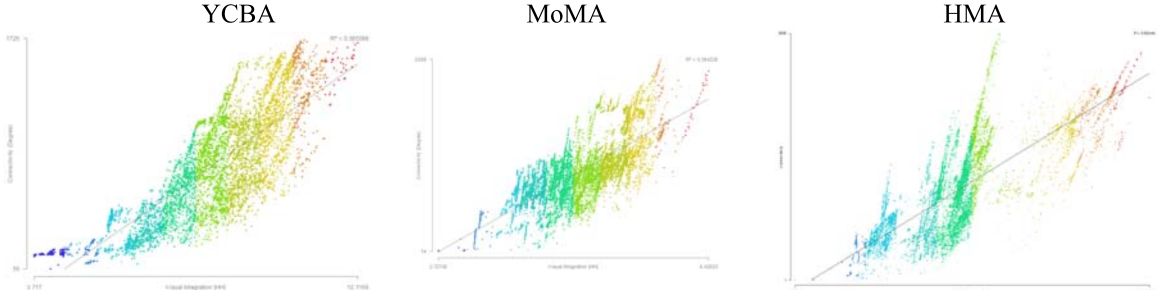

Figure 7.2. Scatter grams of visual connectivity and visual integration measures in the three gallery layouts.

7.3 The Exhibition Narratives within Reproductive and Generative Potentials of the Layouts

In order to explore the influence of the museum gallery layouts on the shape of the exhibition narratives, this study examined how the narratives were presented in the gallery layouts and how the layout contributes to the potential to reproduce the intended interpretation of the exhibition content or generate alternative interpretations. As explained in Chapter II section 2.2.2, this investigation draws upon the theoretical framework of space syntax methodology.

On the basis of the two models space syntax offers to examine the relationship between human spatial activity, built environments reflect and reproduce existing social structures, where space usage is predetermined by a program or social structures (reproductive model); or built environments are seen as a means of generating new structures by defining new relationships and encounters where the program or social structure does not pre-determine the space usage (generative model) (Hillier, 1996, 2005). When these two models are applied to museum gallery environments, the exhibition content can be considered a program that could pre-determine (or not determine) space use patterns. Accordingly, if the exhibition content presented in a museum has a highly structured content, as in the first model, and if the layout is planned to reflect (and reproduce) the content within its existing structure, the space usage patterns might be determined by the conceptual relationships structured in the content (which is defined by scholarly or curatorial interpretation of the display objects). In this case, the gallery layout would present the exhibition narrative in a didactic manner because the space-usage patterns would be directed by a spatial structure that reproduces the conceptual structure. In the other extreme, if the exhibition narrative is not highly structured, for example, the conceptual relationships between display groups are defined only implicitly, or display groups have vague relationships with other groups as well, the layout structure would make a difference in the order in which the content can be explored by visitors. This could facilitate presenting the display groups in alternative relationships, which then would generate new interpretations of the content.

Based on this theoretical model, this section comparatively examines the potential of the gallery layouts to contribute to a reproduction of the content narrative or the creation of alternative interpretations. This examination uses two levels: The first level examines the degree to which the content has a highly structured or less structured conceptual organization; the second level looks at whether this content is presented in a highly structured or less structured physical layout.

Whether exhibition content is highly structured or not can be determined on the basis of the display strategies that are applied to interpret the content in relation to accepted scholarly interpretations. Some of the most commonly used display strategies in contemporary museum practice are reviewed in Chapter 2. As discussed, the more scholarly a museum institution is, the more closely the display strategies follow the conceptual structure defined in art historical interpretations, such as a chronological ordering. Also, as discussed by Serota, the more rich and complete the museums' collections, the more they are able to present their content in a scholarly manner and thus, the exhibition content is likely to be more strictly structured to reflect the traditional art historical interpretation of the content (Serota, 1997). However, museums that have less complete collections often present works of art to be appreciated in relation to experiential qualities such as visual affinities, which can be grasped by a broad audience. This presentation strategy may not rely on the existence of strong conceptual ties among other display groups, potentially leading to a conceptually less structured content organization.

Given their robust collections, the YCBA and the MoMA are renowned as scholarly institutions, and thus they have the potential to plan and present their exhibitions in a structured manner in keeping with art historical interpretations. Indeed, due to the richness of their collections as well as their rigorous goals for interpretation, the MoMA and the YCBA are prone to having highly structured narrative organizations. In contrast, the HMA's curatorial intention is shaped by the aim to address a broad audience, which implies that the curatorial approach is more populist rather than scholarly. As discussed by the curatorial team, since the HMA does not have a complete collection of modern and contemporary art, their exhibitions are shaped by display strategies presenting art on the basis of visual affinities among distinct display groups as well as the experiential qualities of certain works of art (Brenneman, 2006). Thus, unlike the MoMA and the YCBA, the HMA is likely to present its collection in a less structured manner.

7.3.1 The Degree of Structure in the Exhibition Narratives

The curatorial intent of the three case study museums results in different, conceptual organizations of exhibitions.

In the YCBA, the content representing British painting and sculpture between 16^{th} and mid-19^{th} centuries is presented in chronological sequences that reflect their development during this time. In these sequences, the works of art are organized according to the themes through which British art has been understood and studied in the scholarly literature. These themes include historical periods, genres, or the individual artist. The chronological arrays of these themes establish the structure of the entire organization. Despite this structure, the installation employs some strategies that downplay strong historical interpretation of the displays. As explained by the curatorial team, some works of art are placed in reference to the architectural characteristics of the gallery (i.e. atrium opening) or to create aesthetic combinations with other works without necessarily following the historical significance. These strategies in the installation offer a break from the structured story line. Therefore, the YCBA's narrative can be considered structured, but slightly less so compared to that of the MoMA.

In the MoMA, art from the late modern and pre-contemporary (1940s to the 1980s) is presented on the basis of Alfred Barr, Jr.'s categorization of the works of art, which emphasizes movements and styles. Since movements evolved during a certain time line (from 1940s to 1970s), the displays are organized according to an implicit chronology. Within this chronology, movements and styles have a complex pattern of evolutions, transformations and derivations from each other, and this complexity is captured by creating display groups that are interconnected. Therefore, the exhibitions have a highly structured conceptual organization shaped around the chronology.

The HMA gallery layout presents a narrative of American modern, contemporary and self-taught art seeking dialogues among the works in these three groups. Although this narrative emphasizes a unified story of these three genres, the actual narrative may require that they be interpreted autonomously. Given the intent to emphasize connections among the works of art, the display groups in the HMA are organized with boundaries between them that are less clear than the display boundaries of the MoMA and YCBA. The displays of various artistic productions (painting, furniture, industrial objects) are grouped on the basis of their visual affinities and placed together to present the artistic milieu of the key periods of American modern art or to present the shared artistic motivations that influenced the Self-taught artists. In presenting the contemporary art, the HMA either arranges the less strictly grouped display objects in an implicit chronology or places the recently acquired objects with less salient relations to be experienced together across space. Therefore, compared to the YCBA and the MoMA the organization of the exhibit content can be considered much less structured.

These observations indicate that the MoMA's narrative organization can be considered the most structured among the three; the YCBA's narrative structure can be regarded less structured than the MoMA's; whereas the HMA's has the least structured narrative organization in the three case studies. This conclusion is demonstrated by the diagram in Figure 7.3, which reveals the degree of organizational structure of the narratives.

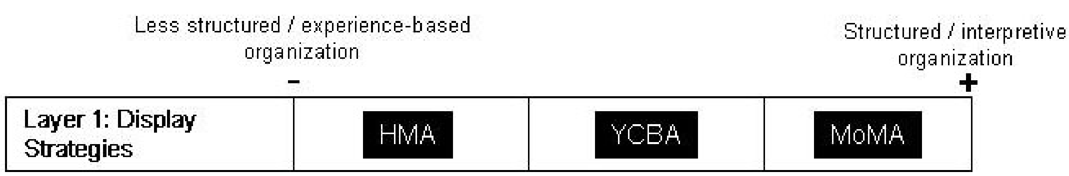

Figure 7.3 Diagram mapping the degree to which the case study museums used conventional display strategies or took a more liberated approach

7.3.2 The Degree of Spatial Structure in the YCBA, the MoMA and the HMA

While the previous section discussed how structured the displays were in the three museums, this section examines the degree to which the gallery layout of each museum is structured.

In the case study analysis chapters, the degree of spatial structure is analyzed on the basis of global and local spatial properties. As can be seen on these analyses, visually highly integrated layouts include a higher number of units that are visually close to all other units and thus the layout is less structured at the global level. Similarly, visually more connected layouts include spaces that have visual access to many other units in their neighborhood, and this indicates that those layouts can be considered less structured at the local level. In terms of visitors' experience, the visually integrated layouts would have a lot of spaces that can be seen within a few steps from the other regions in the configuration and thus a visitor's vision is less restricted when exploring and grasping the layout. In contrast, in visually less integrated layouts a visitor can visually grasp the space only by moving to different locations. As for the implications for exhibition narratives in the gallery layouts, in a visually integrated (less structured) layout, the spatial units would be visually interrelated to many other spaces; thus, the display groups in those spaces can be read comparatively with the displays in other spaces. This opportunity may facilitate exploring the various relationships among the display groups. More specifically, an integrated layout may facilitate relating the display groups with larger groups of displays than would be available only in the subsequently permeable spaces. On the other hand, the visually less integrated layouts dictate the order in which displays can be seen, and thus limit the ways in which display groups can be associated with each other. A similar potential can be observed at a local level when there are high degrees of visual connectivity in a space. In gallery layouts that have higher visual connectivity the displays can be related to a number of other displays in the neighborhood; however, the gallery layouts that have lower visual connectivity will have limited connections among the displays in the neighborhood, which can be explored only through directed movement. Therefore, visually connected gallery layouts offer opportunities to generate alternative interpretations of the narrative at a local level.

As introduced in the Methodology chapter section 3.5, the degree to which the case study museum layouts have highly structured or less structured spatial organization can be examined through the mean connectivity and mean integration values along with their standard deviations. These values obtained from the three museum layouts are provided in Table 7.2. In order to evaluate the values comparatively, the mean integration and mean connectivity were mapped into a diagram shown in Figure 7.3 that visualizes the increments in these measures. To compare the gallery layouts in terms of their layout size, this diagram also includes a bar mapping the analyzed "grid cells" counts of the three layouts indicated in Table 7.2. This bar serves as a reference to evaluate the comparison of the mean integration and connectivity values. As shown in the diagram in Figure 7.3 and the values in Table 7.2, the YCBA layout has the lowest values of visual connectivity, and thus has strictest spatial organization at the local level. The HMA is has the highest general capacity for visual connectivity, and thus can be considered the least structured layout at the local level. The high standard deviation in the HMA's mean connectivity value implies that some display areas are highly connected to their neighborhood, offering a view of the largest amount of space possible, while others are severely isolated. In contrast to the HMA, the MoMA layout has a rather high connectivity that barely deviates from the mean, and

Table 7.2 Comparison of Mean Connectivity and Mean Integration measures along with the gallery areas measured by number of grid cells

	YCBA	MoMA	HMA
Mean V. Connectivity	**782.58**	**916.46**	**1018.46**
V. Conn. St. Dev.	**396.60**	**367.12**	**505.22**
Mean V. Integration	**8.24**	**6.08**	**7.07**
V. Integration St. Dev.	**1.66**	**1.02**	**1.46**
Number of grid cells	**6466.00**	**11033.00**	**11423.00**

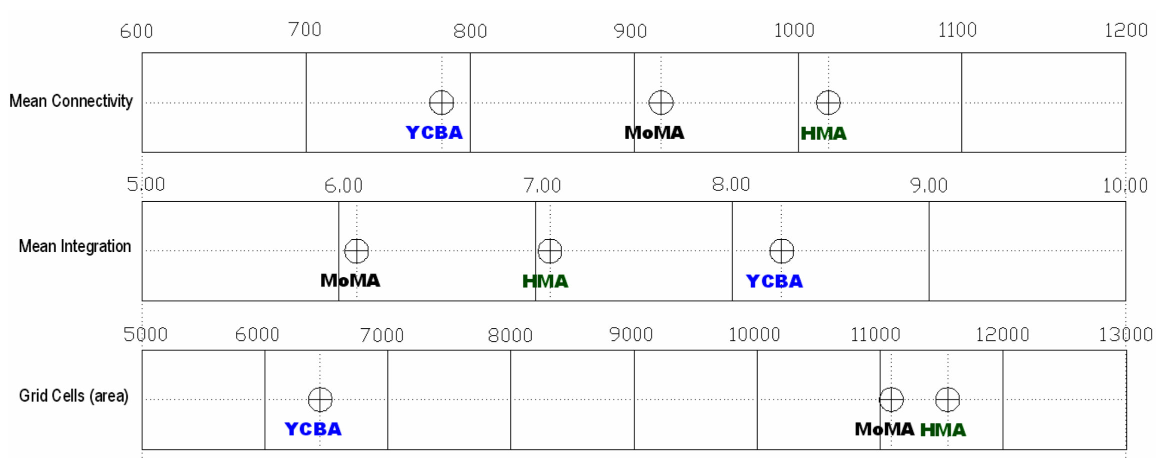

Figure 7.4 The diagram mapping the three layouts with the mean connectivity, integration values, and visual intelligibility and analyzed grid cell measures

thus most of the galleries are interconnected to their neighborhood. According to the mean integration values in Table 7.2, the 4th floor of the MoMA has the lowest mean integration and this varies little within the space, indicating that among the three layouts it has the most structured spatial organization at the global level. To sum up, the YCBA has the highest visually integrated layout among the three, and thus it is the least visually structured layout at the global level. The HMA is visually more integrated than the MoMA and thus has less structured spatial organization at the global level.

