Space Design for Connected Place Memory:
A design framework for harnessing spatial
context to support informal museum learning

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ABSTRACT

For museums, exhibitions are a principal conduit for delivering informal learning, yet published knowledge and opinion in the fields of exhibition design and museum studies include no substantial principles for the design and assessment of exhibition space beyond basic recommendations on viewing conditions and space provision. This thesis is principally concerned with the role of space in museum exhibitions. Space is the first layer of information visitors encounter on their journey through an exhibition. It is also the primary container for exhibition content and a key factor in visitor experience, the design of exhibition space no doubt exercising an influence over museum learning. Empirical research into exhibition space is limited to tracking visitor’s movement and behaviour. It rarely considers visitor’s cognitive engagement with exhibition space, or how this might support or detract from museum visitors’ interaction with exhibition content.

Drawing on aspects of constructivist educational theory, spatial intelligence studies and mnemonic loci learning, the thesis proposes a framework for understanding how design might develop connected place memory to support informal learning in museum exhibitions. An interdisciplinary weaving of theoretical sources, supported by interviews with working designers and detailed analyses of exhibition areas in three museums informs the discussion. The interviews indicate that exhibition designers have tacit understanding of the role of exhibition space in supporting visitors’ informal learning, but that they need knowledge-based design frameworks to better understand and address the relationship between exhibition space and spatial learning. The thesis argues that the concept of connected place memory and its four integral elements—orientation, space cuing, organisation and staging—offer exhibition designers valuable criteria for planning the spatial characteristics of new exhibition areas and for evaluating and revising those of existing exhibition spaces. It contends that exhibition environments with vivid spatial characteristics make fewer demands on museum visitors in respect of spatial orientation and memory, allowing visitors to devote more of their attention to exhibition content. To exemplify the value of the design framework for creating connected place memory, the final section of the thesis uses 3D simulation to redesign three existing suites of exhibition spaces in three different museums. The framework provides a theoretical foundation for the design of exhibition space in support of visitors’ learning experience and exhibitions’ educative role. It may also contribute to the design of other interior environments where informal learning or vivid recall of the spatial environment and its contents is an aim.
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Here, I offer my sincere regards and blessings to all of those who supported me while undertaking my doctorate.
DECLARATION

This thesis contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the thesis. To the best of my knowledge this thesis contains no material previously published or written by another person except where due reference is made in the text of the thesis.

Wi-kuan Lin

Signed

07/04/2011

Dated
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INTRODUCTION

Internationally, museums attract millions of visitors a year, striving to provide each of them with a rich learning experience. Once, museums displayed their treasured artefacts in permanent galleries, rarely changing their arrangement. Today, rotating permanent and temporary exhibitions play a central role in attracting visitors to museums. Alongside providing cultural enrichment, entertainment and social experience, informal education is now a major role for museums. A corollary here is that exhibitions need to provide effective learning environments for visitors, an aim that has clear implications for the practice of exhibition design. In using exhibitions as the major medium for public communication and knowledge provision, the curatorial and design staff of museums needs a theoretical basis for the development of exhibition environments.

Sequential waves of social, cultural and technological change have influenced theory and practice in the museum sector, but the combination of exhibition space and exhibition content continues to provide the experiential basis for museum learning. Recent trends towards virtual museums, commercial activity and high-impact museum architecture have seen interior space in museums increasingly allocated to other activities than exhibitions. These trends make museums more accessible and appealing, but they also threaten the continuation of physical exhibitions and raise important questions about the fundamental characteristics and values of a museum. The rise of the ‘new museology’ in the 1980s challenged the museum sector to recognise the meaning of ‘museum objects as situated and contextual rather than inherent’. Interior space plays a major role in contextualising exhibition content, with implications for the provision of learning experience to visitors.

Exhibition space embodies exhibition content and influences museum visitors’ behaviour and learning experiences. It should never be considered as empty or neutral. Exhibition content, ranging from material artefacts to virtual displays, is often the focus of a museum visit, but attending a museum is a specific type of environmental experience created by engaging with the displays on view in the interior space of a museum. In being integral to the whole museum experience, interior space contributes to the formation of meanings and memories in exhibitions. Together, exhibition content and space shape the distinctive learning experience provided by museums. This thesis argues that space should not be

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1 For example, in 2008, Australia’s one thousand museums attracted an estimated 30.7 million visitors. Australian Bureau of Statistics 2009, Museums, cat. no. 8560.0, Australian Bureau of Statistics, Canberra.
understood as a passive or secondary element of exhibition and interior design in the museum. Rather, it should be consciously developed to directly support museums to achieve their pedagogical goals.

In recognising the importance of exhibition space, this thesis identifies the relationship between exhibition space and visitors’ learning experience as an area in need of intensive reflection and research. It considers how people make sense of space, the state of current knowledge about museum learning and the nature of the relationship between learning in space and the reception of exhibition content. Museum settings provide a specific type of learning environment, where visitors guide themselves through the exploration of displays and other sources of information and experience. The recognition of such leaning behaviour—often termed informal learning—extends back to the 1920s when E.S. Robinson began to study the relationship between the physical setting of the museum and museum visitors’ behaviour, noting the phenomenon of museum fatigue and the way in which certain museum displays attract and hold visitors’ attention more successfully than others.4

Since the 1920s, the discipline of museum studies has made significant progress in understanding the behaviour and experience of museum visitors. Its sub-area of visitor studies reports on the effect of exhibition settings on visitors’ behaviour. The main factors investigated in the visitor studies literature include attention, circulation, orientation and visitor satisfaction.5 The museum studies literature identifies the importance of the museum’s public education role, reflecting on the motivations for visitors’ interest and behaviour in exhibitions. It also proposes a range of different models of museum learning. Despite the extensive commentary in the literature of museum education, which includes many recommendations on exhibition design, there are only a handful of papers that attempt a holistic consideration of the role of exhibition space in the learning process. Few propose substantive theories for the treatment of exhibition space in respect of design. The potential for exhibition space to enable museum visitors to derive meaning from their exhibition visits and to learn is rarely discussed.

By exploring the relationship between exhibition space and learning, this research aims to establish a theoretical framework for designing exhibition space in support of informal museum learning, although it does not claim that the design framework ensures the

occurrence of learning, or determine its nature. The learning process in exhibition space is strongly related to the phenomena of human learning psychology. The thesis considers relevant published knowledge and opinion from the areas of cognitive psychology, spatial intelligence and learning theories in conjunction with the studies in exhibition design, museum studies and museum education to shed light on the potential of exhibition space to contribute to museum visitors’ learning through the development of connected place memory. The remainder of the introduction outlines the research context and sets out the research questions and goals.

The problem context and the poverty of design theory

The establishment of the International Council of Museums in 1946 initiated an international discussion about the role of museums in society and the nature and purpose of their practices. This included museums’ activities in mounting rotating exhibitions of their collections and staging of thematic temporary exhibitions, the latter flourishing as a principal presentation form in the many museums established around the world since 1946. Today, exhibitions sit at the juncture of the diverse aims and roles of the contemporary museum, providing a major challenge for the enterprise of exhibition design, which supports the presentation of exhibition content and facilitates the diverse needs of those involved in the exhibition process, including museum visitors.

The museum literature recognises the importance of exhibitions as museum’s main medium of communication with their visitors. Journals like Museum International and Museum Management and Curatorship routinely present exhibition cases for discussion, as do the journals of the different national and regional museum organisations. Exhibition committees and special interest groups are now a common feature of museum organisations, as in the examples of the Temporary and Travelling Exhibitions Special Interest Group of Museums Australia (Australia) and the National Association for Museum Exhibition (NAME) of the American Association of Museums (AAM) (USA).

Since WWII, museum professionals internationally have harnessed diverse methods and technologies to the task of enhancing museum visitors’ experience of exhibitions. However, despite the broad knowledge and experience gained in the area of exhibition practice in the post-war period, no significant theories of exhibition design have emerged. Indeed, curatorial issues and perspectives dominate the discussion of museum exhibitions, which mostly focuses on reporting individual cases. Various guidelines, techniques and skills are proposed to help curators and designers develop successful exhibitions. Attempts have
been made to establish the essential principles of exhibition design. One notable example is the set of design guidelines developed by the Royal Ontario Museum, Canada, which aims to provide approaches for better communication with the public through exhibition design.\textsuperscript{6} Hall and Dean cover the broad exhibition design process, providing comprehensive guidelines for its conduct.\textsuperscript{7} Caulton investigates interactive exhibitions and offers some basic standpoints for developing hands-on exhibits.\textsuperscript{8} However, compared to the richness of the museum literature from the perspectives of anthropology, architectural history and criticism, art history, cultural studies, curatorship, history, politics and sociology, the discussion of exhibition design is underdeveloped and does not address the complex issues involved in staging contemporary museum exhibitions. In reviewing recent publications in museum studies, McClellan argues that what is published is ‘almost exclusively theoretical and historical in focus; readers looking for practical, ‘how to’ guidance will be disappointed.’\textsuperscript{9} He notes that museum professionals write only a small percentage of texts in the museum studies literature, speculating that although museum curators do not significantly contribute to the discussion of museums, they are most likely the major audience for the expanding literature in museum studies. McClellan thus questions the relationship between the theory and history of museums and contemporary museum practice, identifying this as a clear issue for the practice of exhibition design.

The degree of creativity involved in the exhibition design process is perhaps one reason for the embryonic state of published knowledge and opinion in the field, relatively few people working in exhibition design having had the inclination, opportunity or background to research and theorise the methods and principles they use. To shed light on the knowledge and understanding that exhibition designers apply in developing exhibitions, this thesis reports the findings of a series of interviews with practicing designers. The interviews reveal that designers rely heavily on innate creativity and intuition in the development of exhibitions. Few of the designers were aware of relevant methods and theories from other fields that they could apply to the practice of exhibition design.

The unique character of individual museum exhibitions is a further impediment to the development of transcendent guidelines and theories for exhibition design, although the

potential to develop exhibition design guidelines or standards is widely debated. A 2003 conference conducted by the United States’ National Science Foundation focused on best practice in science exhibitions, seeking to establish some criteria for their development and evaluation.\textsuperscript{10} McLean suggests good science exhibitions share certain characteristics, but there is a total lack of agreement on what these underlying principles might be and no theoretical basis for the successful staging of exhibitions.\textsuperscript{11} In a 2007 review that explored exhibition design as an aspect of visitor studies in the museum sector, Macdonald argues that an effective exhibition language is still to be developed.\textsuperscript{12} In examining the history of exhibition design at the Museum of Modern Art, New York, Staniszewski argues that the art of display design has been collectively forgotten.\textsuperscript{13} The poverty of exhibition design theory is a barrier to the professional development of exhibition design and limits its contribution to the development of successful museum exhibitions. Indeed, Lorenc argues that it is hard to consider exhibition design as a profession, even though it is the subject of vocational education in the tertiary sector.\textsuperscript{14}

With public education a major mission for contemporary museums, the practice of exhibition design needs to be grounded in an understanding of visitors’ learning processes. The International Council of Museums initiated international discussion about museum education in the 1950s, the study of museum learning generating considerable discussion on the part of museum specialists in the intervening period. Two major approaches dominate discussion of the nature of museum learning. The first is learning theories from the fields of education and psychology. The second is knowledge and understanding gained from the field of visitor studies. The discussion of museum learning employs several predominant models to describe visitors’ informal or free-choice learning behaviour in museums. Hein advocates constructivism as the most appropriate model for museum learning.\textsuperscript{15} Falk and Dierking propose the contextual model of learning as a framework for understanding visitor learning.\textsuperscript{16}

\textsuperscript{11} K. McLean 2004, ‘Introduction: Best practice should be a tool, not a rule’, in K. McLean and C. McEver (eds), \textit{Are We There Yet?}, pp. 2-4.
Despite the substantial literature on museum learning, key ideas in this body of knowledge and opinion have not been adequately incorporated into theories of exhibition design. Miles made an early attempt to explain the development of museum exhibits from an educational perspective. Drawing on the rich experience gathered during a long career in exhibition design at London's Natural History Museum, Miles proposes a set of guidelines for developing educational exhibitions. More recent discussion of exhibition design makes little attempt to connect these propositions to the literature on museum learning. Some museum professionals argue that the growing understanding of human cognition and learning should inform the nature of museum settings. In Caulton's examination of hands-on exhibitions, he argues that systematic investigation of people's learning in informal settings is needed to further develop the understanding of museum exhibitions. Hooper-Greenhill suggests that learning theories and research findings regarding people's cognitive processes should be systematically applied to the practice of exhibition design. However, she offers no substantive propositions for how this might be achieved.

Within the scant general literature of exhibition design, the idea that exhibition space might have a bearing on or contribute to informal learning is even less considered. In recent times, design has begun to gain attention in the development of learning spaces in formal education. The integration of information and communication technology, learning theories and student demographics are the major driving forces challenging contemporary education planners and designers to rethink the nature of learning environments in schools and universities. By contrast, the role of space language in regard to the design of museum exhibitions is at a nascent stage, although spatial planning is often the primary step in the exhibition design process.

Exhibition space is the first layer of information that visitors encounter in exhibitions. Visitors may not view all an exhibition's content during their visit, but they experience space as soon as they cross an exhibition's threshold. In art museums and galleries, the 'white cube' exhibition space has often been mistaken as a neutral container for exhibition content, becoming the target of significant analysis and critique from artists and art theorists for its role in ascribing meaning to works of art and in exercising a strong

18 Caulton, p. 21.
influence over people's behaviour and experience in museums and galleries. The use of open plan exhibition design in science museums presents a different set of problems. Exhibition space can be flooded with information, information pollution making space incomprehensible. For Allen, science exhibitions that are filled with rich information displayed in large, open environments can resist 'immediate apprehendability'.

A more sophisticated conception and application of space design in museums could work in harmony with exhibition content to achieve improved learning experiences. Rouette, for example, argues that exhibition space can have a significant affect on visitors' experience of an exhibition, physically and psychologically. Measuring visitors' learning experience and retention of exhibition content as an aspect of exhibition evaluation and visitor studies has advanced the museum sector's understanding of the connection between exhibition settings and learning. However, there is no systematic investigation of the bearing on or contribution of space to learning. Recently, the spatial analysis technology known as Space Syntax has been used to analyse and predict how spatial organization affects visitor movement in exhibitions. Although visitors' engagement with exhibition content influences their circulation in space, visitors' perception of spatial information cannot be revealed by this method. The understanding of exhibition space needs to be far more developed if museums are to offer the visitor a holistic, compelling and memorable experience, including through their approach to space design in exhibitions.

**Research areas and knowledge gap**

In investigating the role of exhibition space in support of informal museum learning in the aim of providing a theoretical basis for the practice of exhibition space design, the research sits between the areas of exhibition design and museum studies. Exhibition design includes the design principles discussed in the museum studies literature. To understand exhibition designers' current professional knowledge, the thesis considers material from interviews with seven exhibition designers. The area of museum education provides discussion of the learning aspects of exhibitions. The literature of visitor studies provides a body of empirical research into peoples' learning behaviour in exhibitions. A
knowledge gap is found within the areas of exhibition design and museum studies, suggesting the lack of a holistic theory for designing exhibition space in support of informal learning in exhibitions.

To frame the consideration of the possible bearing on or contribution of exhibition space to the learning aspect of museum exhibitions, the thesis looks into the areas of learning theory, cognitive psychology, and environmental psychology and design. These areas provide many insights into how people learn in different contexts. The thesis explores three specific bodies of theory to this end: constructivism, spatial intelligence and mnemonic loci. I combine aspects of each to develop a design framework to make of individual exhibition spaces more understandable and memorable for museum visitors in the aim of having a positive influence on museum learning.

Since the 1990s, constructivism has become a popular theory for describing visitors’ learning behaviour, duly influencing museums’ approach to public education and the development of exhibitions. Initiated by Jean Piaget as a developmental psychology, constructivism helps explain the stages, elements and characteristics in the acquisition of knowledge. Suggesting that individuals construct knowledge from their own experiences, constructivism parallels the current understanding of museum learning. The study of constructivist learning has significant implications for exhibition design, in suggesting that exhibitions need to accommodate not only visitors’ behaviour in space, but also their comprehension of exhibition content.

Long being recognised as a major human competency for survival, the study of spatial intelligence is another area contributing to the understanding of learning behaviour in space. The term spatial intelligence is still widely debated in psychology in respect of whether it should be considered an intelligence, although the study of spatial ability has identified the major elements people use to develop spatial cognition. Museum interiors and exhibitions often contain complex spatial arrangements. A range of insights from spatial intelligence contribute to the thesis in shedding light on how people learn in and about space. They then inform the theoretical framework for designing exhibition space to align its nature with museum visitors’ spatial learning behaviour to support spatial cognition.

Utilising the potential of spatial intelligence, mnemonic loci allows the research to link exhibition space, spatial learning and museum learning. Mainly a study of using space as a
memorising tool, mnemonic loci reveals one psychological fact about human spatial intelligence; information can be memorised and recalled by using place memory. The design of exhibition space then has potential to impact on visitors’ image and apprehension of content. Visitors can gain better memory and understanding of content from their place memory. Besides the strong image of each space, for information situated in complex exhibition environment, it is also important to allow visitors to connect different spaces and so the content within them. Forming connected place memory shows one way to support visitors’ understanding of space and content. Concluded from the principles of constructivism, spatial intelligence and mnemonic loci, the concept of connected place memory shed light on the use and design of exhibition space for learning purpose.

**Research questions and methods**

In considering how exhibition space might help visitors create connected place memory in support of informal learning, the study questions the current frameworks and spatial elements for the design of museum exhibition space. Research into human cognition suggests that creating connected place memory could play an important role in the development of museum exhibitions as informal learning contexts. This thesis argues that principles of exhibition space design based on theories of human spatial interaction can contribute in positive ways to museum visitors’ learning processes. The nature of spatial cognition theories and museum visitors’ learning behaviour are both complex subjects not readily translatable into the language of interior design. The design framework developed from these bodies of theory is formulated to link corresponding elements form the two sets of theory in ways that designers can practically develop actual exhibition spaces that might prompt the formation of connected place memory. The framework also helps designers to relate design elements to exhibitions’ pedagogical goals.

To establish the theoretical framework and spatial elements in aid of the formation of connected place memory in the design of exhibition space, the study uses combination of four research methods: theory analysis, interview, example analysis and exemplary design. The thesis firstly uses current understanding of human spatial ability and learning behaviour to develop a theoretical framework for understanding how design might prompt connected place memory to support informal learning in museum exhibitions. The framework includes a set of spatial elements as the basis for design. To reinforce the knowledge gap identified in the review of relevant literature and to link the theoretical framework to designers’ experience and knowledge, the thesis reports on interviews with
seven museum professionals, most of them exhibition designers. Using the spatial elements from the theoretical framework as a set of analytical tools, the thesis analyses exhibition areas in three museums—the 17th & 18th Century European Art Gallery at the National Gallery of Victoria (NGV), Melbourne, the City Museum at the Old Treasury Building, Melbourne and the Human Body exhibition at the Melbourne Museum—to exemplify how the spatial characteristics of many exhibition areas are unlikely to prompt the development of connected place memory. Finally, the thesis uses the theoretical framework and its spatial elements to redesign the 17th & 18th Century European Art Gallery at the NGV to show how designing to create connected place memory directs the practice of exhibition and interior design. The combination of the four research methods is the basis for the proposition of a final design framework at the conclusion of the thesis.