These results suggest that, at local level the YBCA offers limited possibilities of connecting neighboring spaces visually, as discussed earlier in reference to the directed sequences in some gallery areas. Nevertheless, it presents quite rich possibilities in terms of relating each space to every other space in the layout. A relatively high standard deviation in the mean integration implies high levels of integration concentrated in certain areas, such as the room sequence in the northern part of the YCBA atria core. The MoMA's layout offers the opposite potential; makes available quite rich connections at the local level through gateways between the galleries, although it is the most limited of the three museums in terms of visually relating each space to every other space. As the standard deviation values suggest, both of these properties of the MoMA are quite evenly distributed throughout the layout, meaning that there is no explicit spatial hierarchy. On the other hand, the HMA provides the richest possibilities in connecting spaces visually at the local level, but this potential is highly localized in some parts, such as the central spine through the Stent wing and some choice point locations in the Wieland wing. The HMA's layout has relatively high values of visual integration in terms of global level visibility. Only in some parts, such as the longitudinal central spine, are there very rich possibilities of being close to all other spaces.

7.3.3 The degree of structure in the narrative organization and spatial organization

So far the previous sections in this chapter have examined separately narrative structure and spatial structure, which define the potential of a layout to reproduce the prescribed narratives or generate their alternative interpretations. However, to understand more fully the potential of the layouts, the two parameters for each of the three museums need to be examined together. This can be done on the basis of a coordinate diagram (Figs 7.5. and 7.6) mapping the degree of layout structure on the “x” axis, and the degree of narrative structure on the “y” axis. For both coordinates the (+) quadrants express the degree of being structured and (-) quadrant indicate the degree of being unstructured. The gallery layouts of the case study museums are included in this diagram according to their relative degrees of the structure of their narrative and layout organizations. More specifically, on the “y” axis, the (+) quadrant maps a high level of structure in the conceptual organization of the narrative according to art historical interpretations. The (-) quadrant indicates a less structured presentation that promotes experiential qualities of the displays. As discussed above, the exhibition installations of the MoMA and the YBCA have a structured organization given their robust collections and their traditional scholarly approaches to exhibiting art. As discussed, the YCBA’s display strategies offer a somewhat less structured narrative organization since some works of art were placed on the basis of aesthetic considerations. Therefore, according to Figures 7.5 and 7.6, in roughly determined increments shown on the “y” coordinate, the MoMA is situated a level above the YCBA in the (+) quadrant representing a conventional approach, while the HMA is placed on the (-) quadrant since its narrative organization is based upon less salient categories and experiential qualities in the works of art.

The degree of structure in the spatial organizations of the three gallery layouts is expressed with the mean connectivity and integration values and shown in Fig.7.4 are mapped into the x coordinates in Figures 7.5 and 7.6. As discussed at the beginning of this section, the

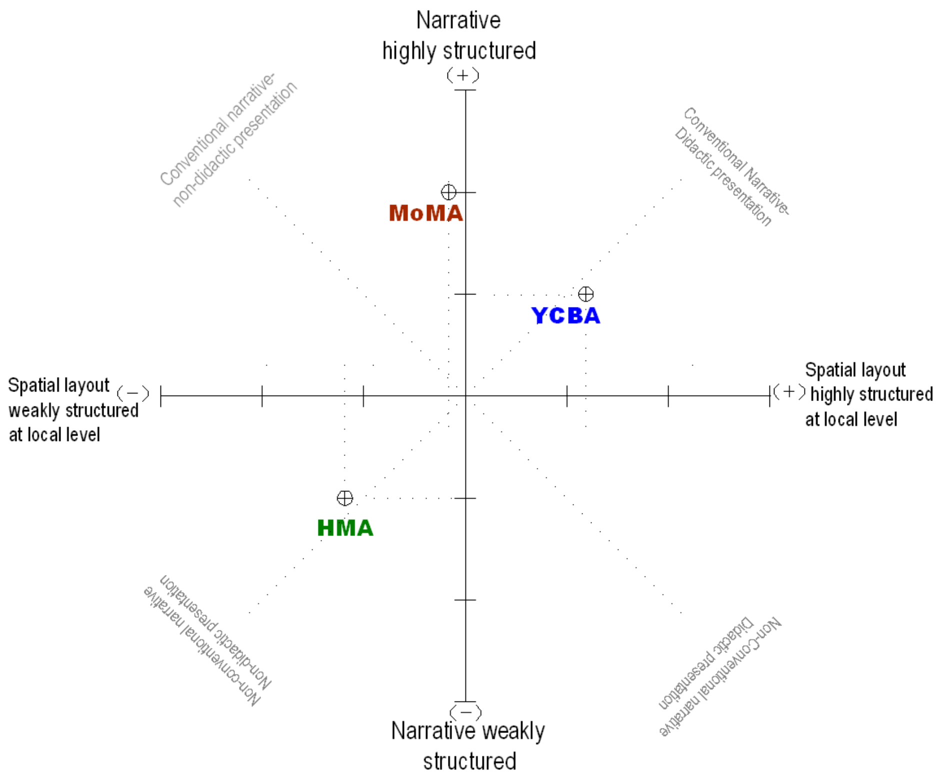

Figure 7.5 Diagram mapping the case study layouts with respect to structure in their narrative organization and local spatial organizations

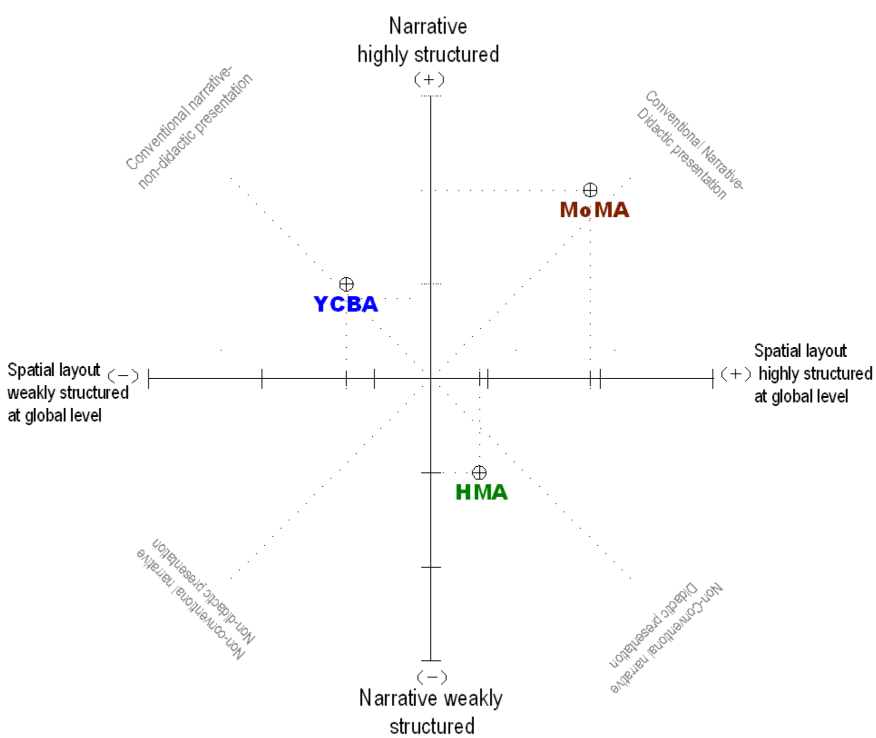

Figure 7.6 Diagram mapping the case study layouts with respect to structure in their narrative organization and global spatial organizations

higher the mean values of connectivity and integration the less structured the spatial organization is at the local and global levels.[36]

The intersection of the values on the x and y coordinates indicating the degree of structure in the narrative and spatial organizations helps reveal the potential of the layouts to promote the reproduction of the exhibition narrative or generation of a new one. As can be seen in Figure 7.5 the YCBA's layout presents a very structured narrative in a highly structured spatial organization at the local level. This indicates that the exhibition narrative of the 16-19th century British art is presented with limited possibilities of relating the display groups with each other created by single sequenced and visually isolated gallery rooms. Nevertheless, the standard deviation value in the connectivity measure (Table 7.2) and connectivity graphs indicate that there are some locations where local visibility values are higher and the display groups can be visually related to the others in the neighborhood. As can be seen in the connectivity graph (Fig.7.1) these visually connected locations can be found around the atria openings. Despite the general limitation in connecting the displays at a local level, the high value of mean visual integration in Figure 7.6 suggests that the YCBA presents a very structured narrative in a less structured spatial organization at the global level than the local level. This potential exists because each space affords visual proximity to every other space through spatial interrelations provided through atria openings and openings at the gallery room corners. As suggested by the standard deviation of mean visual integration and the visual integration graph (Table 7.2 and Fig.7.1), the property to be visually close to other spaces is concentrated in the northern-side sequence of the atria core, which presents the British portraiture. Therefore, the potential of the layout to generate narratives works mostly to establish alternative relationships of the British portraiture with other themes. As a result, at the global level the YCBA is a layout conducive to

[36] The standard deviation values of the connectivity and integration values are disregarded in these diagrams.

generating alternative interpretations of the exhibition narrative. At the local level, however, the presentation of the content is more didactic.

Figures 7.5 and 7.6 suggest that the MoMA's fourth floor layout presents a structured narrative of late modern and pre-contemporary art through a spatial organization that is highly structured at the global level and less structured at the local level. More specifically, the layout presents a scholarly interpreted content through a highly organized viewing order at the global level, and this restricts the opportunities to relate the display groups across space. As the lower standard deviation of the integration values suggest, the global visibility does not vary in high ranges and thus the layout has a weak spatial hierarchy at the global level. At the local level, richer possibilities of visually connecting displays are afforded with spatial interconnectedness through doorways where visitors have opportunities to relate the chronologically subsequent displays with each other in multiple ways. Indeed, the MoMA uses these opportunities to accentuate the complexities and contrasts among the art movements that characterize the development of the late modern and pre-contemporary art that cannot be presented in a strictly linear viewing sequence. Indeed, as understood from the interviews with the curator, the MoMA collaborated with the architectural team to create galleries that are spatially interconnected to each other in order to present a narrative that acknowledges the inherent complexity in the story of modern art (Elderfield, 2004). Therefore, even though the MoMA layout offers some potential to generate alternative interpretations, since the MoMA controlled the layout planning, it can be argued that the fourth floor gallery layout presents the narrative in a highly didactic manner.

As the diagrams in Figures 7.5 and 7.6 suggest, it is possible to conclude that the HMA's skyway layout presents an unstructured narrative in a gallery layout that has varying degrees of structure at the local and global levels. The high mean connectivity value indicates that the HMA layout can be considered less structured at the local level. However, it should be noted that the connectivity values in the skyway layout vary between much higher and much lower values

(Table 7.2 and Fig.7.1). This means that some parts of the layout may present many possibilities for connecting the displays with others in the neighboring locations, while in some other parts these possibilities are limited. As can be seen in the visual connectivity graph, higher capacity to see neighboring locations in the Stent wing's L-shape corner visually connects the works of self-taught, late modern and contemporary art displayed in different directions. A similarly high degree of connectivity in the Wieland wing visually connects the display groups of contemporary works. On the other hand, the mean integration value of the HMA gallery layout implies that the layout has a stricter structure at the global level and thus provides quite limited possibilities in reading the displays in relation to others in the entire configuration. As can be seen in the visibility graphs, this capacity is strong only in the spaces along the central spine connecting the Stent and the Wieland wings. This integration property along the spine helps relate the display groups that include some of the self-taught and contemporary works of art with other display groups that only have these genres and modern art works of art. The other parts of the HMA gallery restrict the ways in which displays groups can be related to each other. These observations suggest that, the HMA's gallery layout is spatially more interesting at the local level than the global level.