**Purpose of the research**

In answering the research question, the thesis proposes a theoretical framework for practical application by exhibition designers. The framework is directed at enhancing museum visitors’ connected place memory, which the literature of spatial intelligence and mnemonic loci suggests may better support informal learning in museums. Exhibition designers have long worked within the available architectural space of museums to support the specific conceptual and learning goals of individual exhibitions, but largely in the absence of any basis of knowledge for the design process. Neither the literature of exhibition design nor museum studies addresses how connected place memory can be mapped onto exhibition space in support of learning experience. Proposing a design framework and corresponding spatial elements for design for connected place memory, the thesis advances a theory of exhibition space design, which it argues, could help visitors better absorb exhibition content as a result of the provision of apposite spatial information. Fields including education and psychology propose learning models that museums apply in developing exhibition content, but these are not related to either spatial or design principles, which are an integral element of museum exhibitions. The framework proposed in the thesis provides an immediate and applicable guide for exhibition space design and for the evaluation of the design of existing exhibition spaces in respect of their scope to promote connected place memory. The thesis argues that the application of the framework by designers should result in exhibition spaces that better support visitors’ meaning making and learning experience because such environments demand less of museum visitors in terms of spatial comprehension.
The value of the research

Despite the range of discussion in the museum studies literature on visitors’ behaviour in exhibition space, there is a need for research and theory that provides a holistic view of the impact of the designed aspects of exhibition space on learning behaviour and experience. This study has the potential to contribute to visitor experience and informal learning in museum exhibitions in several ways. Firstly, it identifies the possibility of framing spatial design as a potential adjunct to informal learning, establishing a precedent for designers to explore new frameworks for the design of exhibition space. Museums can benefit from the research in that it provides insight into the potential of exhibition space design to actively contribute to museum visitors’ learning experience through the formation of connected place memory. A broader implication of the research is its potential to contribute to the rapidly growing field of informal learning environments, including virtual learning spaces. The thesis advances a theoretical framework and design guidelines for designers and educators who seek to incorporate spatial learning in self-guided learning environments.

The structure of the thesis

Following this introduction, the thesis has six chapters and a conclusion. Chapter One provides a contextual review of the main research areas of museum exhibitions and museum learning. It discusses the evolving social and cultural roles of the museum from the mid-twentieth century, identifying the major trends in exhibition design before focusing on the activity of museum learning. I discuss relevant aspects of published knowledge and opinion in the field of visitor studies to establish how the museum sector understands the relationship between exhibitions and learning experience. Chapter One identifies constructivism as the principal model of museum learning in museums today and thus the most relevant one to underpin a theory of design for the development of connected place memory.

Chapter Two investigates design theory and professional knowledge in the area of exhibition and environmental design with a focus on the relationship between space and learning. It identifies the poverty of principles and theories of exhibition design and the lack of theories for designing space within informal learning environments.

Chapter Three sets out the knowledge gap, research questions and methodology for answering these questions. It establishes the theoretical stance of the research within the
wider context of design research, setting out an interdisciplinary strategy for establishing a theory of design for the development of connected place memory. The chapter argues for the three research methods: interview, example analysis and exemplary design.

Chapter Four examines current knowledge on human spatial ability through the areas of constructivism, spatial intelligence and mnemonic loci, a set of published knowledge that sheds further light on museum visitors’ learning behaviour. The chapter concludes the discussion of area of knowledge outside design of relevance to designing exhibition space for the development of connected place memory, thus establishing the overall knowledge base of the thesis.

Chapter Five proposes a design framework for the development of connected place memory in museum exhibitions, building on the arguments set out in the previous chapters of the thesis. It explains the four main design elements of the design framework, their various sub-elements and the role of each in supporting the formation of connected place memory in the design of exhibition space. The framework informs the analysis of relevant museum examples and a program of exemplary design. These support the overall contention of the thesis and demonstrate the framework’s potential as an analytical tool and conceptual basis for exhibition design in the museum context.

Chapter Six uses three sets of research data to support the need for the development of a theory of connected place memory and which support the value and applicability of the framework for the development of connected place memory in actual museum settings. The chapter opens by reporting on the semi-structured interviews with seven museum professionals. These establish the parameters of current practices in respect of exhibition design in museums, providing a sense of museum professionals’ understanding of the relationship between exhibition design and informal museum learning. I follow this discussion with an examination of the application of the framework for the development of connected place memory to the analysis of three relevant examples: the 17th & 18th Century European Art Gallery at the NGV, the City Museum at the Old Treasury Building and the Human Body exhibition at the Melbourne Museum. The chapter concludes with the presentation of a program of exemplary design work in which I use the framework for the development of connected place memory to redesign the 17th & 18th Century European Art galleries at the NGV. The design work is presented through 3D simulation, employing still images.
CHAPTER 1

MUSEUM LEARNING

Each visit to a museum exhibition is a journey of learning in which museum visitors encounter a sequence of artefacts, experiences, information sources and environments that seek to influence their knowledge, emotions and outlook on the world. Today, museums are multifaceted institutions that operate in diverse contexts and contribute to human society in a variety of ways. Increasingly, public education and outreach is a principle role for museums and an important justification for their public funding, enabling museums to continue their work in collecting and researching artefacts of high cultural, scientific and social significance. The educational role of museums has long been recognised, but it was not until WWII that the field of museum education began to emerge as a professional sphere. Museums' transformation into educational institutes has not been an easy one, the complex historical instrumentality of the museum being based on their role as repositories of exemplary artefacts attesting to human cultural achievement and the diversity of the natural world. Today, Message argues that, 'museums exist as variously configured sets of institutional coordinates that aspire to function as popular, demotic spaces dedicated to representing a variety of experiences and modes of citizenship.'

In progressively embracing its relationship and responsibility to the public, the museum sector has gradually developed the idea of the visitor-centred museum, with museums today eager to show their social relevance by emphasising their educational role. According to the International Council of Museum's (ICOM) latest definition, 'a museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study, and enjoyment.' Echoing ICOM's efforts to define the nature and purpose of the contemporary museum, many national museum associations frame their own definitions of the museum, which also typically highlight museums' educational mission. The Constitution of Museums Australia stresses the educational function of the museum,

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stating that, ‘A museum helps people understand the world by using objects and ideas to interpret the past and present and explore the future.’ The American Association of Museums describes the contemporary museums’ mission as including ‘collecting and preserving, as well as exhibiting and educating with materials not only owned but also borrowed and fabricated for these ends’.

The emphasis on museums’ educational role creates a need to understand the nature of museum learning in order to provide effective learning experiences for museum visitors. International conferences and discussions conducted by ICOM and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) since the 1940s chart the growing significance of museum education, these activities being bolstered by the subsequent establishment of various local and international organisations to promote the field of museum education, including the Group for Education in Museums (UK), Museum Education Round Table (US) and the Museums Australia Special Interest Groups. Today, museum learning is a significant area of debate in the museum studies literature, key topics of discussion being informal learning, learning theories and visitors’ learning experience. The rapid growth of the field of visitor studies since the 1980s has provided many insights into museum visitors’ learning behaviour and experience. Better understanding of visitor learning has contributed to the museum sector’s understanding of its educational role. However, despite the effort to establish visitors’ learning behaviour and experience in the decades since WWII, an agreed theory of museum learning is yet to eventuate, the nature of individual museums as specific contexts for visitor learning being an impediment to the framing of one single learning theory.

The following section investigates published knowledge and opinion on the nature and characteristics of museum learning in the aim of identifying how the museum sector understands the nature of exhibitions as learning environments. It surveys the changing role of museum education since 1946, the year that saw the establishment of ICOM, an important milestone in the development of the modern museum. The broad review of perspectives on museum education since WWII shows that important new ideas about museum learning have emerged, but it also reveals that many earlier perceptions and

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32 A non-governmental organisation established in 1946, which has consultative and associate relations with United National Educational, Scientific, and Cultural Organisation (UNESCO)
practices persist. The review shows that the field of visitor studies is the source of the major evidence about how people learn in informal museum settings, providing the foundation for museum learning theories.

Two key sources represent the development of the museum learning debate. The first is the program of conferences conducted by ICOM and UNESCO since 1946. The second is the set of relevant articles in Museum International, the scholarly journal on museum practice founded in 1948 by UNESCO and which museum scholars and professionals internationally contribute to. Other sources flesh out the discussion to provide an overview of the evolution of the museum learning debate. My aim here is not to present the historiography of the debate, although this is of interest in its own right. Rather, my goal is to identify the most pertinent models of museum learning as the basis for the proposition and defence of the framework of exhibition design for connected place memory outlined in this thesis.

The following section reveals that constructivism, a major theory in the field of developmental psychology, is the most common theoretical framework the field of museum studies uses to describe the nature of informal learning practices. Another relevant theoretical perspective on the nature of human cognitive function and learning discussed in the museum literature is Gardner’s theory of Multiple Intelligences. Gardner’s arguments about the breadth of human intellectual capacity outside logic or verbal ability have inspired many in the museum sector to broaden the nature of museum experience and the methods for presenting exhibition content. Of key relevance to museum practice and this research is the place of spatial intelligence in Gardner’s theory, the design framework for the development of connected place memory in museum exhibitions seeking to harness people’s spatial ability and learning to enhance the experience and effectiveness of informal learning in the museum. The thesis combines constructivism and spatial intelligence to form the basis for the development of a set of design precepts that inform the practice of exhibition space design in the museum sector in the aim of better supporting informal learning.

The evolution of the museum as an educational context

Following the massive destruction of WWII, many countries sought to celebrate their natural and cultural heritage in the immediate post-war period through the development of new museums. The boom in new museums saw the museum’s sector go beyond its traditional work in the identification, preservation and interpretation of important
artefacts of cultural and natural history to embrace a more broadly social role of disseminating knowledge and values. The establishment of ICOM in 1946 initiated wide discussion on the relationship between museums and education among an international community of museum specialists.

The period 1945 to 1950 represents the museum sector’s first concerted attempt to consider the museum’s role as an educational institution, resulting in efforts that were more experimental than theoretical. Several articles on educational topics appeared in the first volume of Museum, the title of Museum International prior to 1993, providing the first evidence of museums lifting their focus above their prized collections. These articles include discussion of new trends in display design in the aim of enhancing the effectiveness and accessibility of the information museums provided to their visitors. Reports from various countries show leading museums experimenting with visual aids, educational films and guided tours as part of their educational strategies. Visual displays are promoted as more effective in attracting and stimulating interest than those relying heavily on written information. Articles reveal museums beginning to reach out to different constituencies to the traditional museum visitor. These new audiences include economically, educationally and socially disadvantaged groups, which museums sought to attract through public lectures, short courses, loan materials and hands-on experiments, these additions to museum practice intended to stimulate interest in museums’ holdings among a broader cross-section of society. Articles show museums cooperating with schools to encourage community involvement, reinforcing the idea that engagement with museums is a learning experience. Indeed, service to youth is a burgeoning aspect of museum practice in the immediate post-war period, as evinced by the number of junior museums established in institutions between 1945 and 1950 and discussed in Museum.

In seeking to establish the museum’s social value, museum professionals stressed the educational role of museums and advocated that museums should become an integral part of the community education system. Certainly, museums actively sought to move into the provision of educational services during this period, but the absence of significant learning

33 ‘Museums and Education’, 1948, Museum, vol. I, no. 3, pp. 121-220. There were four topics in this issue: Museum Teach, Educational Display Devices, Children and the Museum, the Film and the Art Museum.
theories raises doubts over the effectiveness of their efforts. As a matter of significance for this research, educational services in museums tended to grow more outside the exhibition environment than within it, the addition of classrooms and lecture halls to museums offering a more formal learning experience.

The debates and experiments of the immediate post-war period provided the basis for international discussion of museum education issues for the next two decades, the role of museum education being clarified and the educational value of exhibitions acknowledged in a series of four major UNESCO seminars held in 1952, 1954, 1958 and 1966. Hundreds of museum professionals from all over the world attended each conference to discuss major issues and developments in museum education, raising the awareness of museum education internationally and giving broad exposure to advances in specific countries. These discussions range across the practical aspects of museum programming and exhibition design to the pedagogical and psychological dimensions of museum education.

Some trends are evident at each seminar and over the sequence of the four conferences. During the 1950s, discussions show museum programs reflecting 'the growing tendency in education to replace purely academic schooling by more active methods'. Museum professionals begin to recognise that objects themselves might not communicate sufficient information, challenging museums to develop more effective exhibition techniques and educational strategies. The 1950s were an era in which museum staff devised many new ways for engaging and informing visitors. These efforts ranged from minor changes like the addition of more informative labels to displays to the introduction of major initiatives like hands-on displays and visual aids to explain artefacts. To recognise the growing educational role of museums, in 1961 ICOM added education to its definition of a museum, its revised charter stating, 'ICOM shall recognise as a museum any permanent institution which conserves and displays, for purposes of a study, education and enjoyment, collections of objects of cultural or scientific significance.'

In reforming museums as institutes for informal learning, museum professionals began to consider the different needs of adults and children in the design of the educational aspects of exhibition programs. The inherent challenges in this were equally recognised. For example, the UNESCO seminar held in New Delhi in 1966 explored, 'problems of teaching

in museums’ from the perspective of issues ‘inherent in the psychology of imagination and of understanding’. Articles published in Museum after the seminar extend the discussion, considering many developments in educational aids and services for museums from ‘the training of museum staffs or school teachers for different types of service’ to ‘the provision of museum equipment from the simplest display methods to the use of television’.41

Following the first three major UNESCO seminars of 1952, 1954 and 1958, the museum sector had forged two significant conclusions about museum education. The first was that educators are ‘far from being fully aware of what museums of all kinds provide to enrich and reinforce their work, and that efforts should continue to be made to help them ... benefit by museums’ services’.42 Although museums were still seen as a complement to formal education, some museum professionals proposed they should play a leading role in education provision by becoming centres for community learning. The second important conclusion was that exhibitions should be the main way of offering educational services in museums.43 Other educational services such as lectures and workshops would serve specific groups of visitors, but it was argued that most museum visitors would learn by attending museums’ exhibition halls. For example, the third UNESCO museums seminar, held in Rio de Janeiro in 1958, concluded that ‘Exhibitions, suitably organized and presented are museums’ most effective instruments of education, and the most valuable means that they offer to the educator in support of his own efforts.’44

Between 1952 and 1968, the museum sector increasingly promoted the importance and value of museum education, although the sector still offered no theories to describe visitors’ learning experiences, visitor studies having only just begun to investigate visitors’ behaviour and experience in the museum. In the 1960s, Screven and Shettel began to examine the impact of exhibitions on learning experience, augmenting the systematic studies of visitor behaviour in museums initiated by Robinson and Melton in the 1920s.45 However, their research was quite basic and did not provide sufficient evidence to build a general theory of museum learning. Rather, it suggested that the strategies for developing exhibitions and understanding museum learning had begun to become more empirically based by this time. Screven and Shettels’ work showed the emerging influence of a behaviourist conceptual framework on ideas of museum learning, which suggested that

41 Ibid.
43 Ibid.
44 Ibid.
45 Bitgood and Loomis, p. 684.
learners will learn what teachers choose to teach, marking museums’ attempt to shift from ‘the role of passive guardian of collections’ to ‘a more outward-looking attitude’. Articles in *Museum* from the period 1952 to 1968 reveal an eagerness to publicise museums to communities and to relate the stories behind museums’ collections, a prevalent concern being the replacement ‘of a rational order of values, for a more convincing recognition of what is at the heart of thing’. Overall, however, the most important development from the period 1952 to 1968 was the goal that the public learns something from what museums provide.

During the period 1970 to 1990, developments in museum practice in specific regions around the world confirm the conclusions reached at previous international UNESCO seminars on the nature and purpose of museum education services. Articles in *Museum* and session titles for UNESCO conferences widely confirm the role of museums as informal learning institutes and mark the efforts of museums internationally to expand their education services outside the limits of the institution. Most significant here was the rising awareness in many countries of the importance of co-operation between museums and schools. For instance, a 1972 round table meeting on the role of museums in Latin America organised by UNESCO in Santiago, Chile, proposed that national educational policy should see every museum providing educational services and materials. In this respect, Gómez Millas argued that museums should play a vital role in life-long education within societies, providing opportunities for public enlightenment, personal development and active citizenship.

Through the combination of local and international gatherings of museum staff, the place of education in museums is well established by the 1990s, although in practice approaches to education delivery often emphasise services and approaches located outside exhibition spaces. Museums now generally consider exhibitions to be the major medium for transmitting knowledge, with a group of those advocating a deeper understanding of museum exhibitions’ potential and impact on visitors emerging. In 1987, Schouten contends that the informal learning situations created by exhibits should be the subject of empirical research to enable the impact of exhibitions on visitors to be evaluated and visitors’ experience to be better valued and understood, enabling

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47 Marcousé, p. 2.
48 Taybr, p. 125.
exhibitions to be developed on the basis of evidence rather than orthodox practice or intuition.52

It is at this point that visitor studies gain real traction in the framing of public programs in museums. Formerly executed by outsiders, visitor studies now became an in-house process in many museums. The Visitor Studies Association (USA), a professional network established in 1988 committed to evaluating people’s learning experience, becomes an important forum for discussing various aspects of visitor studies and exhibition evaluation, marking the growing prominence of the field in museums. The establishment of the Visitor Studies Association suggests how research into museum visitors has become an internal process of museum practice. Visitor studies investigate topics like exhibition effectiveness, visitors’ environmental behaviour and learning factors.53 The popularity of visitor studies in the 1990s contributes to the formation of learning theories. For example, John Falk and his colleagues initiate studies on the relationship between the settings of field trips and learning experience, providing the basis for Falk and Dierking to propose their Contextual Model of Learning for the museum in 2000.54

In the 1990s, the literature of museum studies is the context for a boom in the proposition of theories of museum learning, driven by continuing debate internationally in the museums sector for more and more effective educational services in museums. During this decade, it also becomes increasingly important for museums to validate the effectiveness of exhibitions and to establish their educational value to justify public spending on museums.55 Besides gaining insights from visitor studies, some museum professionals begin to look to other fields to better understand the relationships between museum services and museum visitors. For example, Hooper-Greenhill argues that to make museums more effective as learning institutions, 'Information gathered through the disciplines of sociology and psychology [should be] incorporated into the exhibition processes'.56 Museums, she notes, are ‘actively re-organizing their spaces and collections to present themselves as environments for self-directed learning based on experience’.57 Learning theories such as constructivism, which understands learning as a personal construct, become increasingly popular in museum field.

53 Bitgood and Loomis, pp. 687-93.
57 Ibid.
Constructivism suggests that knowledge is gained through individual meaning making processes, challenging the principles of behaviourist education under which museum education had formerly operated. Hein, for example, considers a range of theories of learning and knowledge in the search for an appropriate model to explain the voluntary nature of museum learning, identifying constructivism as the best candidate.\textsuperscript{58} Similarly, Falk and Dierking, in viewing museum learning as a free-choice process of making meaning based on museum visitors' personal, physical and socio-cultural makeup, embrace constructivism as the basis for their model of museum learning. Their 'Contextual Model of Learning' suggests that 'all learning is situated within a series of contexts'.\textsuperscript{59}

Constructivism also supports the established perception in museum discourse and practice that the provision of 'hand-on' displays creates more compelling and effective museum education. For instance, Caulton's 1998 primer on 'hands-on' exhibitions examines the major educational principles on which interactive exhibitions are based.\textsuperscript{60} He identifies two important theories as relevant to individual museum learning in the museum: Piaget's developmental theory of learning, which is the basis for the development of constructivism, and Gardner's theory of Multiple Intelligences. Gardner's \textit{Frames of Mind}, which advances his theory of Multiple Intelligences, was first published in 1983 and suggests that each individual possesses a different intellectual profile composed from seven intelligences, rather than the single intelligence measured by IQ tests.\textsuperscript{61} Widely adopted by formal educational institutes as a basis for revised pedagogical practices, the theory of Multiple Intelligences also found supporters among museum professionals who perceived education as an important objective for museums in an era in which their role is linked to social democratic ideas of equal opportunity and institutional inclusiveness. Notably, Hooper-Greenhill suggests that museums should provide environments that stimulate the wide range of intelligences, arguing for 'serious consideration of how the ideas of Howard Gardner can be applied in the museum context'.\textsuperscript{62}

In visitor studies of the 1990s, the educational effectiveness of exhibitions is extensively investigated, resulting in a greater understanding of visitors' learning behaviour. Publications from the Visitor Studies Association, the establishment of the Visitor Studies Group (UK) in 1998 and studies conducted by research centres such as the Australian

\textsuperscript{58} Hein 'Museum Education', pp. 345-50.
\textsuperscript{60} Caulton, pp. 17-36.
\textsuperscript{61} Seven intelligences include linguistic, musical, logical, spatial, kinesthetic, intra-personal and interpersonal capacities.
Museum Audience Research Centre (AMARC) contribute to the emphasis on learning processes and the formulation of pedagogical strategies for museum exhibitions. Besides evaluating the affect of exhibitions on visitors’ learning experience, another major trend in visitor studies is the examination of environmental behaviour, which investigates how physical settings affect people’s behaviour and experience. There are several useful accounts from this time of the relationship of visitor behaviour and exhibition contexts, notably that of Bitgood and his colleagues, which mainly concerns visitors’ orientation and circulation in exhibitions.63

Since the late 1990s, however, discussion of the value of information and communication technology as a conduit of enhanced content delivery has eclipsed discussion of museum education in terms of theories of learning and human cognition. Computer technology, following Moore’s law, advanced dramatically in the 1990s, finding diverse applications in museum practice and quickly becoming entrenched as the emblem of an advanced public knowledge institution. The use of multimedia has steered museums in new directions; since 2000 there have been few articles in Museum International discussing educational programs in museums, especially by comparison to the large number of articles on new technology.64 The decline in the number of articles on museum learning and education suggests that information technologies are understood to have an implicit educational dimension. However, outside the museum field doubts have been raised about the use of information technology in education. As early as 1996, Veenema and Gardner cautioned that, 'Technology does not necessarily improve education ... It could become a valuable education tool, but only if we use it to capitalize on our new understanding of how the human mind works.'65 More recently, museum-specific research has been undertaken that questions, for example, the use of rich media in virtual museums without the application of valid educational principles. For example, Brown argues that museums should, ‘look beyond the types of media used and consider the kinds of learning outcomes implied or explicit to assess the learning effectiveness of the design.’66

64 Museum, the international journal published by UNESCO, was changed into Museum International in 1993.
Despite the growing focus of digital delivery platforms for exhibition content, education and learning are still important issues for museum practice. Contemporary museums have an urgent need to secure their positions in everyday society and in the virtual world. They face growing competition from entertainment industries, which are often highly successful in their use of information and communication technology if audience numbers and commercial profits are a gauge of success. In this climate, museums may distinguish themselves by focusing on the preservation of natural and cultural heritage and education, but they will still face significant competition for audience share unless they do this in an exemplary and appealing fashion by paying increased attention to evaluation and evidence-based programming. Understanding museum learning and visitor experiences is central to the success of museums. Although the development of museum education, learning theories and visitor studies has identified the character of museum learning, Hooper-Greenhill argues that, 'definitions of what count as learning remain fluid'.67

Learning theories

The contextual review of museum education identifies three major bodies of theory of relevance to the nature of museum learning: Behaviourism, Constructivism and Multiple Intelligences. This section sets out these theories to establish a relevant conception of museum learning on which to base a framework for the development of connected place memory in museum exhibitions. Behaviourist approaches have been widely used in formal education and have had some impact in discussions of museum education, although they have little direct influence on the characteristics of informal learning in museum settings. Today, constructivism is the most frequent model for explaining people's learning behaviour in museums. In addition, the museum sector adopts the theory of Multiple Intelligences to suggest that people learn through different cognitive capacities, thus requiring the provision of diverse information forms and experiences in museum exhibitions. The discussion of the nature of human spatial intelligence has much to offer principles of exhibition space design and I include it in this thesis to indicate the value of psychological studies into human space perception in understanding the role of exhibition space in supporting informal learning in the museum.

Behaviourism

Although not explicitly named in the museum literature, behaviourist approaches have been widely used to understand museum learning. Behaviourism reflects a positivist view

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of epistemology in considering the learner as a vacuum waiting to be filled with knowledge existing in the outside world. Seeing knowledge as something added to learners incrementally, behaviourist pedagogy strongly supports the need for teachers to structure courses appropriately so that learners can acquire knowledge step by step. Popular in school settings, behaviourist approaches have spread to other learning settings, including museums.

Even with the later emphasis on communication in museum education, the staged presentation of content in museums largely reflects a behaviourist approach. However, recent studies in the experience and learning of museum visitors suggest that the behaviourist model of learning fails to adequately describe the learning behaviours of museums’ diverse audiences. In describing the use of behaviourism as a communication model in museums, Hooper-Greenhill contends that behaviourist approaches conceive the museum as conduit for the transmission of knowledge where structured information passes seamlessly from sender to receiver. Table 1 sets out several key characteristics of this classical communication by transmission model as summarised by Hooper-Greenhill.

<table>
<thead>
<tr>
<th>Educational model</th>
<th>Behaviourist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength</strong></td>
<td>Strong message.</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
<td>Fails to recognize personal ways of understanding meaning.</td>
</tr>
<tr>
<td><strong>Museum</strong></td>
<td>Linear development process, no reflexive, no evaluation, no consultancy, no collaboration</td>
</tr>
</tbody>
</table>

Table 1: Summary of principles of transmission communication.68

Hooper-Greenhill criticises behaviourist approaches, which are used in the development of many exhibitions, as reflecting a one-way, linear transmission of information.69 She argues that by contrast, ‘the audience is always "active", whether or not museums recognize this’.70 Once museums acknowledge visitors' active learning behaviour, the one-directional behaviourist approach to the presentation of information appears inadequate to the task of raising the interest and curiosity of museum visitors and risks overloading them with information. Using evidence from the fields of neuroscience and visitor studies,

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69 Ibid., p. 16.
70 Ibid., p. 19.

Some studies in neuroscience have shown that when learning happens, many different areas of the brain beyond those that process information delivered from the sense organs become active and acquire information. Such research indicates that learning is a constructive process that happens within each individual, neither functioning in one area of the brain nor simply taking information from outside world.\footnote{J. H. Falk 1997, ‘Recent Advances in the Neurosciences: Implications for visitor studies’, Visitor Studies, vol 9, no. 1, pp. 227-38.} Falk, Dierking and Adams argue that museum learning has been based on traditional transmission models of learning, presentation models echoing teaching strategies based on behaviourism in their tendency to be instructive.\footnote{Falk, Dierking and Adams ‘Living in a Learning Society: Museums and free-choice Learning’, p. 325.} Given the evidence from visitor studies, cognitive psychology and neuroscience, lately behaviourism has been challenged as the traditional approach to museum learning, being overtaken by communication models in which content providers and participants are seen to create and share knowledge in a two-way exchange.

**Constructivism in the museum**

As a learning theory, constructivism suggests that people construct knowledge or meaning from their own experience. Initiated by Jean Piaget as a theory of developmental psychology, constructivism has had a great impact on education, especially in informal settings.\footnote{J. Piaget 1950, The Psychology of Intelligence, Routledge, London.} Its emphasis on learning instead of teaching contradicts standard conceptions of pedagogy in formal education. Constructivism attracts interest from those involved in providing learning opportunities in situations outside of formal education, where context predominantly provides the basis for learning.

Museum professionals see constructivism as relevant in museum settings in privileging active learning rather than passive knowledge delivery. Constructivism challenges the assumption that reception provides immediate and universal access to linguistic and visual meaning. Hein proposes the idea of the constructivist museums, reflecting his interest in a learning model that accommodates the different learning needs of diverse museum visitors.\footnote{G. E. Hein 1995, ‘The Constructivist Museum’, Journal of Education in Museums, no. 16, pp. 21-23.} In reviewing the range of theories of knowledge and learning applied in museums, Hein suggests that educational approaches in the museum sector can be
organized into four different categories: traditional lecture and text, discovery learning, behaviourist learning and constructivism. He argues that theories of knowledge in the museum range from those that see museum content as existing independent of the learner to those that see knowledge as being constructed by museum visitors. In terms of the process of learning, museum visitors are seen as gaining knowledge either by 1) incrementally adding outside knowledge or 2) constructing their own meaning. For Hein, the educational approach adopted by museums is conceptualized in the diagram below:

![Diagram of Hein's four possible combinations of learning and epistemology](image)

Hein argues that museums can be categorized according to these four general approaches to learning. (Figure 2) He suggests that when museums use constructivism as a learning model, they understand the relationship between the museum visitor and museum exhibitions to be a complex sequence of two-way interactions between visitors, exhibition content and the communication context. Hein concludes that the 'Constructivist Museum' offers the best learning context.77

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76 Ibid.
Figure 2: Hein’s four different kinds of museums.78

Other museum professionals advocate the idea of a constructivist museum for different reasons. In analysing communication strategies for developing exhibitions, Hooper-Greenhill suggests that a constructivist educational model favours the concept of cultural communication, which considers ‘communication as a society-wide series of processes and symbols through which reality is produced, maintained, repaired and transformed’.79 Hooper-Greenhill also advocates a model of museum learning close to the paradigm of constructivist learning when she describes communication as ‘a cultural process of negotiating meaning’.80 She argues that the principles of constructivism should be better valued as a model for communication in museum exhibitions. She advances Sotto’s learning theory as the best approach to understanding learning in the exhibition development process, including exhibition design. This theory describes several important characteristics of the learning process:

- People need a mental model to learn new things;
- A working model is built from action and experience;

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79 Hooper-Greenhill (ed.) The Educational Role of the Museum, p. 16.
80 Ibid., p. 17.
- People make meaning of their lives through pattern recognition;
- People learn through problem-solving;
- The strongest knowing comes from appropriate experiences;
- There are two major forms of knowing-verbal and felt knowledge. Felt knowledge is gained through action.81

A close consideration of Sotto's theory reveals it to be an extension of constructivism, in representing knowledge as a derivative of people's own action and experience.

In developing interactive exhibitions, Caulton suggests that Piaget provides the best primary educational theory for exhibition development in establishing the need to provide rich environments and deep levels of engagement and exploration for museum visitors.82 Caulton also identifies Gardener’s Multiple Intelligences theory as important for the application and development of interactive exhibitions, but concludes that systematic research is needed to investigate people’s learning in informal environments.83 The value of hands-on exhibitions in providing learning experiences especially needs to be studied through validated research methods, which are tested and extended in practice.

**Multiple intelligences**

A research project investigating the extent of human intellectual potential led to the development of Multiple Intelligences theory. The neuropsychologist Howard Gardner integrated insights from psychology, biology and anthropology to propose the idea of Multiple Intelligences to explain the complexity of human intellectual competence.84 Definitions of human intelligence drive the understanding of human intellectual potential. Gardner defines human intelligence in terms of a broad range of human competence, arguing, 'An intelligence is the ability to solve problems, or to create products, that are valued within one or more cultural settings.'85 Since its publication, Gardner's Multiple Intelligences theory has had a central influence over ideas of human intelligence and modes of learning. Traditional measures of human intelligence such as IQ tests focused on formal educational performance, emphasising the linguistic and logical capacities of human intelligence. Since Gardner, both curriculum and intelligence testing mechanisms have been tailored to embrace an expanded idea of human intellectual competences.

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81 Ibid., pp. 143-44.
82 Caulton, pp. 18-21.
83 Ibid.
85 Ibid., p. xiv.
Multiple Intelligences theory contests the idea of a single holistic intelligence, presenting a framework for the presence of discrete human cognitive capacities. Gardner's latest version of the theory proposes that there are nine intelligences: Linguistic, Musical, Logical-Mathematical, Spatial, Bodily-Kinesthetic, Interpersonal, Intrapersonal, Natural and Spiritual. Each individual possesses these capacities in different strengths. This conception of human intelligences has validated teachers' daily experience in schools, where students show various strengths in different areas; Multiple Intelligences theory challenges traditional school systems that value Linguistic and Logical intelligences most highly. The immediate implication of this theory in education is the adoption of different forms of teaching and divergent presentation methods for course materials. Teachers who embrace Gardner's theory prepare taught content in different media and develop new curriculum to cater to the diversity of their student's intelligences. Moreover, students are able to present their work in diverse formats.

Education is the sector of society most influenced by Gardner’s research, but its relevance to institutions like museums that presents information to the public and see the provision of informal learning opportunities as part of their purview is plain. Museums today seek to accommodate a diversity of visitors, Grek arguing that the present era of ‘the new, open and accessible museum (and gallery) has changed the way education is constructed and offered in the museums’.86 Multiple Intelligences theory suggests a theoretical foundation for addressing how different visitors learn from their journey through a museum. The wide use of mixed-media, multi-media and interaction in exhibitions today acknowledges the diversity of human intellectual capacities and preferences and reflects the idea that learning occurs through different channels, many museum professionals valuing the potential of Multiple Intelligences theory as a model for museum education. For example, Hooper-Greenhill contends that Gardner’s theory shows much potential in achieving museums' communicational goals by 'broadening the possibility of relating to people with many skills and abilities'.87 In discussing interactive exhibitions and educational theories, Caulton suggests that Gardner’s view validates the development of hands-on exhibitions as one's intelligences can be stimulated in a richly interpreted environment.88

The aspect of spatial, sometimes called visuo-spatial, intelligence in Gardner's theory suggests that spatial capacity is not only central to human survival, but is also a capacity

88 Caulton, pp. 18-20.
that can be developed to a certain extent. The importance of visuo-spatial capacity has long been recognised by museum professionals. For example, Dean’s examination of the theory and practice of exhibition design speculates that visual perception is a very common conduit for absorbing information in museums, compared with words and other perceptual apparatus. Drawing on cognitive psychology, Dean proposes six cognitive approaches that people use when presented with visual information:

1. Pattern seeking and recognition;
2. Mentally rotating objects in space;
3. Identifying dynamic structures, or mentally constructing movement capacities of objects;
4. Orthographic imagination or mentally constructing three-dimensional objects from two-dimensional representations such as maps or schematics;
5. X-ray visualisation or visualising relationships as though one could see through objects;
6. Visual reasoning or imagining action/reaction events.89

Besides these six visual-mental operations, Dean examines other factors that cognitive psychology argues exercise influence over learning processes, including personal worldview and the physiology of the human brain.90

Dean suggests some guidelines for design based on his study of human cognition, but detailed design principles have not been developed to support higher level learning activities in museum exhibitions. For example, the discussion of shape as the basic element in designing physical and spatial environments is barely represented in the literature on exhibition design.91 Visitor studies show great interest in investigating the relationship between physical setting and spatial behaviour. Popular topics include layout, orientation and circulation.92 Although visitor studies provide many insights into how visitors learn about space, deep questions about the relationship between space and exhibition content are not investigated in the literatures of museum studies or exhibition design. This research proceeds on the basis that the study of spatial intelligence proposed in Gardner’s theory suggests there is considerable potential in the treatment of the spatial elements of museum exhibition to facilitate learning. As this research concerns the learning aspects of

89 Dean, pp. 26-27.
91 Ibid., p. 39.
S. Bitgood 2003, ‘Visitor Orientation: When are museums similar to casinos?’, *Visitor Studies Today*, vol. 6, no. 1, pp. 10-12.
exhibition space, Gardner’s study inspires the research to look further into spatial capacity. The research then draws specific insights from psychological studies to consider the nature of spatial learning and the possibility of enhancing connected place memory in museum exhibitions to support their role as informal learning spaces.

**Visitor studies**

The contextual review of museum education shows that a contemporary expectation of public institutions like museums is that they both justify their receipt of public funds and base their public activities on knowledge rather than assumption. Since the 1980s, visitor studies have become an important part of museum practice, dedicated to gathering substantive data about the needs, preferences, characteristics and behaviour of museum visitors in order to enhance museum visitors’ experience in the museum and to expand the numbers of regular museum goers. The establishment of organisations such as Visitor Studies Association (US) in 1988 and Visitor Studies Group (UK) in 1998 signifies the international museum sector’s growing focus on its relations and communication with museum visitors. Many individual museums and professional associations in the museum field maintain special interest and research groups in the area of visitor study, including the Evaluation and Visitor Research Special Interest Group (Australia) and Committee on Audience Research and Evaluation (US).

Nevertheless, visitor studies is still an emerging area of research and practice in museums. Its terms, concepts and methods are only loosely established and in some respects controversial because they span many disciplines.\(^93\) The diverse areas on which visitor studies draws, the multiple purposes of its enquiries and the varied interests and backgrounds of investigators contribute to a lack of definition in the field. For the purpose of this research, this section reviews the current state of visitor studies with a particular focus on what it has to say about the relationship between exhibition space and museum learning experiences. The section clarifies the major areas and theoretical approaches to evaluation in visitor studies. It then investigates the major studies of the impact of physical environment on visitors, including behaviour and learning. It shows that there is little discussion of the use of exhibition space as a tool to supporting learning in museum exhibitions, although environmental behaviours such as orientation, way-finding and circulation are often explored within the ambit of visitor studies. Research into meaning

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\(^{93}\) Hooper-Greenhill ‘Studying Visitors’, p. 362.

making process in museum exhibitions conducted from a constructivist perspective is beginning to emerge in the field.94 However, very few studies consider how visitors make meaning of or in exhibition space, the role space may play in informal learning processes being in need of much further exploration.

The field of visitor studies has a long history, but its main development dates to the 1980s. Since this time, studies of museum visitors have contributed a substantial body of multifactorial knowledge describing who museum visitors are, why they visit museums, what they obtain from their visits in general and from museum exhibitions in particular and how they receive information and experience. Different terms have been used for describing this evolving field, including exhibition evaluation, audience research and visitor behaviour. In 2006, Hooper-Greenhill described the field of visitor studies as still fragmented, but agreed that ‘visitor studies’ can be used as an umbrella term for a range of investigations into museum audiences.95 Driven by differing aims, museums and related organisations carry out a wide range of visitor studies in diverse contexts and employing various research methods. Currently, the findings of visitor studies mainly inform strategic thinking and exhibition planning in the museum.