In comparison to the YCBA and the MoMA, the HMA presents the narrative in a less structured spatial organization at the local level and thus the layout has a greater potential for generating alternative interpretations of the content in small combination of displays in various parts of the gallery. The HMA's strict layout organization at the global level helps to reproduce the museums' interpretation of twentieth century American Art, which emphasizes the dialogues among the American modern, self-taught and contemporary art. Therefore, the exhibition installation in the HMA's layout works in concert with the museum's inclusive approach to investigating the dialogues among the works of the modernist tradition and untrained artists.

As can be seen from these observations, the YCBA, the MoMA and the HMA gallery layouts have various potentials to reproduce or generate the exhibition content at local and global levels. These potentials frame the curatorial voice of the three museums. The MoMA maintains a conventional and scholarly approach, while acknowledging the complexity of the content. The YCBA also has a scholarly approach, but is relaxed and through the atrium introduces an aesthetic dimension to exploring further dialogues between the works of art. The HMA layout frames the museum's own curatorial interpretation of the content which appreciates grassroots art together with the known masterpieces of scholarly interest, while allowing alternative comparisons among the displays at the gallery room level, and thus contributes a more inclusive interpretation of twentieth century American art.

7.4 Prediction of the Space Use Patterns by the Visibility Properties of the Three Museums

In order to explore to what extent the gallery layouts of the museums predict the space use patterns, this study looks at the potential links between visibility properties and the distribution of space-use patterns in the three gallery layouts. As explained in the Introduction, these links are investigated on the basis of both top-down and bottom up characterizations of space; to this end, the analysis correlates syntactical and non-syntactical visibility properties with the measures describing the three kinds of space use patterns. In this section, the analyses of the space use patterns and their links with the visibility properties in the three museums are comparatively discussed.

7.4.1 The Distribution of the Space-Use Patterns in the Three Layouts

Before discussing the correlation analysis results, this section compares how the space use patterns (exploration, display viewing, and making contact with layouts) were distributed in the three layouts.

In the examination of the patterns of exploration, the distribution of exploratory behavior is expressed by the number of lines crossing each gallery in the three layouts. As might be expected, the movement distributions differ among the three layouts. The rates of exploratory movement are given in Figure 7.7a, which shows that the YCBA has the highest number of movement lines (47-33 lines) crossing the gallery space located between the two atria, the Introduction gallery. In the MoMA, the spaces crossed by the highest numbers of movement (63-39 lines) are along the room sequence starting from the north entrance and moving towards the south galleries in a counter-clockwise direction. In the HMA, the highest numbers of movement lines (48-33 lines) are in the galleries located along the longitudinal axis connecting the two wings of the museum (Fig.7.7).

To examine patterns of display viewing, this study aimed to understand in which galleries visitors made more frequent contact with displays, and thus used the measures derived from the stop counts in the three museums. As discussed in the previous chapters, one of these measures is the average of stops counts for each display object in each gallery. Another way of looking at stopping behavior was to count how many displays were viewed in each gallery regardless of how many times they were visited. When the distributions of these two measures were examined in the three gallery layouts, considerable variation was found in terms of the kind of locations where visitors tended to stop and view the displays. As can be seen in the diagrams illustrating the statistical results (Figs. 7.7b and 7.7c), in the YCBA, the galleries where visitors stopped most frequently to view displays are located around the atria, although not all rooms around the atria have high counts. In the HMA, visitors stopped more frequently and viewed a higher number of displays in the galleries situated at the periphery. In the MoMA, the spaces where displays are viewed frequently do not show a particular pattern; in fact, the rate of contacting displays is higher in galleries where popular paintings are located. When we compare the stop counts rates with the rates of exploratory behavior, for both the MoMA and the HMA high rates of stopping do not always overlap with high rates of movement. This disparity between the patterns of contacting displays and exploratory movement is discussed further in the following section along with the correlation results.

The patterns of contact with layout were examined by looking at the stops that took place as visitors scanned galleries visually or looked at the atria, i.e. 'scanning stops.' The percentage of 'scanning stops' within all stops recorded in each gallery was used to examine the data in the three layouts cross-comparatively. In the YCBA the higher scanning stop rates are found in the Introduction gallery. This might be due to the observed tendency of visitors to scan the space through the western (entry) atria openings. High scanning stop rates are also registered in the spaces overlooking the main atria. It is likely that the west atrium in the YCBA attracts scanning stops by creating opportunity for orientation upon arrival at the gallery, while the main atrium motivates visitors to stop to look around by creating an opportunity for a restorative pause half way through their itineraries. In the MoMA, the high percentage of scanning stops are found in the circulation space overlooking the atrium and gallery 28 which includes large size contemporary works. This indicates that the space usage in these spaces is characterized with the behavior of scanning the gallery environment to get oriented. In the HMA, the central spine is the space where visitors' stopping behavior is characterized by the scanning behavior.

An examination of the percentage of scanning stops in conjunction with movement line distribution (Figs. 7.7a and 7.7e) shows that the percentage of 'scanning stops' is usually higher in the spaces with high rates of exploratory behavior. In the YCBA and the HMA, spaces with high rates of the scanning stops and the exploratory movement mostly coincide. In the MoMA, while the spaces with high rates of scanning stops somewhat coincide with spaces where exploratory movement is concentrated, other spaces on the east side of the gallery floor, which are in fact circulation areas around the north entrance, clearly have higher rates of scanning stops.

These observations suggest that for all three museums, visitor scanning behavior takes place in approximately similar locations as visitors' exploratory behavior.

The similarities in the distribution of the scanning stops and exploratory movement can be confirmed with correlation values obtained from a direct comparison of movement lines and stop counts in the galleries of the three museums. As can be seen in Table 7.3, exploratory movement and scanning stops co-vary, whereas stops to view displays seem to occur in places other than those with high rates of exploratory movement. With regard to the relationship between exploratory behavior and display viewing behavior, further correlation investigations

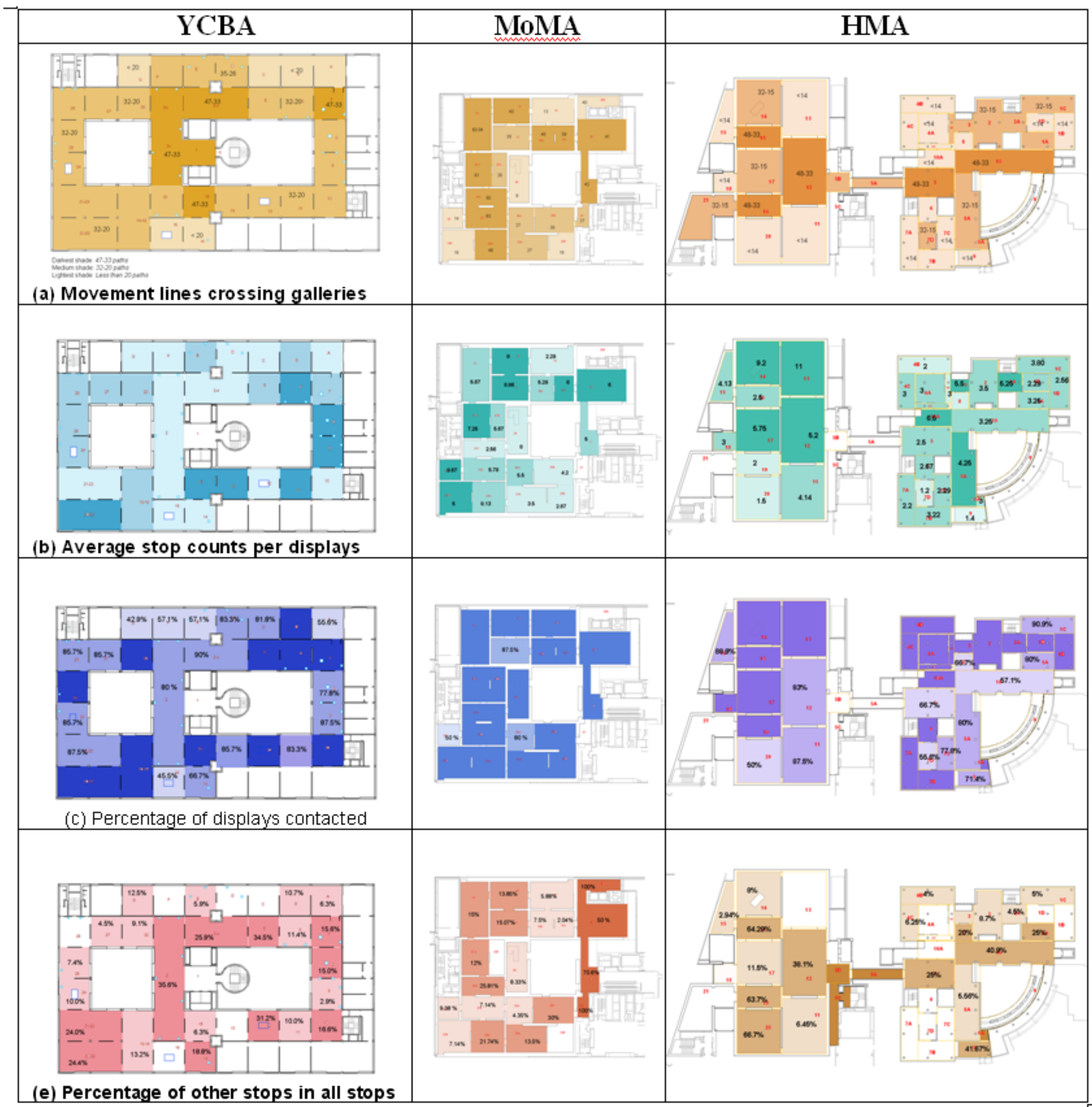

Figure 7.7 Comparison of Gallery Layout in terms of their Spatial Layout Properties

Table 7.3 Direct correlations between movement lines and stop counts in the three museums

		Stops at displays	Scanning stops	
Number of movement lines crossing each gallery	YCBA	0.17	0.53	***r***
		0.376	0.002	***p-value***
		-	0.28	R^2
	MoMA	0.32	0.55	***r***
		0.14	0.010	***p-value***
		-	0.30	R^2
	HMA	-0.62	0.63	***r***
		0.727	0.000	***p-value***
		-	0.40	R^2

normalizing the effects of gallery room size and available displays showed that only in the YCBA are stops describing display viewing and exploratory movement found to be somewhat linked.

The influence of visibility structure in predicting the space-use patterns is investigated separately for the patterns of exploration, display viewing and making contacts with layout. The analysis results of these patterns in the three museums, specifically, variations in the results in reference to morphological characteristics of the three museums are discussed cross comparatively in the next section.

7.4.2 Prediction of Explorative Behavior

The investigation correlating the number of movement lines with the visibility properties of the galleries suggests that in the YCBA, the MoMA-New Extension and the HMA visibility predicts explorative movement. The analysis shows consistency in the effect of visibility on the patterns of explorative movement, but there is some variation in the aspects of visibility that predicts these patterns in the three museums. First, in all three museums to some extent visual integration (the capacity to be visually close to all other spaces) influences visitors' exploratory movement. However, this influence varies in strength and significance throughout the three layouts. In the YCBA, for instance, global visibility properties predict more than half of the variation in exploratory movement. This effect can be considered quite strong given the possible other factors that can influence visitors' movement. In the HMA, visibility accounts for one third of the variation in movement. The lowest effect of global visibility is in the MoMA where visual integration explains only one fifth of the variation of movement lines, and this effect is found to be less significant than the results found in the other case studies (Table 7.4). Second, the property of visual connectivity, the capacity to see neighboring locations, also has some effect on exploratory movement in the three museums. But, again the strength of this influence varies. The correlation results show that in the MoMA connectivity is the syntactical property that has the strongest influence on movement, while in the YCBA it has the weakest effect (Table 7.4). This result suggests that in the MoMA local visual information seems to be the most influential in guiding visitors' exploration. Although this property has a weaker effect on movement in the HMA and the YCBA, it still plays an important role in how people move through these layouts. Finally, visual control, which is connectivity to less connected spaces, has the weakest effect in the YCBA; in the two other galleries this property plays a role only where the effects of local visibility properties are stronger.