Broadly, visitor studies have two main branches: audience research and exhibition evaluation. Audience research concerns the socio-cultural and cognitive makeup of museum visitors. Although the term is often used interchangeably with visitor studies, in this research I see audience research as the study of museum visitors in terms of demographics, behaviour, satisfaction and other aspects, these investigations excluding any consideration of what audience members experience in museum exhibitions. Much like the role of market research in new product development, audience research can help museums better target museum offerings to visitors’ needs and interests, although there are clear issues in how this should be approached, with audience members being seen either as research subjects or, where museums use more participative processes, as collaborators in investigations.

Exhibition evaluation is the area of visitor studies that is most relevant to this thesis. Museum professionals first recognised the value of exhibition evaluation in the 1970s.96 Since then, evaluating exhibitions has become a regular part of museum practice. The

The results of exhibition evaluation have contributed to the theories and principles of exhibition design. Since exhibitions are designed for people, exhibition evaluations investigate how exhibitions affect visitors’ experience and behaviour. Many studies focus on how visitors behave in and learn from an exhibition, most seeking to understand the effectiveness of education and communication. Increasingly, museums recognise that audience members have diverse backgrounds, knowledge and expectations, employing exhibition evaluation as a crucial method for understanding and addressing visitors’ needs and perceptions.

In terms of conducting exhibition evaluations, there are four main evaluation approaches, front-end, formative, remedial and summative, these corresponding to the four key stages of exhibition development, which are planning, production, the exhibition phase and the post-exhibition phase. Front-end and formative evaluations aim to understand an exhibition’s potential audience and predict their behaviour and experience within it. The latter two types of exhibition evaluation collect actual visitors’ responses to real settings. For the purpose of this research, relevant studies are limited to remedial and summative evaluations as they reflect visitors’ actual behaviour and experience in exhibitions. Many methods and techniques have been developed for evaluating exhibitions. Loomis provides an early overview of exhibition evaluation methods. His study outlines the common questions asked and methods used in various types of evaluation exercises. Bitgood groups these under the areas of education, recreation, way-finding, circulation and comfort and identifies two main research methods: direct observation and self-reporting.

The questions asked in exhibition evaluations reveal the major interests of museums in this respect. Most exhibition evaluation projects investigate the relationship between communicative approaches and the reception of exhibition messages. Such evaluations seek to understand whether the educational goals of exhibitions are achieved. In measuring the success of this dimension of exhibitions, the term ‘exhibit effectiveness’ describes changes in visitors’ conception and knowledge. Shettel suggests that ‘exhibit effectiveness is conceptualised as a measurable change in viewer behaviour produced by

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the exhibit and consistent with the stated aims or objectives of the exhibit.' The measure of exhibit effectiveness is often further broken down into two major interests: visitor behaviour and visitor learning experience. The focus on studying behaviour concerns the visible, external behaviours that can be observed objectively by evaluators. The study of learning experience seeks to reveal the subjective, psychological makeup of museum visitors and their response to exhibitions in these terms. In this regard, the theoretical stance of studying behaviour and learning experience can be placed under the behaviourist and constructivist paradigm respectively.

Similar to the development of museum education, behaviourism is a major theoretical stance in the visitor studies field. Since the early initiation of visitor studies in the US in the early twentieth century, behaviourist methods have been widely used in measuring exhibit effectiveness. Behaviourism has also affected the practice of exhibition evaluation in other countries. One significant example is the long time development of London’s Natural History Museum, which employed all four types of evaluation over a twenty-year period of exhibition development to establish criteria for exhibition design. Hooper-Greenhill describes the underlying principle in the Natural History Museum’s guidelines as a transmission model of communication. Museums set up the educational goals and expectation that visitors should be able to retain information if exhibitions are properly designed. Visitors receive stimuli from exhibitions and responses happen. Measuring visitors' behaviour and response can feed back to the design of stimuli. Behaviourist approaches to exhibition evaluation are more commonly carried out in science museums, where transmitting logical, scientific knowledge is seen as paramount.

**Observing behaviour**

Operating under a behaviourist paradigm, a key type of exhibition evaluation concerns the effects of physical settings on visitor behaviour. Where the perceived goal of exhibitions is to transmit knowledge, measuring visitor’s processing and retention of exhibition content becomes the major focus of visitor studies. Linked to this ‘learning’ process is visitors’ behaviour in response to the designed component of exhibitions. Since space affects the way museum visitors perceive and interact with objects, many exhibition evaluation

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exercises investigate visitors’ movement through exhibitions, in the belief that this can affect their perception and hence their capacity to understand exhibition content, such data suggesting to museums that they might better predict how visitors will respond to an exhibition’s message.

Observing and tracking visitor behaviour are among the earliest objectives of visitor studies. These methods can shed light on whether people use the visitor path as intended, which exhibits attract visitors and how long visitors stay in an exhibition. The study of visitor behaviour begins with the research initiated by Robinson and Melton on the environmental effects on visitors. Studies in the field have contributed to the practice of exhibition design and generated key terms still widely used in the museum studies literature to describe environmental effects and visitor experience, including ‘museum fatigue’, ‘attracting power’ and ‘holding power’. From observing visitors’ movements in exhibition environments, exhibition evaluators draw collective maps of visitors’ tracks through exhibitions, identifying some characteristics of exhibition space. Coined terms like hot spot and cold spot describe the ability of specific areas in an exhibition to gain visitors’ attention. The comparative effectiveness of exhibits can be inferred on this basis.

The idea of identifying characteristics of the physical environment through observation remains an objective in recent research into museum exhibitions. Commonly, studies into visitors’ circulation and orientation in exhibitions use observing and tracking. The findings of such evaluation studies have contributed to understanding the environmental behaviour of people in museums, supporting the framing of principles of exhibition design. Since the 1980s, Bitgood and his colleagues have conducted several studies on people’s behaviour in a museum visit. As a result, Bitgood suggests that to achieve effective exhibitions, exhibition design needs to consider three major elements that affect visitors’ environmental behaviour: conceptual orientation, movement and layout.

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105 Scott, pp. 2-3.
signage and graphics.\textsuperscript{109} Such studies are based on the observation of visitor behaviour, but often seek to explore how museum visitors build conceptual orientation and undertake way-finding. On the basis of a range of earlier studies, Bitgood and Cota advance some basic principles for orientation and way-finding in museum exhibitions that remain relevant today.\textsuperscript{110} They suggest that conceptual orientation and way-finding should be provided not only at the beginning and end of exhibitions, but also whenever the need throughout exhibitions.

The media that enable conceptual orientation and way-finding are not restricted to three-dimensional objects. Two-dimensional formats such as signs or visitor map, can also act as orientation devices. Although relevant studies provide many insights into how exhibition environments affect visitor behaviour, they all have a major shortcoming in that they do not probe what visitors actually experience or learn through their exhibition journey. As such, this research provides no explanation of visitor experience or the knowledge that visitors acquire. The act of spatial cognition on the part of museum visitors and, more importantly, the links that might exist between the understanding of exhibition space and content cannot be revealed by such investigations although the compilation of empirical data about visitor behaviour in museum exhibitions may appear to be of inherent value.

\textit{Investigating meaning making}

Opposing behaviourist conceptions of the transmission of knowledge, a trend in visitor studies emerging in the 1990s is the focus on personal meaning making processes. The understanding of how visitors perceive, think and act in relation to exhibitions can inform exhibition design in facilitating the mental construction of information and visitor experience.\textsuperscript{111} Studies based on a constructivist view of learning are also fuelled by cognitive psychology, new understanding of visitors and evidenced-based social policy.\textsuperscript{112} The studies done by Hein, Falk and Dierking contribute most in terms of a theoretical foundation for considering museum visits as instances where the personal

\begin{footnotesize}
\begin{itemize}
\item Bourdeau and Chebat, pp. 64-72.
\item Peponis, Conroy Dalton, Wineman and Dalton, pp. 453-73.
\item Bitgood and Cota ‘Principles of Orientation and Circulation within Exhibitions’, pp. 7-8.
\item Hooper-Greenhill ‘Studying Visitors’, pp. 371-74.
\end{itemize}
\end{footnotesize}
construction of meaning prevails. Following constructivist perspectives, Dierking and Falk frame research into visitors’ experience of the museum visit around an Interactive Experience Model that that holds that, ‘all experience, and subsequent learning, is contextual’. According to this model, visitors construct their experience by interacting with three contexts; the personal, physical and social. Later, Dierking and Falk build on this model to propose their Contextual Model of Learning. As Dierking and Falk point out in their description and defence of the model, physical context is a major factor affecting learning in museums, suggesting that the relationship between physical setting and cognition needs to be further explored in visitor studies.

Influenced by the trend for a constructivist approach to museum exhibition development, evaluation strategies for museum exhibitions have started to reflect a quest for deeper understanding of the basis and nature of museum learning. The focus of evaluation in respect of design moves from the evaluation of the general effectiveness of design in supporting content to the examination of design in its capacity to enable learning. In investigating how visitors learn in art museums, Toit and Dye argue that, ‘a creative process of concept formation and imaginative elaboration’ has been identified in visitors’ own making of narratives. In another study, McIntyre claims an ‘immersive, enabling, and supporting environment and flow of different space elements’ is essential to learning processes of ‘dimensional imagining, personal reflection and heuristic self-discourse’. Inspired by the Contextual Model of Learning, Bamberger and Tal conducted a study to investigate the ‘long term effects of school museum visits’. Their research validates the Contextual Model of Learning by showing the affects of social and personal context on students’ long-term memory of museum visits. However, physical context is neglected in the study. Studies probing museum visitors’ meaning making process are on the increase, but exhibition studies mainly focus on the issue of exhibition effectiveness from a sociological perspective. How museum visitors make sense of space and the role of space in informal learning remains unexplored.

113 Hein Learning in the Museum.
119 Ibid.
Chapter summary

This chapter has reviewed the museum studies sector’s understanding and opinions of the nature of museum learning. It has argued that the role of museums as informal education institutes has been increasingly recognised in the period since WWII. It has established that the museum sector sees exhibitions as the major medium for providing knowledge, but that there is also a recognition of the need for improved, evidence-based approaches to exhibition design that they might provide the most effective context for visitor learning. The chapter has shown that in describing the nature of museum learning, the museum studies literature favours several key theories and models of learning. As such, the chapter has identified two areas as prospective theoretical perspectives for framing of principles of exhibition space design. I have shown how the conception of museum learning has shifted from a behaviourist to a constructivist perspective, according to which visitors are recognised as active rather than passive learners. Ensuing chapters of the thesis use constructivism as the model for understanding the characteristics of museum learning.

Chapter One has also identified Gardner’s Multiple Intelligences theory and its views on human spatial capacity as having important implications in facilitating museum learning. Chapter Four considers published knowledge in the area of spatial intelligence as a basis for using the design of exhibition space to develop connected place memory as a means of facilitating museum visitors’ informal learning. The discussion of visitor studies in Chapter One has established that although exhibition evaluation exercises have provided understanding of the impact of the physical context of exhibition space on museum visitors, most studies are based on observational and behaviourist paradigms and provide little explanation of what visitors actually experience in exhibition space or how this might contribute to learning. Chapter One has thus identified a significant research gap that the remainder of the thesis addresses in exploring the potential interaction between space, exhibition content and peoples’ cognition in museum exhibitions.
CHAPTER 2

THEORIES OF EXHIBITION DESIGN AND THE EXTENT OF DESIGNERS’ PROFESSIONAL KNOWLEDGE

Staging exhibitions is a major undertaking for museums, serving as a key conduit for communicating their research and collecting activities to the public. If museums are to offer their visitors rewarding experiences, they need a basis for understanding the parameters of effective exhibition design. Internationally, the nature and purpose of museum exhibitions in terms of their social, cultural, economic, political and institutional roles is under constant review, yet exhibition design remains one of the least explored and theorised aspects of museum practice. This does not mean that exhibition design takes place in the complete absence of practical and theoretical knowledge. Individual designers and design teams possess a storehouse of experiential and professional knowledge about their practice. Such knowledge may be passed between designers in the workplace or through design education, but is rarely recorded in published form. Based on a review of exhibition design theories with a focus on exhibition space and learning, Chapter Two explores designers’ knowledge of the task of museum exhibition design.

The review of the exhibition design literature substantiates the knowledge gap that the thesis addresses and provides a theoretical foundation for the research. Although there are established principles of exhibition design, these are not in a form that is immediately relevant to the design of museum exhibitions as informal learning spaces. Visitor studies have contributed various insights on how space can affect visitor behaviour and learning, but most of these principles reflect a behaviourist viewpoint that fails to acknowledge how visitors make sense of exhibition space and content. Exhibition designers have very limited avenues for exploring their knowledge and experience of exhibition design, there being few professional or scholarly journals in the field. To further investigate the relationship between space and learning, Chapter Two surveys relevant published knowledge and opinion in the areas of interior and environmental design, the nature and effect of space being a major focus of discussion in these design fields.

The review of the literature on exhibition design to reveal what it understands about the nature of exhibition space and its relationship to people’s behaviour and learning necessarily excludes those parts of the exhibition design literature that concern trade shows and world fairs. My review focuses on principles for the design of museum
exhibitions. Likewise, it does not examine general design principles such as contrast, harmony, rhythm, and balance, which are fundamental elements of the exhibition designer’s training and knowledge, but are not discussed in the literature in terms of their affect on the audience for exhibition design. The published material considered in this review excludes the many handbooks and manuals that discuss the technical aspects of exhibition design, providing detailed information of the design of exhibition elements such as display cases, lighting and labels. Such sources include abundant information, but do not make a theoretical contribution to the understanding or development of exhibitions from the perspective of human spatial cognition and museum learning.

Exhibition design relates to the fields of interior and environmental design in terms of the basic conception of space, necessitating a clarification of terms. In this thesis, ‘space design’ refers to the nature of the physical form of exhibitions as containers for museum visitors and exhibition content. Space design embraces the fundamental dimensions of space and circulation. From social and psychological perspectives, space design can also include place design, which considers the affect of space on people beyond the basic functions of containment within and movement through space. Place here means experienced space, there being a growing literature on the psychological function of space design in the fields of environmental psychology and design. This research thus adopts a wider meaning for space design, including place and environmental design.

The museums’ role and its implications for exhibitions

Museums are among the most complex cultural, social, educational and political institutions in contemporary societies. Although museums often distinguish themselves through their collections, collecting is not the ultimate goal for contemporary museums. If it were, warehouses would be enough to fulfil this purpose. If researching their collections were added to this preservation role, laboratories would be the only addition to the warehouses. The housing of museums in iconic buildings with outstanding facilities indicates that a primary intention of contemporary museums is to attract visitors and offer them compelling experiences that will hopefully have a lasting impact, including from an educational perspective. Since the establishment of ICOM in 1946 as an advisory group to UNESCO, there has been an international building boom in museums, the number of museums in the world in the late 1990s numbered at 25,300. If the worldwide boom in museums has generated a diverse and expansive set of debates about the nature and

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purpose of exhibitions. According to this literature, museums aim to provide visitors with a range of social, cultural, educational, recreational and entertainment experiences, individually or collectively. To this end, exhibitions have become one of the museums’ major functions, Swinney arguing that ‘exhibition is the key’ to the existence of museums, while Neal claims that a museum’s strength is based on exhibiting objects.122

The role of museum exhibitions is intrinsic to the mission and the challenges museums face in specific contexts. The genesis of the modern museum is in the cabinets of curiosities of the seventeenth century, which were dedicated to displaying a personal collection of unique objects. Following the spread of democracy in Europe from the late 18th century, collections of artefacts were opened to the public as a setting for meaningful civic participation, engagement and edification.123 As museums evolved from private exhibition rooms to public institutions, the roles of exhibitions as a mechanism of display extended to communicating, educating and entertaining visitors.

The changing role of museums is reflected in the definition of museums provided by professional museum organisations. Prior to the 1950s, ICOM defined museums as ‘all collections open to the public’.124 Since 1951, the function of displaying or exhibiting has been added to ICOM’s definition of a museum, the importance of exhibitions being recognised globally. The purpose of exhibitions now coincides with the circumscribed roles of the museum, which ICOM defines as study, education and enjoyment. Reflecting ICOM’s definition, Museums Australia, for example, describes the museum’s role as to ‘help people understand the world by using objects and ideas to interpret the past and present and explore the future’.125 This set of objectives is carried out by exhibitions. The American Association for Museums (AAM) also highlights the missions of today’s museums including collecting, preserving, exhibiting and educating.126

Now that presenting exhibitions has become a major activity for museums, communicating their efforts in research and collecting to visitors means they need to achieve exemplary standards and understanding of exhibition design in order to offer visitors rewarding experiences. Principles of exhibition design for the museum are based on appropriated knowledge from other fields, including education, ethnography, gender

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125 Museums Australia viewed 15/10/2009
126 American Association of Museums viewed 15/10/2009
studies, psychology and sociology. Many published sources on curatorial practice discuss principles and techniques for the development and design of museum exhibitions.\textsuperscript{127} These publications recognise the importance of the learning aspects of museum exhibitions. However, this understanding is rarely translated into principles and techniques of exhibition design, especially the relationship of exhibition space to informal learning. Achieving exhibitions’ educational goals largely relies on how curators and designers intuitively frame exhibition design strategies.

Despite the complexity of the design task in respect of museum exhibitions and the practice-based knowledge designers acquire in their work, there are few professional organisations dedicated to museum exhibition design. The International Committee for Exhibitions and Exchange (ICEE) is a professional committee of the International Council of Museums. A concern of ICEE’s concerns is the development of exhibitions, but the Committee issues few publications and has no journal. Members of this organisation exchange practice-based knowledge of exhibition design through informal discussions and annual conferences, as is the case with the various national organisations for exhibition design. For example, the Temporary and Travelling Exhibitions Special Interest Group of Museums Australia provides a platform for the exchange of knowledge and the promotion of the value of museum exhibitions, but it does not publish in the area. Other professional exhibition design organisations such as the British Display Society and the Exhibition & Event Association of Australia mostly focus on the design of commercial exhibitions. \textit{Exhibitionist}, a journal published by the National Association for Museum Exhibition (NAME) of the American Association of Museums, is the only professional journal dedicated to the discussion of museum exhibitions. Its content covers many aspects of exhibition design, including theories, practices, critiques and techniques. Exhibition designers can contribute to other museum journals or to design journals, but the poverty of dedicated professional and scholarly journals on exhibition design indicates a field at an immature stage of development, the formation of evidence-based theories of exhibition design being a requirement for both advancing and legitimating the field.

Designing exhibition for learning

The museum studies literature reveals three main perspectives on the transmission of knowledge in museum exhibitions: informing, communicating and meaning making. If an exhibition is approached as a continuum with exhibition content and visitors at two ends of a line, each of the three perspectives on knowledge transmission implies a different mediating role for exhibition design during the exhibition development process. Where the focus is on informing— the oldest pedagogical model—exhibition development concentrates on the presentation of exhibition content. As the emphasis in museum exhibitions has shifted to communication, the importance of visitors' perspectives has been elevated, requiring appropriate interpretive strategies to be used to enhance understanding. Meaning making, the most recent trend in thinking about how museum visitors interact with exhibitions, perceives the museum visit as unfolding around the individual learning processes of each visitor.

The review of museum learning in Chapter One established wide acceptance in the museum sector of the idea that visitors construct individual meanings from their journey through an exhibition. Yet an informational approach to the delivery of exhibition content continues to be the typical way of providing learning experiences to museum visitors. The opening of the Louvre Palace’s Grand Gallery to the public in the 18th century established the display of artefacts as the principle approach to public engagement in the museum.128 Since then, the scope to view the authentic artefact and the depth and range of individual museum collections has been a major factor in attracting people to museums. Presenting collections in well-controlled environments is still intrinsic to exhibition design, the underlying principle being to let displayed objects speak for themselves. Here, the transmission of knowledge and experience is enabled by allowing museum visitors close contact with artefacts while keeping artefacts safe. However, increasingly, museums are expected to address wider societal needs than simply providing a treasure box of human cultural and social history, or of the natural world.

In the second half of the twentieth century, the value of a museum became more performance based, the number of visitors a museum attracted being a key measure of performance.129 To attract more visitors, museums increasingly began to consider that

129 Ibid.
the simple display of a permanent collection of artefacts did not attract a wide range of visitors, did not effectively transmit knowledge and did not provide a valued experience to a broad public, existing knowledge being needed to appreciate and contextualise museum artefacts. With this recognition, museums employed the language of exhibition design to reach out to visitors to inform, inspire and excite them. Today, museums increasingly recognise the paramount importance of communication to an audience. The need to be seen to be creating value in communities challenges museums to enhance community access and engagement. Identifying effective communication strategies is now often central to museums’ strategic plans and exhibition development.

The role of exhibitions as a communication medium has been gradually recognised by museum professionals. In 1976, the Royal Ontario Museum, Canada, formed a communication design team to conduct comprehensive research into museums’ emerging communication role, including how exhibitions could be planned to meet this objective and secure the future of their institution. Other museum professionals also highlight the importance of communication in museum exhibitions. Neal, for example, describes the museum as providing a communication conduit between citizens and those with specialist knowledge. Lord observes that the growth of museums indicates not only increasing interest in preservation and heritage, but also museums’ success as a form of public communication. Recognizing the significant communication role of the museum, Hooper-Greenhill argues that exhibitions carry ‘the major characteristic of most forms of mass communication’, describing museums as ‘one medium of mass communication’. Besides attracting and engaging visitors, exhibitions also serve to educate museum visitors through the act of communication. The underlying approach to exhibition development can be still seen as behaviourist. The identification of appropriate strategies for the interpretation of exhibition content is often the first step in achieving an exhibition’s communication goals. In this respect, exhibition designers are viewed as interpreters of exhibition content more than beauticians, although curators still take the principal interpretation role. The museum studies literature includes many principles for effective communication with museum visitors, but the interpretative process of exhibition design mainly relies on designers’ creativity, experience and received wisdom, there being little

130 Royal Ontario Museum, p.p. vii-x.
131 Neal.
established knowledge or supporting evidence to lift the practice of exhibition design above intuition and anecdotal experience.

The rise of visitor studies and a constructivist perspective on museum learning has lead to visitors’ engagement with museum exhibitions being seen as an active meaning making process, progressively replacing the ‘informing’ and ‘communicating’ models of museum exhibitions. Accordingly, understanding the makeup of target audiences, including their social backgrounds and learning styles, is now central to exhibition planning. As museums become visitor-centred and educational in focus, exhibitions increasingly ‘provide the motivation and support to engage directly with the site and/or collection’. Where the pedagogical model is one of active meaning making, exhibition developers and designers employ various instruments to stimulate visitors to construct their own understanding of exhibition content.

Interactive or ‘hands-on’ exhibitions are a popular way in science museums of encouraging visitor engagement with exhibition content. For example, the NEMO science centre in Amsterdam argues that its exhibition practices seek to provide an informal learning environment that focuses on developing visitors’ knowledge rather than ‘broadcasting a message from the top down’. The institution approaches exhibitions as an opportunity for designers to experiment with different exhibition elements and settings to support the meaning making process. The trend for visitor-driven meaning making has sparked the emergence of ‘open-ended’ exhibitions that push the boundaries of established museum practices to the limits. Lacking labels for exhibits, methods for guiding visitors through exhibitions and any prescribed pedagogical goals, some contemporary museums plan exhibitions to allow for self-generated exploration and interpretation on the part of museum visitors. Most of the exhibitions that emphasize visitor engagement are found in science museums, but there is little doubt that museums are increasingly recognising visitors as active participants in meaning making, seeing that exhibitions need to be ‘minds-on as well as hands-on’.

137 Allen ‘Designs for Learning: Studying science museum exhibits that do more than entertain’, p. 25.
Perspectives on space and learning in museum exhibitions

Based on museums’ growing need to design exhibitions as learning opportunities reflecting three integral processes of informing, communicating and meaning making, this section establishes the lack of theory for designing exhibitions as informal learning environments. Although the learning aspect of museum exhibitions is a highly relevant topic for the practice of exhibition design, most discussion of exhibitions in the museum study literature considers exhibition planning or management from a curatorial perspective. Few designers have published on the subject of the design aspects of exhibitions. Compared to the general literature in museum studies, the number of articles on exhibition design is small. Perspectives from visitor studies dominate the discussion, mostly adopting a behaviourist view of museum learning. Any discussion of the design of exhibitions as informal learning environments lacks a holistic perspective on how visitors learn in space. Questions concerning how visitors construct meaning through the combination of exhibition space and content and how the spatial elements of exhibitions might support the meaning making process remain unanswered. The following review of relevant literature reveals that existing exhibition design principles have a weak theoretical base and need to harness learning theories as a frame of reference for better understanding museum exhibitions as places for informal learning.

Taking the process of informing visitors as the main aim of exhibitions, much discussion of exhibition design principles focuses on the effective presentation of artefacts. This discussion reflects a behaviourist paradigm, with the elements of exhibition design identified as having aesthetic and visual roles. In a review of exhibition evaluation exercises, Hooper-Greenhill suggests that exhibitions developed from a behaviourist viewpoint work from ‘a transmission model of communication and an expert to novel model of teaching’, with museum visitors being expected to retain the information presented in exhibitions. Forging visual contact between museum visitors and exhibition content is an important first step in museum learning, but the techniques for achieving this do not consider how museum visitors actually learn. The primary assumption is that visitors will automatically learn if exhibitions are well designed. Discussions of design principles for museum exhibitions consider the range of factors that

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might make the setting for information more attractive, comfortable and comprehensible. For instance, Klein argues that encouraging visitors to become active agents in the learning process means that ‘designers should try to appeal to both the head and the heart’. The exhibition design literature suggests many principles for informing exhibition goers, but these do not describe the relationship between design and learning. Moreover, principles for space design mostly focus on the basic spatial characteristics needed for comfort and circulation, such as the optimum area for exhibitions and do not consider the aspect of spatial learning. For example, Bitgood and Patterson suggest design principles that relate to the characteristics of museum architecture and exhibit furniture to visitor behaviour. However, Bitgood and Patterson base these principles on empirical studies of external behaviour, not museum visitors’ internal cognitive makeup.

The early museum studies literature discussed exhibitions purely as conduits for information, where current thinking and practice in the museums sector approach exhibitions as an opportunity to provide museum visitors with rich information. However, in respect of design, the discussion of exhibition design continues to focus on the quite basic idea that museum displays need only be attractive to be effective. One of the earliest texts on exhibition design is Coleman’s 1927 manual for small museums, which considers the nature and role of exhibitions in art, history and science museums. After providing a comprehensive account of museums in the United States, Coleman describes the museum’s role as elevating ‘the general level of refinement by giving pleasure and imparting knowledge’. According to Coleman, museum displays and exhibitions serve to ‘present objects pleasing to the eye and to utilize objects as means of conveying information’. Her discussion of the character and purpose of museum exhibitions establishes exhibition design as an activity that provides harmony, balance and rhythm to exhibition content, contributing to the visual and atmospheric qualities of museum exhibitions. Exhibition space is treated as a container for content. Although Coleman considers the basic functions of exhibition space, her discussion neglects the nature of knowledge transmission in exhibitions and the relationship between space and learning, setting a precedent for subsequent writers on the subject of exhibition design, who largely approach museum visitors as passive destinations for exhibition content.

141 Klein Exhibits: Planning and design, p. 19.
143 L. V. Coleman 1927, Manual for Small Museums, G P. Putnam's Son's, New York.
144 Ibid., p. 10.
145 Ibid., p. 209.
After Coleman, there is no single design theory devoted purely to designing exhibitions for the purpose of informing museum visitors, however, this conception continues into the present. For example, Rouette’s 2007 description of exhibition design for small museums describes exhibition design as ‘setting the mood or atmosphere of the exhibition space.’\textsuperscript{146} Given that museum’s collections are still largely considered to be the most important aspect of a museum, it is perhaps no surprise that many exhibitions still focus more on artefacts and information than what their visitors experience. As such, the nature of space as an active contributor, or even just a backdrop for presenting exhibition content is easily overlooked by museums. The consideration of space in exhibition design mainly includes the basic requirements for accommodating visitors comfortably and arranging exhibition content in a logical sequence. Klein, for example, identifies the relationship of exhibition content and space as important to information flow, highlighting the persistence of the transmission model of information giving in museums in arguing that ideally visitors would follow the order in which museums set out information for optimal transmission of knowledge.\textsuperscript{147}

Information provision remains a fundamental goal in exhibition planning, although some museum theorists challenge the conception of museum visitors as passive learners. Dierking sees behaviourist models as providing a narrow explanation of learning in museum despite their continued use in the field.\textsuperscript{148} Making exhibition content and space attractive is a vague principle for encouraging museum visitors’ effective engagement with information. In making general recommendations for exhibition design, a behaviourist model takes little account of the different ways of presenting and receiving information and also fails to account for the diversity of museum visitors, with what is today identified as their different learning styles and preferences. How space might contribute to the learning process remains unanswered in this model.

Nevertheless, since the end of World War II, a change in approaches to exhibition design is evident in museums.\textsuperscript{149} Visitor studies have shown the diversity of museum visitors, prompting a shift in focus in the development of exhibition design from a transmission model to an interpretive paradigm.\textsuperscript{150} A frequently recommended change in communication approach is storytelling, which Lorenc, Skolnic and Berger describe as ‘the

\textsuperscript{146}Rouette, p. 47.
\textsuperscript{147}L. Klein, Exhibits: Planning and design (New York: Madison Square Press, 1986), 17-18.
\textsuperscript{149}S. Weil, ‘From Being about Something to Being for Somebody: The ongoing transformation of the American museum,’ Daedalus 128, no. 3 (1999).
\textsuperscript{150}Hooper-Greenhill ‘Studying Visitors’, p.362.
central craft of the exhibition’. In discussing exhibitions as storytelling, different authors write from the basis of their own experience and knowledge rather than providing transcendent theories of exhibition design. An early effort to consider the relationship of exhibition space to theories of communication and learning is the Royal Ontario Museum’s guidelines for planning exhibitions. Its guidelines for exhibition development promote storytelling as a prime curatorial approach and communication strategy for sparking informal learning. The Museum’s guidelines take a behaviourist view, arguing that information needs to be provided incrementally and arranged in order from the simple, followed by the concrete, then the abstract; setting a theme for an exhibition through a storyline being an effective way of orientating exhibition content towards learning.

The Royal Ontario Museum’s guidelines include a section on spatial factors. This considers the physical context of an exhibition, the relationship of space and subject matter and visitor circulation. The space and subject matter section of the guidelines addresses the relationship between space and learning. The section recommends that space subdivisions follow the division of content and be organised to reinforce an exhibition’s storyline without being too rigid, thus allowing visitors other options if they choose not to follow the main sequence of exhibits. The guidelines recommend the use of spatial cues or focal points to increase the comprehension of space and to help visitors find their way through exhibitions. Circulation and pacing are discussed in the guidelines, but in terms of their impact on visitors’ outward behaviour in exhibition space, not in respect of their learning behaviour. Hooper-Greenhill verifies that the guidelines provide one of the few discussions of the relationship between communication, learning and exhibition space in the museum studies literature. She acknowledges the importance of knowledge of exhibition space in discussing the development of educational exhibitions, but she is not explicit about how design might facilitate this.

The most comprehensive text on exhibition design from the designer’s perspective is Hall’s examination of the designers’ role in the exhibition team. Drawing on the experience of designing many blockbuster exhibitions, including The Treasure of Tutankhamen (1972), Hall addresses the institutional situation of exhibition designers and the organisation of the design process in museums. For Hall, curators and academic specialists are always

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151 Lorenz, Skolnick and Berger, p. 104.
152 Royal Ontario Museum.
153 Ibid., pp. 87-90.
eager to present information to the public, but need to 'see matters through the eyes of the visitor' to create displays and exhibitions that are comprehensible and interesting to a wide audience.\textsuperscript{156} She describes designers as the vital interpreters of exhibition content, standing between content providers and museum audiences.

Hall’s stance also marks museum’s historical shift from seeing exhibitions as vehicles for presenting information to an opportunity to communicate with visitors. To better understand the communication process and achieve better results, she encourages designers to consult the psychology literature.\textsuperscript{157} Crucially, however, she notes that, 'the findings of the psychologists are not expressed in the designer’s mother tongue', there being, 'few books that attempt to close the gap between the two communities'.\textsuperscript{158} Recently, McLean has reiterated the need for more research into the nature of museum exhibitions, arguing they 'remain the most mysterious and least researched aspect of informal learning environments'. She also recommends recourse to environmental psychology to 'explore the effects of learning environment design'.\textsuperscript{159}

Hall’s interest in visitors’ psychological responses to exhibition design does not extend to considering how exhibitions might accommodate visitors’ learning activity. Her emphasis is on the communication of information, not constructive learning and she proposes a set of ‘design idioms’ that position exhibition visitors to receive information.\textsuperscript{160} These idioms fall into two main categories: atmosphere and action. The idioms of atmosphere help create the mood or theme of exhibitions, affecting visitors’ emotional experience. The idioms of action are design elements that motivate visitors’ cognitive engagement. For Hall, an exhibition requires several types of action idioms: idioms of ‘alert’ for drawing attention, ‘pacing’ for controlling visitors’ flow through an exhibition, ‘emphasis’ for highlighting key sections and ‘punctuation’ for sectionalising storylines.\textsuperscript{161} Hall suggests that exhibition space should speak the same language, providing attraction, flow, emphasis and division, but she does not provide further suggestion about which design characteristics of exhibition space might achieved this, consequently identifying a lack of clear idioms for communicating the nature of space to museum visitors in support of informal learning goals.

\textsuperscript{156} Hall, p. 91.  
\textsuperscript{157} Ibid.  
\textsuperscript{158} Ibid.  
\textsuperscript{160} Hall, pp. 127-34.  
\textsuperscript{161} Ibid.
Lord and Lords' manual for developing museum exhibitions is another detailed discussion of the role of exhibition design in communicating exhibition content. Lord and Lord argue that exhibitions enhance visitors’ ‘apprehension of meaning ... the purpose of a museum exhibition [being] to transform some aspect of the visitor’s interests, attitudes or values affectively, due to the visitor’s discovery of some level of meaning in the objects on display’.162 They frame visitors’ learning processes in ways that are reminiscent of constructivist learning theories in their emphasis on the importance of learners’ own experiences, but there are no substantive design guidelines or criteria for designers to codify these objectives in a meaningful way. For Lord and Lord, developing museum exhibitions is a question of communication, not design.163 In discussing the purpose of exhibitions, they argue that the major objectives for exhibition teams are all communication problems, including:

- ‘What meaning do we wish to communicate?
- To whom do we intend to communicate these meaning?
- What are the most appropriate means of communicating these meanings?’164

To address such questions, understanding how visitors learn in exhibitions is crucial. Lord and Lord posit four modes of exhibition apprehension: contemplation, comprehension, discovery and interaction.165 Table 2 compares their four modes, characteristics and corresponding exhibition types, but design principles for each type are not included in the discussion.

<table>
<thead>
<tr>
<th>Mode of Apprehension</th>
<th>Type</th>
<th>Common in (but not limited to)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemplation</td>
<td>Aesthetic</td>
<td>Art Museums</td>
<td>Individual perception of specific works</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Contextual or thematic</td>
<td>History, archaeology and ethnographic museums</td>
<td>Relational perception of artefacts in context or in relation to a theme</td>
</tr>
<tr>
<td>Discovery</td>
<td>Exploration-as in visible storage</td>
<td>Natural science museums</td>
<td>Exploration of specimens grouped by category</td>
</tr>
<tr>
<td>Interaction</td>
<td>Live demonstrations; multimedia</td>
<td>Science centres</td>
<td>Kinaesthetic response to stimulus</td>
</tr>
</tbody>
</table>

Table 2: Modes of visitor apprehension of exhibitions.166

162 Lord and Lord (eds), pp. 16–7.
163 Ibid., p. 19.
165 Ibid.
166 Ibid., p. 22.
In considering exhibition space, Lord and Lord suggest two sets of design criteria: mission-driven and functional. Functional design criteria are geared towards practicality, where mission-driven criteria are concerned with communication objectives. Although sample criteria are provided, both sets of criteria are discussed mainly from the perspective of the museum’s need to communicate content. There are no principles for designers to follow in the development of communicative space. Lord and Lord’s model of exhibition communication neglects the importance of space in the experience of museum exhibitions and its potential impact on visitors’ informal learning.

Influenced by visitor studies and learning theories, the idea of engaging visitors and supporting meaning making processes is the most recent development in exhibition planning. Chapter One examined various learning theories as appropriate models for engaging museum visitors, but these were not addressed from the designers’ perspective or linked to exhibition design principles. The following sections of Chapter Two investigate the major design principles discussed in the museum study literature as facilitating meaning making.

The idea of engaging visitors through exhibition design emerged in the 1980s. The emphasis on interactivity in some learning theories prompted the recognition that cognitive, affective and interactive modes of presentation might be used to encourage some kind of activity in visitors. Many exhibitions since have been designed to engage visitors, but few design theories provide a holistic view on how design actually affects visitors’ interaction with or understanding of exhibition content. More importantly, the literature rarely discusses how space might engage visitors and support learning.

Dean’s investigation of learning theories for the museum is one of the few texts to connect visitor learning to specific design principles. Chapter One discusses Dean’s perspective on the characteristics of human learning activities. Table 3 sets out Dean’s principles for successful museum exhibitions, suggesting how these are informed by learning theories and making some specific references to design. Among the design elements Dan considers, traffic flow is the major factor related to exhibition space and learning. Dean suggests three approaches to traffic flow in arranging exhibition space to meet educative objectives: directed, suggested and unstructured. The directed approach provides a rigid and restricted learning experience to visitors. The other two seek to allow different levels of freedom of choice in moving within exhibition space and interacting with exhibition content. The approaches are obviously influenced by the three different conceptions of
museum learning, but no other elements for making exhibition space responsive to learning are provided. Although Dean identifies the need for design to address the cognitive elements of learning, the actual spatial elements for achieving this are absent from his discussion.