If these results are interpreted in reference to the levels of integration and connectivity available in the three museums (represented by mean integration and mean connectivity values in Table 7.1), what emerges is that the extent to which exploratory movement is predicted by visibility properties parallels the strength of these properties in the gallery layouts. In other words, visitors are guided by the best available levels of visual information. Since the MoMA and the HMA are not well integrated overall and not very intelligible, it is the connectivity value that guides exploration; however, in the YCBA the most influential property is visual integration. When these results are interpreted along with the morphological characteristics shaped by the atria and room configurations, the results show that the YCBA's morphology, shaped by two atria visually linking the galleries in multiple directions, conveys global level information that guides visitors in their navigation. In the MoMA, the interrelation of gallery rooms is achieved only through doorways, and a limited connection between the rooms, while the atrium restricts visual information to the local level. As a result, visitors are guided step-by-step through information that is progressively disclosed. In the HMA, the morphology is shaped by central axis in the longitudinal direction and attracts visitors' exploratory behavior along that direction, as confirmed with the influence of visual connectivity and integration that are strong along the central spine. The galleries at the periphery of the two wings are characterized by moderate level visual connectivity due to interconnectivities among the adjacent rooms and this explains the distribution of movement towards those areas.

Table 7.4 Correlations of number of movement lines with VGA measures in the rooms of the three gallery layouts

		Visual Integration (HH) Max.	**Visual Integration (HH)**	**Connectivity**	**Visual Control**	
Number of movement lines crossing each gallery	**YCBA**	0.77	0.76	0.60	0.38	***r***
		0.000	0.000	0.000	0.031	***p-***
		0.59	0.58	0.36	0.14	***R²***
	MoMA	No correlation	0.43	0.68	0.66	***r***
			0.047	0	0.001	***p-***
			0.18	0.46	0.44	***R²***
	HMA	0.44	0.57	0.64	0.54	***r***
		0.006	0.000	0.000	0.001	***p-***
		0.19	0.32	0.41	0.29	***R²***

The results concerning the prediction of movement on the basis of non-syntactic visibility properties of the gallery rooms (the average values of visual field measures in each gallery) illuminate what aspects of local visual information may play a role in the modulation of movement. Specifically, in the three museums movement is influenced by local non-syntactic properties, such as isovist occlusivity, the isovist perimeter, the isovist maximum radial and isovist area (Table 7.5). In both the YCBA and the MoMA, significant correlations were found for the isovist occlusivity, isovist perimeter and area measures. This indicates that in these gallery layouts hidden regions (expressed by occlusivity), exposed wall surfaces (denoted by perimeter), and the size of visible regions (expressed by area) are important aspects of local visual information that modulates movement. In the HMA, the promise of exploring hidden regions and exposed surfaces seems to be less important, while the size of the visible regions is the most influential local visibility aspect that predicts movement.

A key step of this investigation focused on the number of paths distributed in available directions at the spaces offering choice and investigated the extent to which gradually unfolding information in permeable directions influences people's choice to move towards these directions. The results show that in all three gallery layouts, isovist occlusivity, which represents the availability of hidden regions, has some effect on visitors' choice in the direction of movement. This suggests that visitors have some tendency to move towards the directions where they can explore hidden regions, and this tendency is stronger in the YCBA than in other layouts (Table 7.6). However, the correlation between the isovist perimeter and movement paths in the MoMA and the HMA indicates that visitors seem to be attracted to directions with more visible wall surfaces. The effect of area and drift in the HMA gallery indicates that the visible area extending away from the visitors' vantage points plays quite an important role in the distribution of movement in permeable directions.

Table 7.5 Correlations of number of movement lines with VGA measures in the rooms of three gallery layouts

		Isovist Occlusivity	**Isovist Perimeter**	**Isovist Max Radial**	**Isovist Area**	
Number of movement lines crossing each gallery	**YCBA**	0.67	0.69	0.38	0.64	***r***
		0.000	0.000	0.033	0.000	***p-***
		0.45	0.48	0.14	0.41	R^2
	MoMA	0.64	0.72	-	0.68	***r***
		0.001	0.000	-	0.001	***p-***
		0.41	0.52	-	0.46	R^2
	HMA	0.38	0.49	0.40	0.65	***r***
		0.017	0.002	0.014	0.000	***p-***
		0.14	0.24	0.16	0.42	R^2

Table 7.6 Correlations between percentage of movement lines and visual field measures in corresponding directions at the choice locations

		Area	**Drift**	**Perimeter**	**Occlusivity**	**Compactness**	
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
	HMA	0.57	0.63	0.56	0.40	0.57	***r***
		0.000	0.000	0.000	0.013	0.000	***p-***
		0.32	0.40	0.31	0.16	0.34	R^2

With these results in mind, it can be concluded that the three gallery layouts contribute visual attributes that guide visitors at a local level and that become available through room configurations and display arrangements. More specifically, the results imply that in the MoMA and the YCBA the extent of visible wall surfaces (and by extension their associated displays) play a part in shaping exploratory movement. In the HMA, the demonstrated effect of isovist area on movement may be affected by the larger size of the gallery spaces (in comparison to MoMA or YCBA) that may offer visitors attractive visible areas with the displays installed at their central locations. The demonstrated link between movement and the isovist maximum radial in the HMA and the YCBA may be explained by the fact that their galleries offer distant views which also apparently attract visitors; this, however, is not a characteristic offered in the morphology of the MoMA.

In addition to these findings indicating the effect of visibility on exploratory movement at the gallery room scale, the finer grain investigation of this effect shows that only in the MoMA the effect of syntactical and non-syntactical visibility influences the distribution of movement at the scale of an individual space. Thus, the MoMA's visitors are attentive to minor variations in what can be seen from the locations in which they move. In the HMA, however, only the capacity to see visually isolated spaces in the neighborhood has some effect on visitor movement (Table 7.7). The stronger results obtained in the MoMA can be explained by the degree to which visibility varies inside the MoMA's gallery rooms. According to the connectivity graphs of the three museums, of the three museums, the MoMA has the greatest degree of variation in the

Table 7.7 Correlation between movement line counts and grid isovist + VGA (Syntax 2D) values

		Non-syntactic			Syntactic		
		Area	**Perimeter**	**Drift**	**Connectivity**	**Control**	
Movement line counts (5-foot) in grid cells	**MoMA**	0.43	0.43	-0.36	0.45	0.48	***r***
		0.000	0.000	0.000	0.000	0.000	***p-value***
		0.19	0.19	0.13	0.20	0.23	***R^2***
	YCBA	*No Correlation*					
	HMA	*No Correlation*				0.34	***r***
						0.000	***p-value***
						0.12	***R^2***

connectivity property because its gallery rooms are large enough for variation in this connectivity property to be registered.

7.4.3 Prediction of Stopping to View Displays

The analysis comparing the stop counts viewing displays with visibility properties helps clarify to what extent visibility predicts visitors' display viewing behavior. The results show that although visibility has some effect on the stopping to view displays, this influence greatly varies in the layouts of the YCBA, the MoMA and the HMA. The investigation using stop counts normalized with the number of displays demonstrates some links with global visibility only in the YCBA and the MoMA, but not in the HMA. In the YCBA, visitors tend to stop for display viewing at integrated spaces more than at other spaces. In contrast, in the MoMA, stop counts are inversely related to visual integration; here visitors tend to stop to view displays at visually segregated spaces. The visual connectivity property does not appear to influence stopping behavior in either the YCBA or the MoMA.

When this investigation is repeated with the stop counts normalized by room areas, in the HMA, however, visitors stop to view display more often at the spaces with low connectivity and low integration.[37] These results suggest that except for the YCBA, in the MoMA and the HMA visitors' contact with displays co- varies inversely with visual integration; further, in the HMA there is also an inverse relationship with connectivity. Thus, in the MoMA and the HMA, where visual integration is limited and localized, visitors stop to view displays in segregated galleries. At the same time, the inverse effect of integration on viewing displays may suggest that visually segregated locations may provide visitors with enhanced opportunities to focus on the displays. In the MoMA, the negative effect of integration on viewing displays can also be explained by the placement of popular displays in segregated galleries.

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[37] The correlation of the stop counts normalized with room area did not show significant results for the YCBA, and the correlation with stop counts normalized by display demonstrated no link for the HMA. This implies the stop counts might be skewed by the number of displays in the HMA galleries, while the counts might be skewed by room area in the YCBA.

These implications can be elaborated along with the results obtained from the investigations correlating non-syntactic visibility properties with the stop counts. When the stop counts (normalized by displays) were correlated with non-syntactic properties, in the YCBA a positive association was found for the isovist maximum radial and a negative link for isovist compactness. Given that isovist compactness expresses the degree to which a visible region is convex in shape, the negative effect of isovist compactness suggests that visitors tend to stop more often in galleries where visibility is extended in various depths in the space. The significant correlation with longer lines of sight suggests that visitors stop to view displays more often in locations that offer longer visual vistas (Table 7.8). In the YCBA, these tendencies in display viewing behavior might be associated with a smaller exhibition area, where visitors are interested in the information beyond the confines of the gallery. However, in the HMA the analysis (using stop counts normalized by display numbers) indicates a negative association between stopping behavior and visual field area (Table 7.9). This result suggests, in this larger museum visitors tend to contact displays in locations that have fairly contained views.

These results demonstrate that in the three layouts non-syntactic properties shape stopping behavior to view displays in various ways. This variation may also explain the different effects of visual integration on viewing displays. As discussed earlier, the effects of visual segregation on stopping behavior in the MoMA and the HMA indicate that visitors tend to have more contact with displays in galleries that are segregated from the rest of the layout and offer the potential for focused viewing. Furthermore, the results obtained from local non-syntactic measures confirm that at least in the HMA visitors tend to view displays more often in locations where views are contained (consistent with the demonstrated link of the stops for display viewing with low connectivity and with smaller visual areas). On the other hand, in the YCBA, visitors tend to have more contact with displays in visually integrated spaces; and here local non-syntactic measures suggest that visitors view displays more often in locations with longer lines of sight and non-convex visual fields. Given that these contrasting effects of local visibility are found in the YCBA and the HMA, whose galleries differ in size (demonstrated by grid cell counts Table 7.2), the difference might be related to the size. In the smaller galleries visitors might be interested in the information beyond the confines of the visited galleries, whereas in the larger gallery visitors may tend to experience displays in contained environments.

Table 7.8 Correlations between display stop counts (normalized by displays) and visibility measures in each gallery room

		Syntactic		Non-syntactic		
		V. Integ. (HH) Max.	**V. Integration (HH)**	**Isovist Compactness**	**Isovist Max Radial**	
Stops at displays (normalized by n. of displays)	**YCBA**	0.38	0.45	-0.48	0.52	***r***
		0.033	0.012	0.006	0.003	***p-value***
		0.14	0.20	0.23	0.27	***R^2***
	MoMA	-0.45	-0.51	*No correlation*		***r***
		0.039	0.019			***p-value***
		0.20	0.26			***R^2***
	HMA	*No correlation*				***r***
						p-value
						R^2

Table 7.9 Correlations between display stop counts (normalized by areas) and visibility measures in each gallery room

		Syntactic			Non-syntactic	
		V.Integration (HH) Max.	**V. Integration (HH)**	**Connectivity**	**Isovist Area**	
Stops at Displays (normalized by room areas)	**YCBA**	*No correlation*				***r***
						p-value
						R^2
	MoMA	-0.67	-0.51	*No Correlation*		***r***
		0.001	0.019			***p-value***
		0.45	0.26			***R^2***
	HMA	-0.54	-0.57	-0.50	-0.55	***r***
		0.001	0.000	0.002	0.001	***p-value***
		0.29	0.32	0.25	0.30	***R^2***

A number of other results regarding visitors' stopping to view displays reveal how viewing displays in YCBA might be predicted in the few galleries where visual connection to all other spaces is absent. In the YCBA, it was found that visitors tend to visit the displays that can be easily seen in the confines of visually segregated gallery rooms. This indicates that for galleries that are visually distant and isolated from the rest of the layout, the behavior of stopping to view displays is influenced by the local visibility properties of the display locations. It could be suggested that in visually isolated galleries, visitors are seeking the highest level of available visual information. To accomplish this, the YCBA visitors tend to balance their use of visual information. However, these same results were not found in two other museums, suggesting the need for further investigation to obtain a substantive explanation.

If these findings are compared with those concerning the prediction of movement, it can be concluded that exploratory behavior and display viewing behavior are not predicted by similar aspects of visibility in all three layouts. In the MoMA and the HMA, exploratory behavior and behavior of viewing displays are motivated by different properties and these behaviors take place in different parts of the layouts. In contrast, in the YCBA viewing behavior seems to be influenced by similar aspects of visibility that predict exploratory behavior, though less strongly so than in the prediction of the exploratory behavior. This implies that only in the YCBA visitors tend to view displays as they move through galleries.