- Comfortable environment.
- Encounter with real objects.
- Strong and recognisable design elements to attract and assist visitor attention.
- Story-telling and engaging mental activities.
- Place objects in context to assist learning.
- Use sensory stimuli to reinforce visual images.
- Weave the cognitive, didactic elements into the contextual framework of the whole exhibition.
- Select language that evokes imagery.

| Table 3: Dean’s design principles for learning.167 |

Another major text on promoting visitors’ engagement is Caulton’s examination of hands-on exhibitions. Caulton includes a comprehensive set of topics on how hands-on displays work as a means of engaging museums visitors. He uses Piaget’s developmental psychology and Gardener’s Multiple Intelligences theory to explain museum learning, setting out its objectives and parameters for the benefit of museum professionals. Table 4 outlines Caulton’s essential characteristics for interactive exhibits. His major strategy is clearly raising physical and intellectual action, although detailed methods for engaging with space are not included. Caulton’s examination tends to be more conceptual than practical, leaving designers to experiment intuitively on their own approaches.

In discussing the physical environment of the museum as a context for learning, Caulton stresses the importance of effective visitor orientation. He identifies four types of orientation: ‘geographical orientation to guide the visitor, psychological orientation to stimulate the right frame of mind, intellectual orientation to encourage understanding content and conceptual orientation to help develop associated ideas.’ 168 However, orientation can only contribute to part of the spatial learning process. Other elements, such as landmark and frame of reference are also crucial for making sense of space.

Furthermore, Caulton does not discuss any further how space can engage visitors and provide a link for understanding content.

Table 4: The needed characteristics of interactive exhibits.169

1. Have direct and obvious actions and reactions.
2. Have clear goals, expressed in terms of encouraging visitor to develop physical skills, to improve their knowledge or understanding, or to refine their feelings and opinions (i.e. psycho-motor, cognitive and affective outcomes)
3. Are intuitive to use and require minimal label-reading.
4. Work at multiple intellectual levels, for visitors of different ages and abilities.
5. Encourage social interaction between friends and family members.
6. Have open-ended, variable outcomes.
7. Are founded upon research into the existing knowledge and understanding of targeted visitors, and which do not include confusing information.
8. Are multi-sensory and employ a range of interpretative techniques, appealing to visitors with a wide range of interests and learning styles.
9. Are challenging but not threatening to visitors and which help to build confidence.
10. Provide enjoyment for visitors, and leave them feeling they have understood something more than they did previously.
11. Are well-designed, safe, robust and easily maintained.

Similarly, Black also provides a set of guidelines for exhibition development comprised of specific principles for engaging the museum visitor. His emphasis on visitor participation exceeds normal definitions of interpretation. Of his twenty-three principles for enhancing visitor participation through exhibition development, the six set out in Table 5 concern exhibition design, exhibition organisation and exhibition space.

- Through orientation, interpretation gives visitors the power to select
- Visitor participation means ‘pacing’ display
- Visitor participation also means rest, recuperation and time for reflection
- Visitor participation means encouraging social interaction
- Visitor participation requires an impact on the emotions and senses as well as on the intellect
- Visitor participation requires a palette of approaches and a layering of content

Table 5: Black’s interpretive principles for engaging visitors.170

169 Ibid., p. 27.
170 Black, pp. 185-210.
In his discussion of orientation, Black reduces Caulton’s four categories of visitor orientation to two: physical and conceptual orientation. He stresses that the content and form of exhibitions must be clearly structured if museum visitors are to be able to understand and determine their paths through exhibitions. Black argues that a lucid exhibition organisation enables visitors to connect the different areas and parts of an exhibition and form a conceptual overview of the exhibition. As is the case with Caulton, Black recognises that space can affect museum visitors’ engagement with exhibition content, but he does not discuss the actual elements for achieving engagement and for supporting museum visitors’ meaning making processes.

To move beyond the hands-on activities that have long been favoured by science museums, a publication from the Exploratorium, San Francisco, reports on a more aggressive conception for exhibition planning. Its ‘Active Prolonged Engagement’ model encourages visitor engagement with exhibition content through the creation of self-discovery displays, exhibits using techniques to promote visitor-initiated exploration with minimum instruction. Adopting a constructivist view, the Active Prolonged Engagement model considers visitors as participants in creating exhibitions, the goal of stimulating active and prolonged engagement with museum exhibits including ‘the generation of activities, questions, and explanation related to engaging phenomena’. Such engagement is seen to encourage meaningful interaction and understanding, rather than simply providing information or activity. The Active Prolonged Engagement project spanned the whole exhibition development process, including visitor studies, planning and evaluation, but proposed no specific guidelines at the conclusion of the project with the result that the concept remains more a general premise than a plan of action and practice for museums. The role of exhibition space as a possible contributing factor in encouraging museum visitors’ extended engagement with museum exhibits is not a consideration in the discussion of the Active Prolonged Engagement model even though issues of visitor fatigue and disorientation are acknowledged factors in curtailing the length and affecting the quality of museum visits.

Until recently, museums mostly employ simple approaches to exhibition design. Lately, some progressive institutions have begun to develop experimental, art-oriented exhibitions in search of new ways to increase the impact of exhibitions and to afford museum visitors a more active role in the creation of meaning from exhibition content. In

171 Ibid., pp. 191-92.
172 Exploratorium, p. 2.
conceiving of museum exhibitions as exploratory opportunities for designers and visitors in the style of contemporary art exhibitions, a new type of open-ended exhibition has emerged. Macdonald and Basu represent exhibition design as a practice dedicated to prompting visitors’ open-ended exploration of exhibition content, arguing that museum exhibitions should transmit deep knowledge and generate compelling experiences for visitors. They argue that ‘contemporary exhibitionary practices cannot be conceived merely as means for the display and dissemination of already existing, preformulated knowledges’. This emerging model of exhibition design rejects didactic approach to exhibition development based on a communication model of learning. Rather, exhibitions seek to encourage curiosity and questioning in museum visitors. Exhibition designers adopt less structured and polite approaches to design, approaching an exhibition as ‘a site for the generation rather than reproduction of knowledge and experience.’ This trend challenges the view of exhibition space as a simple container of objects, a source of exhibition atmospherics and a set of clear, logical pathways through exhibition content. Using the example of Daniel Libeskind’s deconstructive museum architecture, which is often set out like a labyrinth, Basu argues that exhibition space should pose questions and challenge museum visitors, the organization of some contemporary exhibitions as maze-like arrangements allowing visitors to see complexity and paradox in exhibition content.

Raising interest and curiosity to encourage a questioning attitude are important steps to knowledge acquisition, but developing exhibitions to be disconcerting is not specifically supported by present theories of museum learning, the value of alternative exhibition practices needing to be investigated through dedicated visitor studies. Alternative exhibition practices are an emergent area of exhibition design and curatorial practice. This research considers mainstream approaches to the development of museum exhibitions and how the design of space within exhibitions and museum interiors as a whole can more effectively support to museum visitors’ development of connected place memory on the basis that the provision of more comprehensible spatial context information will better support museum visitors’ informal learning.

A review of the museum studies and exhibition design literature shows that a set of guidelines and elements for facilitating both connected place memory and informal learning through spatial design still needs to be developed. Principles of museum learning

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174 Ibid.
175 Ibid.
have shifted over the decades from informing to communicating to meaning making; to a degree, principles of exhibition design in the museum literature have shifted to reflect this change, but are marked by a lack of depth whatever learning theory is dominant. The relationship between learning and exhibition space is barely considered, the discussion of the spatial elements for designing museum exhibitions and interiors as effective learning environments being especially sparse. The next section considers areas of knowledge outside the museum studies literature that provide accounts of the relationship between the nature of learning and the physical context where learning takes place.

**Linking space and learning in environmental design**

The literature of environmental psychology and behaviour explores the relationship between space and learning, with the various fields of environmental design including architecture, interior design and urban planning looking to environmental psychology and behaviour to understand how physical environments can affect people. Conceived by Egon Brunswick in the 1940s, the field of environmental psychology and behaviour is a diverse area of research that investigates the negative and positive relationships between people and their environment. Some knowledge from the field has been applied to exhibition design, but these attempts have produced few design principles, echoing the treatment of exhibition and interior design in the museum studies literature. This section discusses published knowledge and opinion on the learning aspects of physical environments. It shows that there is little development of design frameworks for informal learning environments, although environmental psychology is useful in understanding the relationship between learning and the physical context for learning. There is growing interest in the development of informal learning space in formal education, but this material needs careful interpretation to make it relevant to the development of museum environments since these serve as informal learning spaces dedicated to the presentation of content, not learning as such.

To start the discussion, it is necessary to clarify the relationship between environmental psychology, environmental behaviour and environmental design. Figure 3 represents the relationship adopted in the thesis.

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The terms environmental psychology and environmental behaviour are often used interchangeably, both being used to describe the relationship between environments and human behaviour. Cassidy summarises the various meanings of environmental psychology since 1950 as a basis for defining environmental psychology as ‘the study of the transactions between individuals and their socio-physical environments’. His discussion highlights the reciprocal relationship between people and environments in arguing that although physical environments affect people, people also create their environments to fit their needs. Early psychologists tended to stress the physical nature of environments in their investigations, but the social nature of environments can also play a role in people’s relationships with environments. The name of environmental psychology indicates a focus on people’s internal states of mind, where environmental behaviour suggests both external actions and internal cognitive activity. This thesis uses the broader term environmental behaviour because it covers both people’s observable external behaviour and non-observable internal activities of the mind, environmental psychology becoming a subset of environmental behaviour.

The literature of interior design has shown interest in the field of environmental behaviour. Interior design has emerged comparatively recently as a distinct field of design and spans the planning of architectural elements and lighting. It is still developing its theoretical foundations, which can be described as embryonic. Dedicated training and practice in interior design is well-established in many developed nations, but Hollis frames interior design as a ‘slippery discipline’, arguing ‘its historical, theoretical and contextual
framework remains patchy’. \(^{179}\) Interior design is often linked with surface treatments and decoration, but recently a growing effort is evident in the scant interior design literature to circumscribe interior design’s integral theories, practices and pedagogies. \(^{180}\) An emerging scholarly literature in interior design argues that the field has more fundamental interests than interior décor in the effects of interior space on people’s social behaviour, daily experience and psychological state.

Research in environmental behaviour provides significant insight into the psychological aspects of interior space, although the development of design theories is not an outgrowth of these studies. The study of interior space and learning is in a particularly nascent state. For example, Scott-Webber offers design principles for the development of learning spaces on the basis of empirical findings in environmental behaviour. \(^{181}\) Both formal and informal learning environments are discussed, but only in respect of schools and workplace. Scott-Webber argues that ‘niche’ areas such as lobbies, common areas, and cyber cafés where ‘spontaneous interaction can occur’ can serve as spaces for informal learning. \(^{182}\) However, she refers to a quite different type of informal learning to that provided in museums, where the provision and organisation of materials for information giving and a range of other experience is intentional and recognised by museum attendees. The design guidelines provided by Scott-Webber are thus of little help in understanding museum exhibitions as informal learning spaces. Nevertheless, Scott-Webber’s article shows that interior designers have started to synthesise the findings from environmental behaviour to propose the design guidelines for learning space.

Lehmbruck provides the first and most comprehensive description of the relationship between museum visitors and museum’s interior space at the level of architecture. \(^{183}\) Drawing on observation of new museums internationally, Lehmbruck describes architects’ diverse and dynamic approaches to the design of museum interiors as resulting in a complex interlinking of museological and architectural factors. He identifies an understanding of the sociological, physiological and psychological impact of museum space on museum visitors as vital to the development of museum interiors.


\(^{182}\) Ibid., p. 71.

Sociological and physiological factors affect visitors’ movements through, attitudes to and experience of museum environments. Psychological factors determine visitors’ perception and experience of space. Lehmbrock argues that although museums are a prime context for investigating the interaction of architectural environments and the human mind, this is an immature area of research.\textsuperscript{184} He suggests that museum visitors should be able to easily grasp the organisation of space and master the architectural environment to readily find their way around a museum. Lehmbrock speculates on the affect of differently shaped exhibition spaces on way-finding, circulation and the placement of displays in the aim of enhancing visitors’ experience, but he does not explore the specific nature of the elements and steps for designing exhibition environments to support learning.\textsuperscript{185}

The design of learning spaces

Exhibition space represents one special type of learning space, and its design can draw on from relevant fields such as education research. This section investigates current trends in the design of learning space, mostly in higher education, that might inform the design of exhibition space. Higher education provides learning environments for adults; the changing nature of student cohorts and societal expectations of tertiary education have generated strong interest in the reform on learning space in universities. The provision of informal learning environments that facilitate non-traditional learning activity is a recent trend in schools and universities. Constructivism has attracted the attention of many education planners here, influencing the development of new school campuses and new types of learning spaces in new university buildings. The development of constructivist-inspired learning spaces requires far more research and testing to establish the effectiveness of different design approaches, but existing debate in the educational literature validates the use of constructivism as an underpinning theory for the design of informal learning space.

The nature of learning space is an emerging issue for education researchers. In many nations, classrooms are the principle site of teaching and learning although the introduction of ICT into schools and universities since the early 1990s has challenged this assumption. On the surface, ICT is a major force driving change in school and campus planning, but at a deeper level, understanding the nature of learning and the demographic makeup of student groups are equally important in driving educational change. Following

\textsuperscript{184} Ibid., pp. 129-267, p. 191.
\textsuperscript{185} Ibid., pp. 191-97.
this trend, many education planners and researchers are currently rethinking traditional paradigms for the provision of learning space so that educational institutes better serve the needs and preferences of young learners and keep abreast of competition in education.\textsuperscript{186}

Until recently, schools and universities were regarded as societies’ primary educational contexts. This understanding is being eclipsed by the idea that learning is a journey of personal development that extends beyond formal education into everyday settings and across the course of life. Learning spaces are thus being redefined as any environment in which people can perceive, comprehend and absorb information. The many assumptions about the nature of teaching and learning in the history of education include certain assumptions about the character of learning spaces. Prime among these is the iconic image of the rectangular classrooms with white walls, furniture arranged in orderly rows facing the blackboard and designated activity areas throughout the room. The rapid evolution of ICT, new understandings of human cognition and changing student demographics have challenged this traditional conception of classrooms in educational thinking. Planners of educational facilities are developing learning spaces to offer new and different learning experiences from the real to the virtual.

Internationally, numerous related projects and organizations have been established to advance understanding of the nature and purpose of learning environments in higher education. For example, EDUCAUSE (USA) and the Joint Information Systems Committee (JISC, UK) seek to enhance educational outcomes through innovations in the use of technology and the nature of learning environments.\textsuperscript{187} The Organization for Economic and Cooperation Development (OECD) has a specific interest in innovation in the nature of buildings that serve educational purposes.\textsuperscript{188} The design of informal learning space in universities and schools typically seeks to provide extra facilities so learning can happen outside classrooms in contrast to the need in the museum setting to focus effort on revising the nature of exhibition space. In schools, the relationship of learning content to learning spaces is rare, although the recent provision of informal learning spaces as an innovative approach to education is relevant to the design of museum exhibitions where informal learning is the predominant learning mode. Unlike an exhibition space, informal learning space in universities and schools is rarely designed specifically for certain content, 

\textsuperscript{187} EDUCAUSE viewed 10/20/2009, \texttt{<http://www.educause.edu/>}.
\textsuperscript{188} Joint Information Systems Committee 2009, viewed 10/20/2009, \texttt{<http://www.jisc.ac.uk/>}.
\textsuperscript{188} Organisation for Economic Co-operation and Development 2009, \textit{Centre for Effective Learning Environments}, viewed 10/25/2009, \texttt{<http://www.oecd.org/topic/0,3373,en_2649_35961311_1_1_1_1_37455,00.html>}.
so the link between space and content in the cognitive process is weak. This differentiates the informal learning environments in schools from those in museums.

Some recent research investigating learning outcomes does advocate the importance of learning environments in the acquisition of knowledge and understanding. Johnson suggests six steps for creating successful teaching spaces today, spanning the need to (1) identify the institutional context; (2) specify learning principles meaningful to that context; (3) define the learning activities that support these principles; (4) develop clearly articulated design principles; (5) create a set of requirements; and (6) determine a methodology for assessing success. He argues for the continual evaluation of the success of learning spaces to advance the understanding of learning space design. In another case study, Jamieson and his colleagues question the performance of new university buildings in Australia, suggesting that the integration of IT should follow pedagogical principles to ensure effective teaching and learning outcomes.

Many education planners acknowledge the importance of self-construction learning processes, advocating that learning space should embrace and support learner-centred activities. Knuth proposes seven pedagogical goals for designers or educators who seek to create constructivist learning environments:

1. Provide experience with the knowledge construction process;
2. Provide experience in and appreciation for multiple perspectives;
3. Embed learning in realistic and relevant contexts;
4. Encourage ownership and voice in the learning process;
5. Embed learning in social experience;
6. Encourage the use of multiple modes of representation;
7. Encourage self-awareness of the knowledge construction process.

Honebein sees these goals as providing a solid framework for building learning environments as long as designers or educators adapt this transcendent framework to different learning situations.

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It is hard to arrive at one single framework for the design of learning spaces, although the literature on new learning environments sees learning principles as fundamental to the process of design. Johnson argues that although each learning institution may adopt different theories of learning, it is vital that each uses dedicated learning principles to drive planning, including the nature of learning activities that will be accommodated, relevant design principles and the assessment of learning outcomes.\(^\text{193}\) The literature on learning environments also demonstrates a clear paradigm shift in education today toward constructivist principles, with technology and pedagogy being understood as necessarily learner-centred. The Joint Information System Committee guide to the design of contemporary learning space suggests that, 'it should become a physical representation of the institution's vision and strategy for learning'.\(^\text{194}\) Many researchers stress the importance of physical space in learning, but there is little research into the affect of space on learning. Chism, for example, argues that more action research is needed to understand the effect of physical space on learning.\(^\text{195}\) Many schools and universities also have an entrenched attachment to traditional teaching spaces, not questioning what an effective learning environment should look like or how it should operate.

**Learning spaces in schools**

Reflecting the three trends driving changes in the design of learning spaces—changes in students, information technology and shifting understanding of nature of learning—a diverse range of research projects investigate innovation in educational environments by the incorporation of new technology into them.\(^\text{196}\) Current learners come to school with varied background, expectations and exposure to media and technology, leading some educators to recognise a change in contemporary learning behaviour. Chism argues that the diverse backgrounds of current students require the use of a range of teaching approaches and environments to accommodate varied learning styles.\(^\text{197}\) Lomas describes the preferred learning experiences of current students as 'digital, connected, experiential, immediate and social'.\(^\text{198}\) He argues that learning spaces need five specific qualities to accommodate students’ learning habits, proposing they be 'digital, mobile, independent,
social and participatory'\textsuperscript{199} The idea that a ubiquitous personal construct should frame individual learning is also gaining traction in contemporary education.

Technology has dramatically changed the conception of school environments, affecting schools’ physical facilities and students’ learning experience. Ubiquitous computing makes information available almost everywhere. New technology allows educational environments to provide greater interaction between students, to promote active learning and enable the provision of social networking with other communities. Many schools and universities are beginning to explore the use of virtual learning environments. For instance, the University of Texas and Southern New Hampshire University have used \textit{Second Life} to deliver teaching materials in a virtual world.\textsuperscript{200} The change of learning environment from the real to virtual allows students to gain more control of their learning process and therefore come close to self-guided learning.

In response to the unprecedented incorporation of technology into all levels of education, evidence from neuroscience and cognitive psychology is also reforming the understanding of human learning. Earlier behaviourist perspectives depicted learning as a set of stimuli-response reactions. Constructivist perspectives have since come to dominate educational thinking. In reporting on pedagogical trends of constructivism, the Scottish Funding Council cites the three learning styles identified by the Scottish National Academy of Science; learning through reflection, learning by doing and learning through conversation.\textsuperscript{201} Constructivism theory is progressively shifting the pedagogical model in schools from traditional teacher-centred models to learner-centred approaches.

The development of new types of learning spaces in schools and universities has prompted the proposition of various design guidelines and principles for creating contemporary learning spaces. For example, part of the EDUCAUSE Learning Initiative in the United States seeks to help educators understand the key factors in the design of learning spaces.\textsuperscript{202} It argues that above all learning should be the centre of learning space design. EDUCAUSE’s publication \textit{Learning Spaces} provides more than thirty case studies intended to help education planners consider design factors.\textsuperscript{203} The principles, technology,

\textsuperscript{199}Ibid.
\textsuperscript{203}Oblinger (ed.) \textit{Learning Spaces}. 
success and uniqueness of each project define the possibilities for informing the development of informal learning environments. These projects span the development of informal learning space in universities and provide inspiration for the future.

The idea of informal learning space is a major new idea in the development of new educational settings. Informal learning spaces are often considered to be the spaces outside of classrooms. Traditionally, areas like lounges, pathways and cafes were not viewed as learning places, but the availability of mobile networking and ubiquitous computing makes learning outside of classrooms possible and increasingly valued by educators. New understandings of the nature of human learning and related educational paradigms especially support the idea of the importance of providing informal learning spaces. In 1999, the Bureau of Labour Statistics in the United States reported that people learn 70% of what they know about their jobs informally. Aker and Miller argue that informal learning spaces should be more valued for their capacity to 'support chance encounter, divergent conversations and reflection and study about content presented in formal settings'.

Where informal learning is recognized as a valid aspect of education, people spend more time learning in informal environments, alone or with groups. On recognizing the importance of informal study areas, many education institutes have initiated new projects such as the Steam Café at MIT (2005), Cybercafe at the University of Chicago (2000) and ES Corridor at Indiana University-Purdue University (2004). The casual environment of each seeks to encourage the idea of 'learning-everywhere possible' and is supported through ubiquitous technology, but the question of how space can actively support informal learning is not considered. A new generation of students, new technology and new understanding of human learning have made many schools and universities eager to develop innovative ways of delivering education and enhancing learning outcomes. Formal education is now extending to informal setting in the quest for more effective learning environments.

Chapter summary

Chapter Two has reviewed the context of museum exhibitions, the educational role of exhibitions, the few existing principles for designing exhibitions to facilitate learning and recent trends in the research and development of learning environment in schools and universities. Although successful communication and education should be the ultimate goal of museum literature, Chapter Two has shown that the literature on exhibition design offers little information on the use of exhibition space to support effective learning experiences. The consideration of space is mostly based on a behaviourist view that incorporates little understanding of how and what visitors learn in and about space. My discussion of the investigation of informal learning spaces in other fields reveals that design principles that there is really no area that has developed design principles that encompass human spatial capacity and its relationship to learning. Despite the growing interest in the development of informal learning space in environmental design, the chapter has established that present settings for research into such questions in the field of education are inherently different to those that relate to museum environments, where space can be considered part of the learning content. Chapter Two has shown that the field of environmental psychology, especially its investigations into the mechanisms of spatial intelligence, suggests the most valuable ideas for merging constructivist learning perspectives with space design to propose how space can support connected place memory in exhibitions as a precedent to meaning making and informal learning. The investigation into the change of learning environment in schools and universities also suggests that constructivism might provide insights relevant to the design of informal learning space. However, the chapter has established that holistic theories for designing informal learning space in museum exhibitions still wait to be proposed.
CHAPTER 3

AN INTERDISCIPLINARY STRATEGY FOR DEVELOPING A DESIGN FRAMEWORK

My review of the literature of museum learning, exhibition design theories and learning space design has identified a lack of holistic theories for designing museum exhibition spaces as informal learning environments. This immediately raises the question of how exhibition space can be designed to support museum learning. To help exhibition planners and designers resolve this question, the identification of design elements and principles becomes important to the establishment of a design framework for determining the relationship between exhibition space and learning experience. Chapter Three sets out the theoretical stance adopted in the thesis. It describes the interdisciplinary strategy that is integral to the project methodology and the three principal methods used in data collection and analysis.

Theoretical stance

This section sets out the theoretical aspects of the program of design research, including the underpinning conceptual paradigm and the theoretical positioning of the research investigation. The formation of theories about the nature and purpose of design can be traced to design debates initiated in Europe in the second decade of the twentieth century among the Constructivist and De Stijl movements and at the Bauhaus. The emergence of design thinking, however, remained largely tied to the sphere of practice. Compared to science and the social sciences, design can be considered an emerging field of academic inquiry that is only establishing its characteristics as a research discipline. The proposition of the first systematic investigation of design methods by Bruce Archer, Christopher Alexander and Herbert Simon in the 1960s is typically viewed as initiating the field of design research.206 The trajectory of design research methods since that time has preferred scientific approaches, often favouring the idea of design science, although design research is currently expanding to encompass a broader range of theories and qualitative and quantitative methods.207 Friedman argues that since design creates direct effects in the world, systematic methods for understanding design problems are required.208 Yet he

also observes that design has not developed grounded theories from practice. Design researchers continue to vigorously debate approaches for the scholarship and research of design as design establishes itself as a field of academic inquiry and industrial research and development.\(^{209}\)

A major dividing line here is the role that theory and practice play in design research. Although practice-based design research is now more accepted as a research method, it is often afforded lower validity due to its focus on personal construction and tacit knowledge.\(^{210}\) One commonly noted difference between scientific research and practice-based design research is the generalisability of research results. To share research knowledge, instead of simply expressing an opinion about an experience, it is important to rigorously reflect on and communicate practical and experiential knowledge. In inquiring into the role and meaning of knowledge in design research and practice, Niedderer argues that the tacit knowledge designers gain through or within practice is as important as explicit knowledge learned from conventional methods, although the communication of research results is a challenge here, since tacit knowledge often evades verbalisation.\(^{211}\) Downton also suggests the need for rigorous clarification and reflection on the process of practice as research in design.\(^{212}\)

This thesis recognises that creative activity is an intrinsic part of design and that research through design can contribute to the body of design knowledge. However, it develops from the understanding that design research needs to face the challenge of its multifaceted context and incorporate both scientific and design approaches to derive generalisable results. By blending methods from social science and design, including interview, example analysis and exemplary design, the research aims to achieve applicable results that can benefit exhibition designers and hence museums and museum visitors.

The knowledge gap around the scope for space design to support informal learning in museum exhibitions sets clear methodological limits, as does the research goal of developing a theoretical framework for the design of exhibition space. The characteristics of the research suggest that a qualitative paradigm is appropriate. One fundamental


\(^{212}\) P. Downton 2003, Design Research, RMIT University Press, Melbourne, p. 5.
division between qualitative and quantitative research approaches is the differential focus on process or outcome. Both qualitative and quantitative methods can be used to generate and analyse research data, but qualitative approaches are typically process-oriented and quantitative approaches are typically outcome-oriented. This research advances a theoretical framework for designing exhibition spaces. I propose the framework for creating connected place memory as a set of elements and principles for undertaking design, making this an inquiry of process.

The design of exhibition space is a highly dynamic and contextual activity, meaning that it is more appropriate to investigate a small number of samples in depth, although the results may be less generalisable than the conclusions that can be claimed from quantitative methods. The design process normally involves certain stages and elements, with the dynamic of each stage greatly affected by the content, physical context, curatorial principles and organisational objectives of an exhibition. These influence the elements incorporated into each project, the dynamic nature of exhibition design making enquiry into the design process uncontrollable, which requires an insider’s perspective to obtain a holistic view of examined cases. The rich and deep data collected from critical cases can provide valuable principles for use in other settings, their examination acknowledged as an important counterpart to theoretical discussion. Yin, for example, argues that the examination of cases provides comprehensive, in-depth study of a problem context.

In seeking to establish fundamental principles that can be applied to the research question underpinning this thesis, the present study sits within Buchanan’s category of basic research. Where the role of design extends beyond matters of aesthetic preference, which can be satisfied by existing models of creativity, design needs to be powered by knowledge. Schön suggests that even when a designer consciously assesses their practice and its outcomes, they risk falling into ‘a circle of self-limiting reflection by attending to his role frame, his interpersonal theory-in-use, or the organizational learning system in which

R. E. Stake 2006, Multiple Case Study Analysis, Guilford, New York, p. 8.
he functions’. To understand the problem context, especially where this concerns peoples’ multifaceted relations with design, design research often looks to disciplines outside design to provide a basis of knowledge and understanding. Cross argues that even where design research seeks to establish its own research methods and paradigms, its fundamental challenge is to conduct both an interdisciplinary and disciplined conversation at the same time. Conversely, Cross suggests that in an emerging field of research, there is a danger that investigations conducted by non-designer researchers may apply methods inappropriate to design. To build integral design research paradigms, he argues that more designer researchers are needed to ensure that knowledge from other disciplines where it is incorporated into design investigations respects what is inherent to design. Buchanan likewise suggests that the central challenge for design research is how designers can learn from other research fields to resolve issues and questions in design research. Bayazit argues that although there are many examples of multidisciplinary and collaborative design research, the application of knowledge and methods from other disciplines remains a challenge for many designers.

These are cautionary arguments for the present investigation into museum visitors’ spatial and learning experiences, which argues for the relevance of published knowledge in the disciplines of education and psychology to the research question. Where design is understood as a way of making and delivering meaning in addition to its aesthetic and practical dimensions, theories of human cognitive development can provide a legitimate basis for design research and practice. Exhibitions seek to provide meaningful information and experiences for museum visitors, suggesting that design research questions in this area should be framed in relation to human cognition and learning, the knowledge needed to understand complex human interactions with design being unlikely to reside solely in design. However, the preceding arguments imply that an interdisciplinary investigation that seeks to understand the role of exhibition space in museum learning should be framed from perspectives emanating from the core discipline of design if it is to achieve a meaningful and original synthesis of concepts and methods from other, relevant disciplines.

219 Buchanan ‘Design Research and the New Learning’.
220 Bayazit.
Besides drawing on published knowledge and opinion on the nature of museum exhibitions and learning, relevant theoretical knowledge and evidence from cognitive psychology, developmental psychology and spatial intelligence supports the investigation of design questions. Theories of human spatial cognition and learning serve two purposes within the research. Firstly, they combine to enable the design problem to be identified and understood. Here, theories of human spatial cognition and learning provide insights into the cognitive makeup of the museum visitor with respect to processing spatial information and learning experience. Published knowledge in these areas also provides a basis for building theoretical principles concerning the nature and role of exhibition space in support of museum learning. The research uses an interdisciplinary strategy that combines theories from outside design into a new concept for designing exhibition spaces for the development of connected place memory in support of informal learning.

**Interdisciplinary strategy**

The research framework is a hybrid of four methods drawn from social science and design research: 1) theory analysis, 2) interviews, 3) the analysis of relevant exhibition examples and 4) a program of exemplary design, the latter two using frameworks developed from the process of theory analysis. Theories from learning and psychology provide principles for understanding learning processes in the informal learning context of the museum. They form the basis of a framework for 1) interviewing designers, 2) the analysis of the spatial characteristics of exhibition spaces in three museums and 3) the redesign of an existing suite of exhibition spaces or galleries. The interviews provide insight into designers’ professional knowledge about their work in and understanding of exhibition design. The analysis of existing examples of exhibition design practice reveals the strengths and deficiencies of the spatial characteristics of current exhibition design practice. The value of the theoretical model is underlined by the program of exemplary design work, reflective practice enabling new design knowledge to be extracted from the process, which then serves to refine the theoretical model.

Figure 4 is a diagram of the four methods employed in the interdisciplinary strategy.
Design problems are typically situated at the intersection of many fields. Museum exhibition design combines cultural, social and technological considerations. Exhibition designers work in interdisciplinary teams, where varied disciplinary approaches and viewpoints must be negotiated and synthesised to arrive at a final design. Svensson argues that the results of interdisciplinary design teams can be shallow if teams comprise people who know ‘a bit of many things’.\textsuperscript{222} Aagard-Hansen suggests that ‘mutual knowledge is a necessary first step towards smooth cross-disciplinary collaboration’, helping to ‘overcome prejudices and discover possibilities’.\textsuperscript{223} As the research investigates museum learning, an understanding of the broader field of human learning is a vital ingredient. Since it focuses on informal learning in the museum setting, the learning theories used are those favoured in the field of museum studies.

Unlike research in other design disciplines, such as graphic or industrial design, it is hard to test ‘conceptual modelling’ in exhibition design through a designed prototype.\textsuperscript{224} Creating a physical design in a real exhibition space is not viable, the research using a 3D simulated design to allow reflective practice and show how the theoretical propositions advanced in the thesis might be implemented in actual museum settings.

The research proceeded in two main stages, firstly identifying initial principles and then applying these principles through design. In the first stage, theory analysis led to the development of an initial design framework. The framework was then applied in the second stage of the research, which consisted of interviews with designers, the analysis of three examples of exhibition design and a program of exemplary design. Integrating insights from design, education and psychology was also a two-step process. A review of relevant publications in learning and psychology established principles for understanding the learning behaviour and spatial cognition of museum visitors. These principles were then reconceived in terms of the language of design to create an initial set of design principles. Combining theories of constructivist pedagogy, mnemonic loci learning and spatial intelligence, the thesis proposes the concept of design for connected place memory, which includes four major elements for designing the spatial characteristics of museum exhibitions to enable them to serve as supportive informal learning environments.

The interviews with the designers contributed to an understanding of current exhibition design practice, its strengths and weaknesses. The initial framework was then compared with exhibition examples to reveal deficiencies in contemporary exhibition design. The principles and elements of the framework were then used to redesign one example, the 17th & 18th Century European Art Gallery at the National Gallery of Victoria. A final theoretical framework and associated principles were then deduced from the second stage of the research. The research thus attempted to critically understand the design problem and also develop a new design theory. Figure 5 is a flow chart showing the research stages.
Research methods

This section discusses the practical components of the methodology, including the application of the methods and the tools and procedures involved in each method.

**Designer interviews**

Interview is a mature research method widely used in the social sciences. In this research it enabled me to understand the nature of exhibition design practices within the museum field and to provide evidence of the nature and extent of designers’ professional knowledge in this area. Although commonly used in human research, the value of interview data can vary widely due to the influence of several factors. Asking questions and conversing with others is common in our daily lives, but to obtain reliable data, research interviews involve specific skills and techniques. Traditionally, researchers have used a ‘stimulus-response’ model for the interview process. More recently, some have proposed a constructive model, where interviewing is viewed as a conversation and a joint process of meaning making.\(^\text{225}\) The subjective frameworks of the interviewer and the respondents in combination with their context can each influence the quality of

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information gained. Interviewer bias or influence can affect the reliability of data. However, interview remains as a highly useful method for sampling opinion and is vital in this research given the scant literature on of the design of museum exhibitions from the design perspective. The interviews serve two purposes in the research. By exploring designers' professional knowledge of designing museum exhibitions for informal learning, they reinforce the existence of a theoretical gap in published knowledge and opinion about exhibition design. The interviews thus help to establish the nature of the principles and knowledge that exhibition designers need in designing successful exhibitions in support of informal learning.

The degree to which an interview is structured determines the breadth and depth of respondents' answers. Research interviews are commonly divided into three categories, the structured, semi-structured and unstructured interview, each indicating the extent to which questions and answers are predetermined. Although there is no clear distinction along the continuum of interview structure, in a structured interview, the process and questions are carefully controlled to elicit specific answers. In contrast, an unstructured interview involves informal interaction between interviewer and informant. A semi-structured interview seeks a balance between controlling outcomes and allowing the potential for unexpected information to be discovered. The choice of interview types depends on the research goals and the required information, as suggested in the following table, Gillham's verbal data dimension.

<table>
<thead>
<tr>
<th>Unstructured</th>
<th>Structured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to other people's conversation; a kind of verbal observation</td>
<td>Structured questionnaire s: simple, specific closed questions</td>
</tr>
<tr>
<td>Using natural conversation to ask research questions</td>
<td>Recording schedules: in effect, verbally administered questionnaires</td>
</tr>
<tr>
<td>'Open-ended' interviews; just a few key open questions, e.g. 'elit interviewing'</td>
<td>Semi-structured questionnaires: multiple choice and open questions</td>
</tr>
<tr>
<td>Semi-structured interviews, i.e. open and closed questions</td>
<td>Semi-structured interview, i.e. open and closed questions</td>
</tr>
</tbody>
</table>

Table 6: The dimension of interview structure.

To tease out designers' current attitudes and approaches to exhibition design, in general and in relation to informal learning, the interviews used a semi-structured approach in which I approached discussion as a purposeful conversation between designer and researcher, with a pre-determined set of questions used to keep the interview on track and obtain comparable, relevant information. Approaching respondents as vessels of information, I asked further questions in relation to respondents' answers to obtain more

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detailed information where necessary. Since it was important to find out exactly which principles individual designers used in their practice, interview questions were typically open and gradually moved from discussion of general exhibition design principles to more specific topics, concerning exhibition design, space design and issues of museum learning.

Closely related to the type of interview structure used in research with human subjects is the question of the use of open or closed questions. Several factors and situations are important in conducting interviews with human subjects for research purposes, including:

- The numbers of people involved.
- Whether people are accessible.
- Whether most of the questions are ‘open’ and require an extended response with prompts and probes.
- Whether everyone is ‘key’ and you can’t afford to lose any.
- Whether the material is sensitive in character so that trust is involved.
- Whether anonymity or confidentiality are an issue.
- Whether depth of meaning is central, with only some approximation to typicality.
- Which research aims mainly require insight and understanding.\textsuperscript{228}

In respect of this study, the number of designers with experience of museum exhibition design is small, limiting the pool of designers available to participate in face-to-face interviews. Designers with substantial museum exhibition experience tend to be those working in museums. The location of my research candidature in Melbourne, Australia, afforded access to a core of designers working in Melbourne’s large, established museums. I was able to interview seven exhibition designers or planners, each being selected on the basis of their experience in developing exhibitions in the museum context and the quality of the institutions they worked for. I based each interview around nine major questions, adding supplementary questions as issues arose during the conversations. I discuss the seven interviewees and set out the nine major questions in Chapter Six of the thesis, which focuses on the research findings.