7.4.4 Prediction of the Stopping to Visually Survey the Gallery Environment

The investigations comparing the stops scanning the gallery space with visibility properties found that visitors' patterns of stopping to survey galleries seems to be predicted by visibility properties in the YCBA and the MoMA, but this prediction is not strong in the HMA. According to the correlations of the scanning stops (normalized by area) with visibility properties, in the YCBA, the rooms' property to provide visual access to neighboring locations and to be visually close to all other locations motivate visitors to visually scan the galleries and look at the atria spaces (Table 7.10). In the MoMA, only the capacity to see neighboring locations seems to influence the scanning behavior; visitors tend to scan the layout or look around the atria in the spaces that reveal visual information of the neighboring locations. However, the same is not true for the HMA; the influence of visibility properties on scanning behavior cannot be demonstrated in this museum. This may be due to the fact that the behavior of stopping to visually scan the galleries in the HMA occurs only in some galleries.[38] Moreover the results for both the YCBA and the MoMA show that scanning behavior in general is predicted by similar aspects of visibility structure that also predict exploratory behavior. This suggests that the behaviors of scanning the galleries and exploring take place in the same locations.

When the percentage of scanning stops among all stops are compared with visibility properties, the results show that in the YCBA visual connectivity, control and visual integration influence this percentage (Table 7.11). This result is consistent with those related to the prediction of exploratory behavior. This exploratory behavior in the YCBA is predicted by similar aspects of visibility (Table 7.4). In contrast, the MoMA results obtained from this analysis show that only the property of visual integration, seems to have an effect on scanning stops. More precisely, in visually integrated locations visitors tend to visually scan the galleries rather than view displays. If this result is evaluated together with results concerning the prediction of exploratory movement and viewing displays in the MoMA, what becomes apparent is that visual integration explicitly predicts only the percentage of scanning stops. Therefore, the behavior of scanning galleries rather than view displays occurs separately from explorative behavior and viewing displays. If the behavior of stopping to visually scan the galleries is considered as a capturing opportunity in which visitors experience the architecture, it can be argued that in the MoMA visibility at the

Table 7.10 Correlations between scanning stops (norm. by area) in all stops & VGA measures

		Visual Integration (HH)	Connectivity	Visual Control	Isovist Occlusivity	Isovist Perimeter	
Scanning stops (scanning + looking at atria) in each gallery room (normalized by area)	**YCBA**	0.46	0.59	0.59	0.45	0.47	***r***
		0.010	0.001	0.000	0.012	0.007	***p-***
		0.21	0.35	0.35	0.20	0.22	$\boldsymbol{R^2}$
	MoMA		0.53	0.64			***r***
			0.013	0.002			***p-***
			0.28	0.41			$\boldsymbol{R^2}$
	HMA						***r***
							p-
							$\boldsymbol{R^2}$

[38] In the case study analysis of the HMA, the investigations demonstrated some links between scanning stops and visibility properties, however these links cannot be demonstrated when the percentage of scanning stops are taken as a measure instead of counts of scanning stops.

Table 7.11 Correlations between rate of scanning stops in all stops & VGA measures in galleries

		Visual Integ. (HH)	Connectivity	Visual Control	Isovist Occlusivity	Isovist Perimeter	Isovist Max Radial	
Percent. of scanning stops (scan. + look. at atria) in all stops	**YCBA**	0.50	0.62	0.62	0.48	0.51		***r***
		0.005	0.000	0.000	0.007	0.003		***p-***
		0.24	0.38	0.38	0.23	0.26		***R^2***
	MoMA	0.48					0.44	***r***
		0.025					0.042	***p-***
		0.23					0.19	***R^2***
	HMA							***r***
								p-
								R^2

global level motivates visitors to experience the architecture on its own, and thus this experience is dissociated from the behavior of display viewing.

The correlation of the rates scanning stops with local non-syntactic properties, contributes to a better understanding of the aspects of visual information that motivate visitors to survey the gallery space (Tables 7.10 and 7.11). In the YCBA, the availability of hidden regions and exposed wall surfaces in the visual field modulates higher rates of scanning stops. Again, the availability of these aspects of local visual information also has an effect on explorative behavior, and one can expect that in the YCBA the behavior of surveying the galleries and explorative behavior take place in approximately the same places. In the MoMA long lines of sight seem to motivate visitors to visually survey the galleries within their general stopping behavior, and this effect is valid only for this behavior. This suggests that the opportunity to experience the architecture is separate from viewing displays and exploring gallery space. In light of this result, it can be noted that in the MoMA, the capacity to project a long lines of sight through doorways and the few atrium openings reveal information beyond the confines of the visited gallery rooms, and it appears that this information provides visitors the opportunity to visually orient themselves to the gallery layout and experience the architecture.

7.5 Interactions between Visibility Properties, Exhibition Narratives and Space-Use Patterns

A comparison of the gallery layout properties with the exhibition narratives and space-use patterns in the YCBA, the MoMA and the HMA can describe how the spatial layout, exhibition narratives and space-use patterns interact with each other through the morphology of the layouts. The potentials provided by the spatial layouts in relation to reproducing exhibition content or generating new interpretations have already been examined by reviewing the possible effects of visibility properties in presenting the narratives in the galleries. Considering the opportunities created by visual integration, the investigations focusing on the three case studies demonstrate the themes presented in the visually integrated locations can be the highlights of the exhibition narrative. There are two possible reasons for this; one is that these themes can be understood in relation to the other displays that are visually closest; the second reason is that the overall exhibition can be grasped through the lens of these themes.

In addition to these potentials in presenting certain themes more strongly, the results concerning the prediction of the space use patterns can also illuminate the potential effectiveness of the gallery layouts in conveying these themes. In other words, by examining the prediction of explorative behavior and viewing behavior in the three layouts, it is possible to see whether visitors actually come in contact with the themes highlighted through visual properties.

In the YCBA, with some influence of the global visibility levels, the high rates of movement are concentrated in the Introduction gallery between the two atria, and the galleries on the north side of the atria core. As a result, visitors very likely read the key developments in portraiture and landscape of the 17th and 18th centuries, as well as the emergence of conversation pieces as a portraiture genre, which are presented in the Introduction gallery and northern side of the atria. Due to the effect of low level visibility, the spaces seldom explored are the galleries at the northern periphery; thus, the works in these galleries, which present the earliest works in a chronological sequence starting with Elizabethan and Jacobean portraits, are not read as a priority. Due to the influence of global visibility, the layout presents the narrative of British art from the 16th to mid-19th century by privileging British portraiture. However, some of the displays groups, of course, attract visitors' attention independently of spatial factors. For instance, display presenting the Victorian period, Turner and Constable are contacted more frequently than other galleries. This shows that in addition to the influence of space the artwork itself has a quite strong effect in conveying the themes.

Other findings suggest that local visibility relationships, particularly the property of seeing neighboring locations, are less influential on visitors' explorative behavior and have very little effect on display viewing, but are more influential in terms of visitors' behavior of surveying the galleries. As suggested by its low connectivity values, the YCBA gallery layout is locally less interesting; except that the atria voids reveal visual information of neighboring locations through interconnectivities at multiple directions. Through these interconnectivities, visitors can grasp how closely related they are to the other spaces in the entire layout, and this would help visitors explore the relationships among the displays as they glimpse those in the neighboring locations. Additionally, the atria penetrations open up other displays on the atria walls, which are mainly British portraiture, to the visitors' attention. Although the YBCA connects the displays in the adjacent locations in a quite structured manner through directed sequences, the high degree of visual connectivity concentrated around the atria openings provide a chance allow visitors to notice other displays. This may result in an implicit potential to explore other dialogues among the display groups. As local visual information available through the atria space seems to predict scanning behavior more strongly than it influences viewing behavior, the dialogues between the works of art visible through the atria are likely be grasped within an awareness of the entire gallery. This may then lead to a unified image of the British works of art along with a synergistic experience of the architecture and space.

In the MoMA, visitor's explorative behavior is predicted mainly by local visibility properties. According to the correlations, the evenly patterned values of local visibility throughout the gallery rooms partially explain the distribution of movement in the layout. This implies that the structured presentation of the content through visual interconnectivities at the local level is quite effective. Indeed, the distributions of explorative movement suggest that the visitors seem to have contact with the displays along the suggested sequence starting from the north galleries and following a counter-clockwise direction. Given this sequence, the majority of the visitors have potentially read the emergence of Abstract Expressionism from Late Modern Abstraction and experienced the sequence presenting the emergence of painterly abstraction and then non-painterly reactions. Through the prediction of movement by local visibility aids the narrative is conveyed in a sequence of locally connected rooms that present the chronologically subsequent art movements. Therefore, it can be argued that the layout is quite effective in conveying the genealogical trajectory of the late modern and pre-contemporary art including its complexities and contrasts. In the MoMA, the stop count statistics suggest that in the majority of galleries all displays are contacted; thus the content presented in most of the galleries is viewed with at least a momentary stop. On the other hand, the link between visual segregation and visitors' contact with displays suggests that more focused viewing takes place where most popular paintings are located and is independent of spatial exploration. As a result, within the narrative of the late modern and pre-contemporary art, Pollock and other Abstract Expressionists and Pop art received more attention. This interesting result suggests that while popular paintings may have a strong effect on visitors' viewing behavior, the absence of global information and lack of local cues support visitors' attention to popular displays. On the basis of this result, it can be argued that the MoMA gallery layout separates the more explorative viewing from more focused viewing. As a result of this potential created by visually segregated locations and popular paintings, the themes presented in the visually integrated locations, the crosscurrents and their relationship with the subsequently developed movements are viewed within a brief survey along with explorative movement.

The much stronger effect of global integration on visitors' behavior of surveying the galleries provides evidence that the gallery layout separates the activity of experiencing the architecture from both explorative behavior and viewing experience. Both visual integration and long vistas in space seem to motivate only the behavior of visually scanning galleries, Being visually close to other spaces through long vistas may allow visitors to have views of the building and displays seen across space. These may help visitors momentarily establish relationships between pieces of art, for example relate some very abstract art that appeared in the 1960s with Post-Minimalism and other more recent contemporary works of art that are remotely placed in the galleries.

In the HMA, the property of connectivity partially explains the distribution of exploratory behavior. This effect of the local visibility confirms that the spatial interrelations between the display groups at local level are likely grasped by visitors, and thus the layout's capacity of generating alternative interpretations of content at local level can be effective. For instance, alternative interpretations of the relationship among self-taught, late modern and contemporary art, which are emphasized at the corner of L-space in the Stent wing, are very likely to be read at local level. In a similar way, comparisons can be made between various groups of contemporary art in the Wieland wing where the displays can be seen at the intersections of the gallery rooms. A somewhat different effect emerges for the central core on the central spine connecting the Stent and Wieland wing in the longitudinal axis. The distribution of exploratory movement reveals that visitors are likely to be aware of the art along the central spine because their spatial exploration mostly takes place along this space. As visitors are motivated to spatially explore (or move around) mostly in the central spine, they are likely survey the works presenting highlights of the late modern, self-taught, and contemporary art, thus the majority of visitors seems to have a picture of the narrative on the basis of this presentation.

According to the analysis of stops to view displays, visitors seem to have contact with displays presenting American modern art and some groups of self-taught art, which are exhibited at the periphery of the Stent wing. Other displays that visitors most often have contact with in the Wieland wing are those of contemporary art created using various media, such as photography and painting in experimental ways. In these galleries visitors also broadly experience the content by viewing almost all the displays available in each gallery. The galleries on the periphery convey the narratives in visually secluded parts in those areas, and offer the potential for the narratives to be understood more in depth and autonomously from the rest of the larger narrative. This effect of visual segregation and seclusion (low integration and low connectivity) on space-use patterns is particularly noticeable for the periphery of the Stent and Wieland wing. As a result, due to visual segregation and seclusion on the periphery, the gallery layout not only dissociates the viewing of displays from exploratory behavior, but also conveys the components of the narrative in a quite fragmented manner. The effect of this is that visitors can read the three components of the narrative separately and then explore the dialogues among them in the visually integrated and connected locations. Due to the emphasis on the dialogues among the three genres with the support of a localized high visual integration, as well as high visual connectivity in various parts of the layout, the HMA has the most explicit potential for generating alternative interpretations of its exhibition content compared to the other two other museums.

7.6 Museum Visit Shaped by Morphologies of the Three Museums

The discussion of the analysis results comparatively among the three case study museums can demonstrate the impact of their morphological characteristics on the museum visit.

The YCBA gallery layout has a generously open and centrally located atria core along with rooms connected through their corners in a small building. This morphology engenders global visibility, the strongest property in the spatial structure. As the visual information gradually unfolds, visitors use the local visual cues shaped by exposed surfaces and hidden regions. Since integration guides visitors in their explorations and viewing of art, the layout is able to transmit the narratives through the lens of the most emphasized themes in the exhibition. Exploratory movement, viewing and scanning behaviors are influenced by the best available level of visibility. Being influenced by the same aspects of visibility to similar extents has a synergistic effect that links exploration, experience with displays and the architecture. When visitors view displays in a small gallery room, they are influenced by the information beyond the confines of the gallery room that is available in long vistas. In visually segregated rooms, visitors are attracted towards displays located at the most integrated portions of the rooms, seeking the most visual information possible. The YCBA layout shapes a museum visit by enabling visual comparisons of displays and motivating spatial exploration as a result of visual closeness and the availability of local visual information, all of which contribute to the understanding of the exhibition narratives.

The MoMA layout consists of a large atrium connected to galleries through few openings and rooms interconnected at a local level. This configuration engenders a visibility structure defined by local visibility emerging from connectivity and control properties. Within the local information, visual cues shaped by exposed wall surfaces and hidden areas are prominent, although the effect of surfaces appears to be the most dominant. As the exploratory movement is influenced by local visibility, the narrative themes are related to each other at the local level, such as through chronologically subsequent styles, and these would be most likely be conveyed to visitors. Further, while visitors read the themes presented in the visually segregated locations and experience the popular paintings, they are motivated to look around in the most integrated locations where they can also experience the most abstract works of art. However, when global visibility is available visitors seem to prefer to look around and experience the building rather than the displays, indicating that architecture and displays are in fact competing entities. Due to the large size of the gallery layout, and the less overlap in the local and global visibility properties, visitors need to explore larger areas so as to grasp the entire layout. The large size of the gallery rooms facilitates the minor variations in local visibility to play a role in predicting visitors' exploration patterns within each room. As a result, the MoMA shapes a museum visit in that visitors are guided through sequentially unfolding visual information of the layout and displays, and are able to read the narratives focusing on the display groups independently of experiencing the architecture and moving through the space.

Finally, the HMA fourth floor has a bi-partite layout that is formed around a central axis connecting the two wings, thus creating a highly integrated and connected spine. Visitors are more strongly guided by local visibility than global visibility. This may motivate them to read the narratives through the local connections between the displays. As discussed in the analysis, the HMA layout is more generative at the local level than the global level, and the influence of local visibility facilitates the reading of the narratives in multiple ways that can be generated though rich opportunities of connecting them. On the other hand, viewing behavior seems influenced by the absence of global and local visibility as well as by strongly organized narratives at the periphery. Consistent with the focusing effect of the absence of visibility, viewing behavior is also affected by the contained spaces. The local cues that motivate visitors to explore galleries are shaped by visibility that opens up extending away from visitors, and this might be shaped by the longitudinal shape of the layout. Visitors' scanning behavior is more independent of the visibility properties appearing at the spaces offering choice, but seems to be associated with exploratory behavior. Thus, the HMA layout offers a museum visit where the narratives can be surveyed along the central alley. Moreover, the themes that are presented more explicitly are read in depth at the periphery and narrowly within the subject, where various visual comparisons between the gallery rooms is still possible.

CHAPTER VIII

CONCLUSION

8.1 Chapter Overview

This chapter summarizes the major findings of this dissertation and describes the contributions of this work to the fields of architecture and museum planning. After a brief discussion of some recommendations for museum design and planning, the chapter concludes by proposing several areas for future research.

8.2 Framework of the Dissertation

The motivation for this dissertation was to identify the ways in which museum gallery morphology can shape exhibition narratives and visitors' space-use patterns in art museums. This entailed two primary investigations: an analysis of how gallery layouts help convey exhibition narratives and an examination of the extent to which gallery layouts predict visitors' space-use patterns.

This study describes the gallery layouts in terms of permeability and visibility properties using space syntax methodology and compares these properties with exhibition narratives and space-use patterns. These comparisons take both a top-down and a bottom-up characterization of the layouts into account to understand the effects of layouts on narratives and space-use patterns in detail. Using top-down characterizations of the layouts, this study is able to identify the role of museum gallery environments in shaping narratives and influencing visitors' behavior as spatial systems that create a network of permeability and visibility relations among spaces. The bottom-up characterizations of gallery layouts helped reveal how gallery environments are grasped by visitors as they move and thus how layouts open up displays and spatial information to them.

The investigation focused on galleries in three art museums, the Yale Center for British Art, the Museum of Modern Art (new extension) and the High Museum of Art. These museums represent specific morphological characteristics that are of interest to this study: atria voids and room configurations visually linking galleries across space. The investigations of how gallery layouts influence exhibition narratives and visitor patterns in these museums help identify how spatial properties created by such morphological characteristics work to shape the narratives and space-use patterns. The details of the spatial properties of galleries in the three museums were derived using space syntax methodology, which produced concrete descriptions of the visibility properties in the gallery layouts. In the case of YCBA fourth floor layout, atria voids and gallery doorways provide connectivity that generously opens up the visual information to visitors. In the MoMA fourth floor, galleries are mostly perceivable through doorways, thus allowing visitors to grasp the space room-by-room as they move, rather than all at once. The atrium void of the MoMA limits the information available on a larger scale because of the few openings to the gallery spaces. In the HMA, the gallery spaces forming central spine (connecting the two wings) enable visitors to see neighboring locations and remain visually close to all other spaces (denoted by visual connectivity and integration measures); however, the galleries on the periphery remain visually isolated from every other space in the layout.

The spatial properties of the museums were correlated and compared with the exhibition content organization and visitors' space-use patterns and revealed how the gallery layouts shape exhibition narratives and predict visitors' space-use patterns. Identifying these aspects provides valuable information for museum design and planning teams, because it helps clarify how museums buildings can be planned and designed to be in concert with museum institutions' specific goals concerning interpretation of art and visitor experience. In particular, planning and design teams may need to take into account a museum's goal to present exhibitions in a highly inclusive way to broad groups of visitors, while retaining scholarly interpretations of the museums collections. In addition, museum planning teams need to consider how visitors are likely to explore the gallery environments and to what extent architectural design can influence the space-use so that gallery environments can be planned for visitors' most effective use. The findings explain the potential of museum layouts to frame the exhibition message and to guide visitors in their spatial explorations, and thus provide useful insights for museum gallery planning and design.

8.3 General and Case-specific Findings

The most significant findings of this dissertation were obtained from the investigation of the influence of gallery layouts on visitors' space use patterns in each of the museums. The cross comparative evaluation of these results has led to some important conclusions. First, visitor navigational patterns in the galleries are predicted by the best available level of visual information, whether this is global level visibility of the galleries or local level visibility exposing visitors to only their neighboring locations. In other words, during their explorations, visitors utilize visual information of the layout through gallery room openings and atria voids. The aspects of local visual information that guide visitors as they move through the gallery layouts, constitute a second major finding concerning the effect of local visual cues: the directly available spaces and hidden regions in galleries influence movement because visitors seem to be motivated to explore these regions, particularly when these hidden regions sequentially unfold. This finding points to the role of "mystery" element in visual information (a scene not immediately available) in modulating the movement. At the MoMA and the YCBA, for example, glimpses of hidden regions are among the most prominent local cues motivating visitors to move in a particular direction. Other influential effects in these two museums are the exposed wall surfaces displaying artworks. At the HMA, although hidden regions also play a role in influencing movement, exposed wall surfaces and visible areas seem to have a stronger effect on movement.

A comparison of the different art display installations in the three gallery layouts reveals that the ways in which artwork is installed may also play a role in modulating visitors' movement. At the HMA, for example, the artwork is often installed at the center of gallery spaces, and the gallery walls are often wide open to view; thus, the exposed wall surfaces and visible areas are stronger local cues that attract visitors. At the YCBA and the MoMA, the spatial organization of the galleries creates regions hidden from view, and the art is installed with this organization in mind; specifically, hidden regions prompt visitors to move and explore the spaces and the art further. Given this effect, the influence of local visual cues on visitor space-use patterns should be taken into account.

The third most important finding of this dissertation concerns the prediction of visitors' display viewing behavior. If visual information is absent at a global level visitors' attention may shift from exploring layouts to viewing displays. The results here suggest that in the museum gallery layouts with visually isolated galleries on the periphery, visitors have frequent contact with displays in those galleries. This may be due to the small amount of visual information at the local level, i.e. a view of a gallery with a limited or no view of the space beyond that room, which may restrict the ease with which visitors can relate to information beyond the visited room. This may direct visitors' attention to the visible displays. For example, the YCBA's partition configuration connects gallery rooms at the corners, thus providing visitors with long views while looking at displays. In contrast, the layouts of the MoMA and the HMA are not configured in this manner, and the absence of global visibility predicts focused viewing. At the YCBA, where the gallery rooms are much smaller than those of the two other museums, global visibility and availability of long views in the galleries seem to motivate visitors to have contact with the displays in those rooms. Because visitors seem to have an interest in the information beyond the confines of the galleries in which they are viewing displays they tend to view displays in one room in conjunction with those in other rooms. In contrast, at the HMA and the MoMA, the larger gallery size helps visitors to remain interested in displays in contained areas that provide little information from other rooms. Although these findings regarding viewing behavior can also be very informative for gallery layout design, further investigations with regard to gallery size are needed.

The fourth important finding of this work is that room and atria configurations may determine whether visitors navigate and view displays in the same spaces, or these activities are undertaken in separate spaces. In the YCBA, similar visibility properties seem to motivate both patterns of exploration and display viewing, indicating these activities occur in similar areas of the galley layout. Because these space use patterns are somewhat associated the room configuration at the YCBA offers a museum visit experience in which visitors tend to view displays while navigating in space. In contrast, at the MoMA and the HMA, patterns of exploration and display viewing are predicted by the visibility properties that characterize each different space. In these two galleries, visitors can be either highly exploratory or have frequent contact with exhibitions, but they are less likely to engage in these behaviors in the same space. One interesting point is that this dissociation between exploratory behavior and viewing displays occurs at the MoMA, although the shape of the gallery rooms does not designate exploratory movement and display viewing to different spaces. On the other hand, in the HMA gallery, the shape of the central space offers uninterrupted permeability and thus suggests a greater potential to channel visitor movement through this space as opposed to the highly partitioned gallery spaces on the periphery. One of the explanations for the dissociation of exploratory behavior from display viewing behavior at the MoMA may be visitors' attraction to popular paintings that are installed in visually segregated areas, while at the HMA, the dissociation is more likely to be the result of morphological characteristics.

A fifth significant result relates to the prediction of scanning behavior. The findings show that visitors stop to visually scan gallery environments when the morphology opens up visual information through atria or centrally located spaces. At the YCBA, scanning stops likely occur in spaces visitors tend to explore, which suggests that stopping to look around informs visitors during their navigations. In relation to each of the three museums, the prediction of scanning behavior along with other space-use patterns is more determined by how visual information is revealed by morphology. More specifically, in the museums where visual information of an entire gallery environment is available only in a few instances (i.e. through few atrium openings), visitors use this information to regain their awareness of the entire layout through scanning behavior, independently of explorative behavior and display viewing. For example, at the MoMA, visitors scan the gallery environment when farther spaces can be viewed through gallery doorways and through atrium openings because this is how visitors come in contact with the information of the layout and thus experience the architecture. The capacity to provide a long view strengthens the property of a gallery being visually close to every other location (denoted by visual integration); this property seems connected only to scanning behavior, not to patterns of exploration or display viewing. As a result of this impact of morphology, at the MoMA the experience of the building's architecture is dissociated from other patterns of space use. Therefore, the architecture itself appears to be an independent entity competing with the artwork and influencing visitors' navigation. On the other hand, at the YCBA, where opportunities to come in contact with the entire layout are more generously provided through atria openings and spatial interconnectivity among the rooms, visitors tend to visually scan the gallery environment. The visual information released by the atrium also influences exploratory behavior and display viewing; thus, the morphology of the YCBA creates synergy between navigation and scanning behavior.

In terms of the fourth and fifth significant outcomes discussed above, one of the most important findings of this dissertation is that the layouts that can be grasped from an extensive array of locations (including the ones along the periphery) motivate visitors to engage in navigation, display viewing and visually scanning the gallery environment. In this way, such layouts create synergy between exploratory behavior and stopping behavior. On the other hand, these behavioral patterns are dissociated in the layouts that have visually isolated galleries. Therefore, visual information extended to a wide range of locations in gallery space through good levels of integration is critical for museum design in terms of orchestrating various space-use patterns in the museum visit experience. As can be seen in the YCBA gallery, for instance, the more generously the visual information is extended through gallery doorways and atria openings linking the heart of the layout with the peripheral locations, the more likely the behaviors of exploration, art viewing and gallery scanning will occur in similar spaces. The more the global level visual information is localized to core areas (i.e. galleries immediately accessible and circulation areas), as in the MoMA and HMA layouts, the more the patterns of exploration, viewing art and scanning behavior are dissociated; in other words, visitors move around, view displays and experience the gallery environment and architecture in separate areas. If one argues that some of the most critical issues in museum planning are to provide good orientation and facilitate visitors' comfortable exploration, and to create synergy between visitors' experience of both architecture and art, it can be concluded that the YCBA achieves this kind of museum experience due to the spatial properties releasing visual information to a wide range of spaces on the gallery floor, which is established by the architectural design. Even more interesting is that the good orientation and comfortable spatial exploration aspects of museum experience were in fact implicit in the YCBA's architectural program, which states that "the organization of spaces should provide legibility [and] choices in navigation" and "evoke interest and curiosity," in order to prevent "museum fatigue" during the visit (Prown, 1977, pp. 13-14). Thus, it appears that the architectural design of the YCBA has achieved what the museum client asked for. In contrast, the

MoMA and the HMA layouts offer another kind of museum experience where visitors' focused display viewing and intense the interactions with art are achieved, while, the experience of architecture is promoted as an additional element that can be available independently of the art.

When these findings are considered along with those concerning the influence of the layouts on the exhibition narratives, it is possible to understand how architecture frames the exhibition, thus influencing the message and tone of the curators' interpretation of the artwork. As discussed in the previous chapter, the YCBA presents a conceptually structured content in a quite interesting way, namely spatial interconnectivity at a global level. By creating opportunities for visitors to visually compare works of art across space, the YCBA layout is able to relax the highly structured presentation. As these opportunities of visual comparisons offer alternative dialogues among and between works of art, this approach goes beyond delivering a scholarly message by giving visitors an additional layer of reading to their understanding of the exhibition narratives. In addition, the influence of global visibility properties on visitor exploration suggests that the layout is able to convey alternative narratives to visitors during their navigation. In other words, a morphology stretching global level visual information from the core areas to a wide range of locations in gallery space by providing visual interconnectivities at a global level can increase the potential for a layout to generate new interpretations of the content at the gallery layout scale.

On the other hand, in the MoMA's gallery layout the spatial interconnectivity between rooms is more profound at a local level than a global level. The reason for this is that global visibility is concentrated in the circulation areas around the atrium rather than in the gallery rooms. Indeed, this helps convey the complexity of the art content, as defined by the organic relationships between the different modern art movements represented in each gallery room. The museum gallery room organization was planned by the curators to convey the complex and structured exhibition concept. The MoMA galleries reproduce the prescribed exhibition organization, without offering alternative comparisons among display groups at the gallery layout scale. In the end, a didactic and conventional curatorial intention is maintained due to the museum gallery layout.

In the case of the HMA, the exhibit content is presented in a less structured spatial organization that is established by a bi-partite gallery layout. Here, the content themes are related to one another on the basis of experiential qualities and visual affinities of works of art within a highly implicit chronology, all of which contributes to a less strict conceptual structure. The spatial interconnectivities along the central core connecting the two wings on the longitudinal axis provide visual links to those sections that separately present these genres, thus creating opportunities for visitors to make their own a visual comparisons of the works of these genres. Given this potential, the HMA layout more readily generates new interpretations at a local rather than a global level. The prediction of visitors' movements along with the property of local level visual connectivity allows for this potential generative effective and thus conveys the exhibition knowledge through other possible interpretations of displays that can be experienced at the room scale. At the same time, the content of the individual genres (presented along the periphery) is more intensively conveyed to visitors viewing displays that are visually segregated and isolated. Therefore, the gallery layout of the HMA motivates visitors in these areas to read and study the content on American modern art, self-taught art and contemporary art one at a time and more in-depth, and then grasp the dialogues and connections among these genres at the scale of the gallery room (local level). This opportunity puts HMA in an ideal position to convey the complexity of the content, both with a focused interpretation and a more general and comparative presentation. The layout, therefore, provides a composite and a less structured interpretation of the collection and conveys its content by allowing visitors to make individual comparisons at the room scale (local level). Since such comparisons would be cognitively less demanding for novice visitors, it can be argued that the HMA layout fashions the content to be conceptually more accessible to a broader group of visitors.

The case-specific results concerning the presentation of the different exhibition narratives leads to the conclusion that the stronger visibility properties, either at a layout (global level) scale or a room scale enhance the ability of a layout to express an exhibition narrative through alternative readings of the works of art. As a result of being able to access more visual information, visitors have rich opportunities to visually relate artwork in alternative ways, pointing to them to new interpretations of the exhibition message. More specifically, if visual information is more generously available at the global level, visitors can possibly discover alternative relationships at the end of their entire visit. If visual information is more generously available at the local level, visitors can compare displays in neighboring locations in multiple ways and they can understand the alternative explorations as they move through the gallery space. The scale (layout or room) at which the gallery environments are more likely to generate alternative narratives may influence the framing of an exhibition message and curatorial work. According to the findings of this work, the gallery environments that offer spatial connectivity at the local level enables visitors to read the entire exhibition by building up their own interpretations as they explore; the gallery environments that present exhibitions through global visual connectivity present exhibitions more generatively at the layout scale; this may facilitate visitors ability to view displays experientially across space while allowing the scholarly message to be dictated throughout the visitors' navigations.

8.4 Contributions of the Dissertation

The contributions of this dissertation are defined by its thorough approach to investigating the interactions of gallery layouts in relation to exhibition narratives and visitors' behavior. These investigations are based on detailed descriptions of visitors' space-use patterns, using top-down and bottom-up characterizations of space. Most prior studies using space syntax consider layouts as a system influencing aggregate space-use patterns that indicate how global measures predict the ways in which visitors move through gallery space. Taking this approach a step further, this study acknowledges a layout's potential as a configuration that works through spatial structures and as an environment understood through gradually unfolding information. Therefore, this dissertation not only looks at the (1) interactions of layout (as a configuration) with aggregate space use patterns, but it also investigates (2) the effect of layout as an environment grasped by peripatetic observers moving through space. As a result, this dissertation explains a layout's effect on space-use patterns in detail and in relation to specific gallery room arrangements and atria configurations.

More specifically, this work demonstrates links between aggregate patterns (movement lines and stop counts) and the global visibility levels by explaining the ways in which layout shapes spatial exploration through various structural properties. These links between space-use patterns and local visibility properties further explain to what extent visitors are guided by the visual information that is exposed to them as they move through space. The demonstrated effects of visual field properties on visitors' navigations and viewing behavior indicate how the specific room arrangements create visual cues to guide visitors in their explorations, considering that the visual field properties describe exposed surfaces, long vistas in space, hidden regions, and size and shape of visible areas. Illuminating the effects of these properties helps explain how design decisions concerning room configuration can shape visitors' space-use, and thus suggests that these indicators should be considered to better inform museum gallery planning.

Another contribution of this study is its examination of how gallery layouts shape the exhibition message at local and global levels, thus providing a detailed understanding of the reproductive or generative potential of layouts at various scales. Exploring whether layouts convey exhibition narratives by reflecting prescribed concepts or generating new interpretations, and understanding the scale at which these potentials are stronger could explain the scale at which layouts present didactic narratives. For example, if the organization of the layout reflects a prescribed conceptual content at a local level, this means the exhibition presentation is didactically presented along with visitors' sequential exploration. Addressing this question, our findings demonstrate the level at which gallery layouts encourage visitors' individualized interpretations.

Furthermore, the contributions of this dissertation are discernible in reference to findings of prior studies, discussed in Chapter II. More specifically, prior studies of gallery layouts' role in shaping exhibition narratives demonstrate the ways in which spatial layout properties interact with the conceptual organization of exhibitions (Peponis & Hedin, 1982; Pradinuk, 1986; Tzortzi, 2003, 2004; Psarra, 2005; Tzortzi, 2005; Psarra et al., 2007; Tzortzi, 2007; Wineman & Peponis, 2009). The methodology of this thesis exploring how exhibition narratives are shaped in galleries draws upon the same theoretical framework on which prior studies are based. This framework treats exhibition narratives as a program of museum layouts, debating whether this program is reproduced or generated through spatial organization. This discussion is based upon Hillier's seminal categorizations of built environments with respect to whether human spatial activity is determined by program or influenced by layout (Hillier & Penn, 1991; Hillier, 1996). Drawing upon this theoretical framework, this study compares the conceptual structure of exhibitions with spatial organization, and thus explores whether the case study gallery layouts reproduce the contents as interpreted by curators or generate new conceptual relationships beyond an exhibition's initial organization. In this sense, another contribution of this dissertation, based on findings of the previous studies, is its comparison of exhibition organization with both local and global level properties of gallery layouts. With these comparisons, this thesis is able to demonstrate the potential of case study layouts to reproduce or generate exhibition narratives at various levels. More specifically, this thesis elaborates on whether content is presented more didactically through local interrelationships between displays or through their global relationships in the entire layout. This outcome can be useful in understanding at which level of the narratives visitors can draw individualized interpretations. This outcome can help museums utilize their layouts to present content from specific to general or general to specific, thus clarifying at which point layouts could open narratives to visitors' further interpretations. These detailed results and specific evaluations of museums' capacity to present narratives add another layer to the perspective of previous studies, thus offering a more informative dimension to curatorial teams by presenting new ways to utilize gallery layouts so they imbue collections with intended interpretations, and support museum goals.

By acknowledging the fact that visual information gradually unfolding to visitors may explain the distribution of spatial exploration patterns, this dissertation analyzes the effects of layout on the basis of a bottom-up characterization of space. In this way, this study advances the ways in which space-use patterns are analyzed through the use of space syntax. This approach is informed by Psarra and Grajewski's (2000), Peponis et al.'s (1997, 1998), and Wineman and Peponis's (2009) emphasis on a peripatetic observer's actual experience of exploring spatial layout properties. Applying this emphasis to analysis, this dissertation invents a technique for comparing the rate of a movement's directions with the visual field properties at those directions. As a result, the findings identify some visual cues such as hidden regions, exposed surfaces, and the shape of visual fields that shape visitor behavior. Therefore, this dissertation is able to explain the explorative behavior in terms of bottom-up characterizations of space, which is described by the visual field measures. These findings add another dimension to the 1997-98 insights of Peponis et al. concerning the relationship between spatial geometry and visual information defined by interstitial surfaces and spaces.

With the explanation of explorative behavior in terms of visual field measures, this dissertation also extends the findings of previous studies in the environmental behavior field concerning the effect of gallery environments on visitors' movement. Thus, this dissertation's findings bring architectural content to the study of the effects of space on behavioral patterns in museums, such as visitors' attraction to exit doors, the preference for making right turns, an attraction to exhibits placed at the central parts of a gallery room, and movement at key points, which are explored in the previous studies in the museums field (Weiss & Boutourline, 1963; Parsons & Loomis, 1973; Bitgood, 1995, 2003; Bitgood & Dukes, 2006). More specifically, by demonstrating the effects of local visual cues, such as hidden regions, long lines of sight, exposed surfaces in visual fields, on explorative and display viewing behavior, this thesis provides a detailed information to understand the effect factors explored in previous studies such as attraction to exit doors and attraction towards certain exhibits.

Most notably, correlating the visual occlusivity measure with the movement distribution at choice points, this thesis demonstrates that availability of hidden regions in visual fields motivates visitors' explorative movement. In the broader scope of environmental behavior research, this finding might give a more specific description to the notion of "mystery" element discussed as a visual-spatial aspect of preferred environments by Kaplan and others (Herzog et al., 1982; S. Kaplan, 1987; Herzog, 1988; Scott, 1990; S. Kaplan, 1992). Indeed, the visual attribute described by the occlusivity measure, which quantifies the hidden regions in the visual field is parallel to "mystery" which was identified in environmental behavior research as "a scene with incomplete but sequentially unfolding information in the urban and natural environments" (Herzog, 1988). The demonstrated effect of occlusivity on visitors' choice in movement directions illuminates that explorative movement can be evoked by hidden regions in the visual field, or qualities of "mystery" in gallery settings. Thus, this dissertation's findings regarding occlusivity suggest that the Kaplans' and others' argument on "mystery" predicting environmental preference in natural and urban settings can also be relevant in gallery interiors, and this confirms also the findings of Scott (1990). The analysis obtained through application of the occlusivity measure helps identify qualities of "mystery" element in terms of visual information defined by spatial arrangements such as views through gallery openings which contain hidden information (i.e. space, displays, and people) beyond partitions. These specific contributions were achieved by investigating the effect of spatial layout on visitor behavior on the basis of a bottom-up characterization of space, in particular, explaining the distribution of explorative behavior in terms of local spatial properties of gallery layouts sequentially unfolding to peripatetic visitors.

In addition, this dissertation's findings demonstrate the influence of global visibility on exploratory movement, confirming findings of previous studies using space syntax (Choi, 1999; Psarra, 2005; Psarra et al., 2007). Those studies have explained the influence of gallery layout on movement, correlating with integration (global visibility), while a few studies also reported consistent but less strong links to connectivity (local visibility). While this study's findings obtained from YCBA confirm the results of Choi (19990, Psara (2005) and Psarra et al. (2007), its other findings obtained from all three case studies show that integration (global visibility) may not, in all cases, be the most influential factor on movement. Instead, this dissertation brings a broader understanding of the effect of visibility properties by demonstrating that the best available levels of visibility, be they integration or connectivity, predict patterns of visitor exploration. The identified links between grid isovist (non-syntactical visibility) and movement lines entering galleries underscore these findings even further, explaining the prediction of movement in terms of local cues defined by room arrangements. By comparing visitors' choice of the direction of movement with a visual field in these directions (in an approach not tried before), this study explains the distribution of movement on the basis of local visual cues unfolding gradually to visitors. In this sense, the work brings a more substantial and detailed understanding of the distribution of movement than discussed by Choi (1999), Psarra (2005) and Psarra (2007).

In terms of the influence of visibility properties on visitors stopping to view displays, this study reinforces Peponis et al.'s (2004), Psarra et al.'s (2007) and Wineman and Peponis's (2009) other arguments about the way in which layout influences this pausing behavior. However, this dissertation's results concerning visitors' viewing behavior suggest that the availability of visual information does not always motivate behavior of viewing displays. In contrast to Peponis et al. (2004) and Psarra et al. (2007), this dissertation argues that absence of visual information may actually create an opportunity to focus on displays. Additionally, the work explains that this layout effect may operate in conjunction with the effect of exhibition installation: the placement of popular paintings (as at the MoMA) or structured narratives in visually segregated areas (as at the HMA) strengthens visitors' motivation to focus on displays. In particular, this study's findings -- that visual segregation and viewing behavior in the MoMA's fourth floor gallery inform one another -- illuminates results previously reported in Psarra et al. (2007), whose work analyzes visitors' viewing behavior using the rates of viewing art, reporting no significant link between these rates and integration. Instead, this dissertation analyzes viewing behavior in terms of a number of different measures, and reports a link between viewing behavior and visual segregation. In the context of this finding, this study also explains the effect of popular paintings on viewing behavior, thus offering a more in-depth discussion on what predicts visitors' viewing behavior as a result of MoMA's layout, which may apply to other, similar cases.

As for the dynamics of scanning behavior, this study's findings align with Psarra and Grajewski's (2000) discussion about the strategic role that atria voids play in visitors' grasping the total picture of layouts and exhibitions. With a more detailed analysis than previously published, this study shows that atria voids opening up visual information encourage visitors to stop, experience the gallery environment, and recognize alternative visual comparisons among the displays. This study's analysis also shows that when atria are not situated at prominent locations, other centrally situated spaces, such as a central spine, can motivate scanning behavior because this space opens up visual information at global and local levels.

8.5 Key Issues in Museum Building Design and Gallery Planning

Being informed by its several important findings concerning visitors' spatial experience and exhibition messages, this thesis is able to provide gallery layout planning recommendations informing museum building design and gallery planning. These recommendations, however, can be most useful when adapted to the museums' specific goals and intents concerning presentation of art and visitors' explorations in gallery space.

As a part of their interpretive goals, museums may like to encourage visitors' focused viewing in certain gallery spaces in order to present certain parts of the exhibition narrative more intensively. The findings of this dissertation suggest that visitors' focused viewing might be facilitated by the absence of global level visual information as well as the attraction of popular paintings and engaging narratives. As shown in the cases studies of this dissertation, this effect might be prominent in gallery spaces that remain visually isolated from the rest of the layout. This underscores a recommendation that in order to convey a narrative intensively, the galleries might need to be arranged in such a way that visual information should not create visual distractions and thus intensify the effect of displays on visitors' attention and engagement. At the MoMA we see that gallery rooms are connected through doorways at their central axes but in staggering positions. This configuration creates isolated corners at which visitors can focus on viewing art allowing explorative behavior to take place at the central areas. In this way, the MoMA's new extension wing layout seems to create an intensified viewing experience for visitors, and thus seems to achieve its design objective, as described by Taniguchi: "to create an ideal environment for the interaction of people and art" (Benavides, 2004)[39] In the HMA, a similar effect is created by room within a room organization where gallery entryways of the inner rooms open up to gallery walls exhibiting art, instead of connecting to another entryway and thus maintains the motivation for display viewing. As can be seen in these examples, designating

[39] This statement made by Taniguchi for the MoMA's architectural design can be found in various sources on the web including Benavides, 2004.

display viewing areas visually away from a series of entryways could be one of the spatial planning strategies that can be implemented to achieve visitors' intensified interactions with displays.

Another museum goal might be to create good sense of orientation and awareness of the museum architecture along with the experience of displays. This might be related to the intent of preventing museum fatigue due to confusion in way-finding, as well as the intent of presenting art using the spaces of architectural expression. This dissertation's findings show that the gallery layouts that provide rich visual interconnectivities reinforce the capability to capture the information of all other galleries. In other words, visual interconnectivities through atria and gallery partitions make visitors able to grasp the entire layout through experiencing its gallery rooms. As can be seen in the YCBA's analysis, such layouts facilitate visitors' ability to engage in display viewing in the spaces through which they meander while visually scanning the gallery environment. In this way, visitors maintain their sense orientation during their experience of displays. This was achieved in the YCBA's gallery floors through Kahn's architectural design situating gallery walls at the center of the gallery span while defining doorways on two sides of the partitions. This arrangement of gallery partitions allows visitors to project their sight to far ends of the gallery floor while viewing displays along the continuous walls and gallery bays they visit. This means, visitors are continuously informed of the spaces and the displays placed beyond the galleries they actually visit. This arrangement helps achieve objectives implied by the museum that "the organization of spaces should provide legibility [and] choices in navigation" and help visitors relax their eyes while viewing displays to prevent museum fatigue (Prown, 1977). Therefore, designing a gallery with generous and frequent openings of atria and gallery spaces can be a strategy to follow in order to create rich visual interconnectivities and thus to facilitate good orientation within synergized experiences of art and architecture.

Among the other important design decision that might concern museums is the size of the gallery rooms in relation to the entire gallery space. Museums may designate the size of the gallery space based on other considerations such as the classification of displays or in accordance with structural elements of the museum building. In any case, it might be helpful for museums to realize the possible effects of gallery room size on visitors' display viewing behavior in order to achieve exhibition goals. The results obtained from this study's analysis imply that, there is greater range of variation in visibility properties in the MoMA's gallery rooms due to their larger size as well as free-standing partitions placed inside the rooms, and that visitors' movement is influenced by the variations in visibility. This influence may result in visitors skipping some displays due to changing visibility levels at display locations. If the curatorial goals of a museum suggest that all displays in a gallery room are equally important for the particular exhibition narrative and visitors' attention to those displays should be even, the gallery room arrangement should provide more homogenous visibility. To achieve this, the gallery rooms may need to be designed in smaller sizes and without interior panels creating high variation in visibility. However, some other results of this study concerning behavior of viewing displays -- which provide additional implications about gallery size -- indicate that in larger galleries that are also visually isolated from the rest of the gallery space visitors' attention is directed to displays because they are less exposed to the information beyond the visited galleries. This suggests that large and visually contained galleries may be ideal for a focused viewing of the exhibition.

Other observations drawn from this case study analysis can be used to inform the planning and design of museums' expansion wings. For example, at the HMA, the addition of the Wieland wing seems to have changed the movement distribution dramatically by channeling the movement in a longitudinal direction. On the HMA's skyway floor the central core that creates a highly integrated connection between both wings, functions as an alley that takes visitors to destination point rather than directing them to peripheral locations. Such effects created by the extension of the gallery floor in one direction (i.e. addition of a wing in the longitudinal direction) may cause visitors to skip other parts of the original wing. Considering these effects of the spatial layout, the placement of displays should be thoughtfully planned in the gallery floors with extension wings.

8.6 Limitations and Future Studies

Despite its contributions, this study is not without limitations. First of all, the findings of this dissertation are drawn from case study analyses of only three museums. Although these museums were thoughtfully selected to be representative of morphological characteristics that influence presentation of exhibition narratives and visitor behavior, an analysis of a greater number of museums sharing similar morphological qualities would have extended the validity of our findings. Additionally, analyzing a greater number of museums with different morphologies could have presented opportunities to examine a wider range of such characteristics and their effects on space-use patterns. Thus, it is recommended that future studies investigate other museums as a way to pinpoint the effect of varying morphologies on visitors' viewing experience.

Similarly, another limitation of this study is that the statistical analysis of space-use patterns reflects the behavioral patterns of a fairly small group of visitors. This is due to the fact that data collection is time-consuming in terms of obtaining the most informative data among the randomly selected visitors and transcribing the data onto computer. Although we believe our visitor group provides sufficient data to describe spatial behaviors within these three museums, collecting data from a greater number of visitors could have increased the reliability of results. This limitation can be overcome in the future if data collection can be conducted using digital signal technologies, tracking and recording visitors' movements and stationary behaviors. Another limitation concerning data collection is related to the course of tracking visitors. In order to register space-use patterns in all the layouts and conduct the analyses with comparable visitor data, we used only data of visitors who completed their entire visit in the course of tracking. Unfortunately, this does not take into account slower visitors and abandons the possibility of analyzing the effect of gallery layout on their behavior patterns. These behavior patterns might yield slightly different results, and a comparison of slow-moving and fast-moving visitors would no doubt reveal other facets of visitors' interaction with the gallery space. This point could, of course, be examined in future studies by investigating the effects of layouts on both slow-moving and fast-moving visitors.

Within the objectives of this study, this dissertation looks at only the spatial aspects of the museum visit and thus infers visitors' experiences from the observable patterns of space-use. This approach focus on detailed observations of visitors' space-use behavior, and therefore, it cannot identify visitors' museum visit experience within its entirety including internal motivations in exploring museum space, or meanings visitors may draw from activities they engage in museum space. This broader understanding of the museum visit would require an in-depth investigation focusing on not only observable behavior patterns but also qualitative data to understand visitors' individual responses to gallery environments. Although, looking at museum visit experience concerning its meaning for visitors was beyond the objectives of this dissertation, understanding how museum space can affect the quality of experience would certainly reveal a new area to be investigated, requiring more comprehensive research that could be executed with thoughtfully designed surveys.

In terms of the methodology of data collection, cultural differences among visitor groups in the three museums were not taken into consideration in this analysis. Indeed, given the observations of this study, we anecdotally noted that there are cultural and educational differences among the visitor groups observed in the three museums. These differences seemed to be related to geographical context, cultural and educational interest areas at all three museum locations. Unfortunately, within the scope of this study, resources did not make it possible to include cultural differences as another variable of analysis. In future studies, such cultural differences can be viewed as a factor explaining visitors' different interactions with artwork.

Other limitations of this dissertation relate to describing exhibition narratives for the purpose of our analysis. As discussed in the methodology, exhibition narratives at the three museums are described based upon the statements curatorial teams provided in open-ended interviews. In these statements, curators were asked to describe the message they intended to convey as well as the utilized display techniques. Unfortunately, these curatorial statements were somewhat abstract and thus much less detailed than expected. In this sense, the curators' statements did not reveal a complete set of information about how exhibition narratives are formed through their scholarly interpretation and deliberate installation choices. To overcome this limitation, we studied museum publications and art historical sources to obtain a complete understanding of the exhibition narratives. Within this context, this study conducted in-depth research and investigation into the significance of artworks so that our analysis of the exhibition narratives could reflect an accurate and reasonably summarized understanding. Again, future studies using a more structured data compilation technique could offer a more in-depth picture of dialogues and messages conveyed in museum exhibitions.

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