A research interview process commonly comprises three parts: opening, topical sections and closing.\textsuperscript{229} An introductory phase of incidental exchanges can be added to the process, to help build rapport between the interviewer and interviewee.\textsuperscript{230} Although information about the research and interview process is provided when the researcher first contacts the interviewee, a brief introduction reminds interviewees of the purpose of the interview.

\textsuperscript{228} Ibid., pp. 11-18.
\textsuperscript{230} Gillham, pp. 37-40.
and research. Such information also builds rapport with the interviewee. The next section focuses on the topical phase of the interview process. Once the interviews began, I asked questions sequentially, the interviewees describing their roles and general experiences, their perspective on the educational aspects of exhibition design and their approaches to the design of exhibition spaces. Following each question, the interviewees were free to discuss their knowledge and experiences, although I did prompt the interviewees during the conversation to obtain more details.

**Example analyses: three museum exhibitions**

To further examine the current practice of exhibition design, the research analysed the spatial characteristics of three exhibitions in three Australian museums: the 17th & 18th Century European Gallery at the National Gallery of Victoria, the City Museum in the Old Treasury Building, Melbourne, and the Human Body exhibition at the Melbourne Museum. The chosen exhibition spaces or galleries represent three different types of museum exhibitions: art, history and science. I photographed the spatial elements of the design of each exhibition space and analysed them according to the design framework for the development of connected place memory to identify current practice in the design of exhibition spaces and to evaluate the strengths and deficiencies of each.

I employed two photographic techniques: High Dynamic Range (HDR) imaging and panorama imaging. Invented by Charles Wyckoff and further developed by Gregory Ward and Paul Debevec, HDR imaging is widely used in photography and computer graphics to record detailed images while coping with variations of luminosity such as the low light conditions such as those found in many museums. The use of HDR imaging allowed me to produce detailed images of exhibition space in different directions. Panorama imaging assembles several photographs as a single, wide image, whereas a camera rotating on a spot captures images under the same condition, such as height and exposure. A wide section of each exhibition area can then be documented. In digital panorama, the images are stitched into a panorama using specific software. The documentation process in the thesis consists of two steps: compositing the HDR image and assembling the panorama. I took photographs in ten to sixteen directions from the centre of each space, three photos being taken with different exposures in each direction. The camera was held at eye level, suggesting the museum visitors’ visual experience of an exhibition. The HDR process then produces one composited image for each direction from the three photographs. The ten to sixteen HDR images for one space are then assembled with the stitching software to

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produce the final HDR panorama. Figure 6 shows an example of the process of documenting panorama images in exhibition space.

Figure 6: An example of documenting a panorama image of an exhibition space.

The thesis presents the panorama as one longitudinal image that documents one exhibition space. Most exhibition spaces could be documented in this format, but there were some in which a panorama was hard or impossible to achieve. I used HDR images with a normal aspect ratio to document these. Using the HDR panoramas to describe each exhibition space enabled me to submit each to analysis and evaluation, the principles of which I explain in Chapter Five.

**Exemplary design: redesigning the 17th & 18th Century European Art Gallery at the NGV**

I use a program of exemplary design to identify the use of the design framework for the development of connected place memory to inform the design of museum exhibition spaces. The subject of this design exercise is the 17th & 18th Century European Art Gallery at the NGV. I retain the curatorial arrangement, but modify the eight rooms of the gallery according to the design framework for the development of connected place memory, this entailing the addition of spatial reference elements including signs, plans, colours, objects and lighting to support museum visitors' spatial learning. I present the redesign program using computer 3D graphics. The redesign of an existing exhibition environment using
computer-aided simulation shows the value in applying the design framework for the development of connected place memory in a way that a totally new design cannot demonstrate, providing points of comparison between the existing and the new environment within limited variables and the research time frame. The program of exemplary design focuses on the spatial aspects of each exhibition space, rather than on exhibition content.

Of the three institutions I examined in the context of the study, I chose the 17th & 18th Century European Art Gallery at the NGV as the most suitable to redesign because the exhibitionary principles of an art gallery result in it being least cluttered with exhibits, making the rendering process more manageable. At the same time, the location and design characteristics of the 17th & 18th Century European Art Gallery make it the most difficult of the three examples for museum visitors to develop connected place memory. The redesign process begins with the analyses of the individual rooms in the 17th & 18th Century European Art Gallery using the design framework for the development of connected place memory to identify its weak elements. It culminates in a series of simulated images of the Gallery that seek to strengthen the elements that might provide museum visitors with connected place memory. Interspersed images of the existing and redesigned conditions of the eight rooms in the 17th & 18th Century European Art Gallery enable a discussion of the use of the design framework for the development of connected place memory that reflects on its application in real settings.
CHAPTER 4
PEDAGOGICAL THEORY FOR THE MUSEUM SECTOR: 
CONSTRUCTIVISM, SPATIAL INTELLIGENCE AND 
MNEMONIC LOCI

Chapter Four sets out the theoretical foundation of the thesis, using ideas derived from the fields of constructivism, spatial intelligence and mnemonic loci learning as a basis for exploring the relationship of connected place memory to the informal learning aspects of museum exhibition spaces. The review of museum learning and exhibition design in Chapter One and Two identifies constructivism as the museum sector’s dominant preferred approach to the provision of informal museum learning. The investigation of constructivism includes general ideas of constructivist learning and its key instruction principles, considering their implications for the design of exhibition space. As a set of theories that explore how people create knowledge in different settings, constructivism has many derivatives. The thesis examines the main concepts of constructivism, emphasising the most relevant to museum learning. Chapter Four then considers current understandings of human spatial ability in psychology to establish museum visitors’ internal state of spatial learning, arguing that this is an adjunct to general processes of informal learning in museum settings. Understanding museum visitors’ internal state of spatial learning is vital to any space design framework that seeks to support informal learning through the development of connected place memory. The literature of cognitive and developmental psychology uses a range of terms to describe spatial ability, including spatial capacity and spatial intelligence. The section on human spatial ability clarifies the terms used in the thesis. It then looks into the development of human spatial intelligence, its different functions and measurement before discussing the various types of knowledge created by spatial intelligence.

In seeking to understand the relationship between exhibition space and memory as a basis for the development of design principles for creating connected place memory in museum exhibitions, Chapter Four also identifies the theory of mnemonic loci as an important area of knowledge relevant to learning processes. The theory of mnemonic loci involves place memory as a technique for memorising lists of information. It suggests that place memory plays a significant role in spatial cognition and can be used and developed to memorise information in space. Chapter Four establishes the connection between place memory, informal museum learning and the practice of exhibition design. It includes discussion of a
number of visitor studies that link visitors’ memory and learning experience to the impact
of exhibition spaces. The chapter concludes with a discussion of the implications of
mnemonic loci for the design of exhibition space where informal learning is the aim.

**Constructivism**

Recent visitor studies conducted in the museum sector show the clear influence of
cognitive psychology in accounting for the nature of visitors’ learning in the museum
environment, the idea that museum visitors have different learning styles having
particular impact in explaining how visitors make meaning from exhibition content. The
field of museum education has a strong interest in human learning processes and other
museum specialists, notably curators, now base their practice on educational theory.
Constructivism is an amenable theory for framing learning in the museum context, where
learning is informal and discretionary in representing learning as an individual process of
making meaning, where people build up their own knowledge.

Previous chapters of this thesis have highlighted the strong interest in constructivism on
the part of a range of writers in the museum field, including Dean, Heine and Hooper-
Greenhill. Each nominates constructivism as a valuable theory for understanding the
educational role and experience provided by museums. Falk’s contextual model of
learning is also an extension of constructivism, suggesting that visitors construct meaning
from their personal, social and physical context. This section examines the primary ideas
underpinning constructivism as they relate to education in general and link to the nature
and role of exhibition space. I organise the section into three subsections: The Theory of
Constructivism; Constructivism and Instruction; Constructivism and Exhibition Space.

**The theory of constructivism**

Constructivism describes a psychological theory of learning that suggests that people
construct knowledge from their experiences. The word ‘construct’ comes from the Latin
construere, which means to arrange or give structure. Various writers predate the
contemporary interest within the fields of cognitive psychology and pedagogy in how
people create personal meaning, including the German philosopher Immanuel Kant and
the American philosopher, psychologist and educational reformer John Dewey. However,
it was the 20th century Swiss philosopher, natural scientist and developmental
psychologist Jean Piaget who established the theory of cognitive development that
underpins the theory of constructivism. Disputing behaviourism, which explained learning
as a consequence of responses to stimuli, cognitive theories of learning focus on the
mental processes through which people internalise information. Besides investigating how people acquire information, the possibility that people construct meaning from individual perspectives is an important aspect of theories of constructivist learning. For example, in 1978 Vygotsky proposed a socio-cultural theory of learning that emphasised the social aspects of the learning process, creating the term social constructivism. Papert’s constructivism argues that learning may be more effective when part of the learning experience involves constructing tangible objects. Glasersfeld proposed the idea of radical constructivism by suggesting that knowledge exists inside people’s head, the formation of knowledge being a subjective construct based on individual experience.

Despite the many faces of constructivism, Piaget’s research into developmental psychology provides the foundation for theories of constructivism. Piaget considered play an important part of children’s learning processes, suggesting that people build knowledge both form external and internal information, hence the idea of constructive learning. In investigating children’s development, Piaget conceived a four-stage theory of cognitive growth spanning the stages of infancy, pre-school, childhood and adolescence. His research proposes that humans learn new knowledge and construct meaning through experience and direct interaction with an environment. Piaget ascribes four development stages to learning: the sensorimotor, preoperational, concrete operational and formal operational. These stages equally represent the sequence through which individuals acquire knowledge. For Piaget, intelligence is a basic part of living organisms that allows them to adapt to their environment and enable their survival. He represents intelligence as a process of adaptation, describing it as a form of ‘equilibrium between the action of the organism on the environment and vice versa’.

Piaget proposes that cognitive structures consist of several contingent schemata. For Piaget, a schema is ‘a general potential to perform a class of behaviours’. From this perspective, the knowing process is a dynamic enquiry into what is familiar and what is novel in comparison to one’s cognitive structure. He argues that two mental processes are involved in how people adapt to the outside world: assimilation and accommodation. Assimilation incorporates new objects into one’s existing cognitive structure.

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235 Piaget.
236 Ibid.
237 Ibid., pp. 8-10.
Accommodation changes one’s cognitive structure to interpret confronting new environments. Intellectual growth is driven by individuals’ tendency to seek to maintain harmonious relationship with their environment. In Piaget’s theory, people achieve harmony by balancing the new and old, a process that he identifies as a key driver of learning. The adaptation process, as Piaget describes it, is ‘an equilibrium between assimilation and accommodation’. As a person’s cognitive structure becomes more elaborate, the dependence on physical environment starts to diminish and the use of cognitive structure increases. This process of interiorisation allows people to think and solve increasingly more complex problems, resulting in the growth of an individual’s knowledge and intelligence.

In the wake of the introduction Piaget’s theory of developmental psychology, many other theories contribute to the formalisation of constructivism. Vygotsky’s social constructivism is probably the most influential. Vygotsky also studied childrens’ development of knowledge to better understand human cognition; seeing learning as a social and cultural phenomenon sits at the heart of his work. Following Vygotsky, social constructivists value the social context of learning and advocate social interaction and collaboration to facilitate learning processes. This extends to the physical context for learning, although social constructivists discuss the nature and influence of learning tasks and materials far more widely than that of the learning environment. Papert’s constructionism emphasises the learning experience of making meaningful objects, leading to the development of Logo, a computer programming language that allows elementary school students to develop knowledge by creating computer graphics.

The different branches of constructivist learning theory share several important features. They all see learning as a personal construct, acknowledging the influence of individual culture, motivation and background on a person’s learning process, with different people having different ways of learning. As a cognitive process, constructivists see learning as an active and ongoing journey of organizing meaning, with learning context a major resource for learning. Learners interact with tasks, teachers, physical settings and other learners. Despite the emphasis on self-exploration, the learning process needs a balance between structure and flexibility. Active learning by students is seen as vital, but constructivism...
still values the role of the teacher who plays the role of facilitator. With appropriate intervention, constructivism holds that teachers should provide proper guidance throughout the learning process to allow learners to discover the principles or structures implicit in taught content.

**Constructivism and instruction**

In emphasising the learning process rather than teaching, constructivist theory has had a significant impact on the nature of formal education. Constructivism sees education as based on individual needs and background. There is no specific pedagogy in constructivist learning approaches, giving rise to diverse types of teaching pedagogy, although in seeing people as creating knowledge from their experience and previous knowledge, constructivism favours learning by doing and personal discovery. The absence of a specific pedagogy means that constructivism presents many challenges for those seeking to provide learning. Rather than seeing teaching as a process of informing, teaching in constructivism involves the provision of learning situations that encourage students to discover new principles, rather than new principles being imposed on learners from an external source such as a teacher. To help students successfully interpret new information, dialogue need to exist between teachers and students. The role of instruction is to foster learning, not control learning outcomes. Common instructional approaches for constructivist pedagogy include learning based on case studies, projects and problem solving.

One of the most influential theories of constructivist instruction is that of Bruner, who argues that the nature of instruction needs to consider four aspects: (1) the predisposition towards learning, (2) the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner, (3) the most effective sequences in which to present material and (4) the nature and pacing of rewards and punishments.²⁴⁵ Bruner's concept of constructivist pedagogy involves four fundamental elements:

1. The learning of structure is the foundation for further learning. A general picture of learning subjects showing relationships can make later learning easier.
2. Instruction needs to concern students' experiences and knowledge so that students are willing and able to learn. This will prepare instruction for students' readiness for learning.
3. A spiral curriculum will allow students to revisit the basic ideas until they fully grasp the complete subjects.

4. Instruction needs to raise the interest and curiosity in students so that they have the strongest motive for learning and exploring further information.\textsuperscript{246}

Constructivist pedagogy sees interacting or engaging with an environment as a major way of initiating constructive learning. Indeed, recently, the design of learning environments has become a hot topic in considering the nature of constructivist instruction.\textsuperscript{247} Here, the meaning of environments is quite broad and includes the employment of tasks, groups, materials and technology. The major goal is to promote meaning making. Jonassen’s model of a constructivist learning context (Figure 7) integrates the inherent principles of constructivism and an instructional framework.

![Figure 7: Jonassen's model of constructivist learning environments.\textsuperscript{248}]

Jonassen’s model places ill-defined problems, questions or projects at the core of a learning environment. Learning environments should provide related cases and information to allow learners to access, deliberate on and adopt new knowledge for the

purpose of resolving problems. To support learners in gathering, visualising, analysing and managing information, the use of cognitive or computer tools such as visualisation and knowledge modelling tools can help learners in the performance of complex tasks. Another important element of constructivist learning is to incorporate social engagement. Constructivist learning theory stresses the need for conversation or collaboration tools in learning environments to enable the sharing of information and the development of learning communities.

Social or contextual support is the final key factor in a constructivist learning environment. All tasks or tools should be sensitive to the learner’s context so that learners are willing to use them and learn. On the instructor’s side, constructivist pedagogical theory proposes three strategies to support learning activities: modelling, coaching and scaffolding. Modelling requires that instructors act as performers and demonstrate activities when they are requested by learners. Besides providing a working example, modelling also shows the covert process of reasoning and decision-making in a skilled performer. Coaching is more focused on the learner. Teachers motivate learners, check performance and provide feedback to challenge learners’ cognitive structures. Constructivists use the concept of scaffolding to highlight the process of developing a staged system to support learning. The difficulty and structure of a task may be adjusted when learners face barriers in performing the task. Instructors can also provide alternative assessments to help learners understand problems.

Constructivism reveals general constituents of an effective learning environment. Although engaging with context and environments is often emphasised in constructivist instruction, the essence of such instruction is to provoke meaningful activities. To initiate the learning process, those developing learning environments firstly need to consider learners’ backgrounds and stimulate their interest or questions. Next, environments need to provide multimodal learning so that learners can make meaning of a new subject from different information. The learning environment needs to balance structure and flexibility to allow learners to easily grasp the structure of the subject matter while providing the kind of open experiences that enable discovery, interaction and interpretation. Constructivist learning theory recommends arranging the learning environment in a sequence from the familiar to the novel so that learners can gradually build up knowledge from previous experiences. Since knowledge may come from other people, interaction with learning communities is crucial for constructivist learning environments.

249 Ibid., pp. 234-35.
**Constructivism and the design of exhibition spaces**

Several key writers in the field of museum studies advance constructivism as a model for museum learning. In connecting constructivism with museum learning, Hein identifies four characteristics of the museum that suggest the relevance of constructivist learning principles, noting that museums have:

- no predetermined sequence;
- allow the use of multiple learning modality;
- the capacity to make connections with familiar concepts and objects;
- the opportunity to invite people to join the design process.  

Hooper-Greenhill bases her principles for the development of exhibitions on models of cultural communication and constructivist education, which she describes as:

- considering what people want to know;
- finding what visitors would be interested in;
- understanding how visitors learn;
- being based on cultural model of communication, building exhibitions with consultation and; collaboration with audiences.

The advocacy of constructivism has influenced the way museums currently approach exhibition design, but challenges remain in the creation of exhibitions as effective informal learning contexts. Museum exhibitions offer different learning environments to school settings. Exhibitions lack the presence of instructors, mainly providing the opportunity to engage with content of potential interest to the museum visit in an environment they may find stimulating. The literature on science museums, for example, criticises constructivist exhibitions for over-emphasising learners’ own interpretation and leading to the misunderstanding of scientific knowledge as being open to interpretation.

From the perspective of metaphysical realism, Miles considers scientific knowledge as external to visitors; he argues that museums need to communicate exhibition content with ‘power, clarity, and relevance’. Hein agrees that ‘the role of learners should not be over-emphasised…at the expense of the subject matter to be communicated’, but he argues that constructive learning must be acknowledged in considering museum learning.

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250 Hein ‘The Constructivist Museum’.
253 Ibid., pp. 10-11.
The debate between realism and anti-realism, combined with discussion of how the different conceptions of epistemology might influence learning approaches and experience through exhibition pedagogy continues in the field of museum studies. Hooper-Greenhill suggests there is a contradiction of the core of the debate, arguing that, 'Much of the debate in the museum field [has] failed to distinguish between, on the one hand, what could be accepted by scientists as valid explanations of the world, and, on the other hand, what is known about how learning occurs'. She nevertheless acknowledges the need for active learning in museum exhibitions. In approaching constructivist exhibitions, Allen draws on relevant visitor studies in the decade leading up to 2007 to suggest four considerations in the planning of museum exhibitions as learning environments: immediate apprehendability, physical interactivity, thematic coherence and diversity of learners. Exhibitions often contain a large range of new information, leading visitors to experience cognitive overload. For Allen, the principle of immediate apprehendability challenges curators and exhibition designers to plan comprehensible exhibition environments that reduce the experience of museum fatigue.

Museum professionals have long suspected that physical interactivity may enhance visitors' learning experiences. However, Allen's studies at the Exploratorium (USA) suggest that a high degree of interactivity does not necessarily improve learning experience. Recently, museums have begun to use storytelling and thematic exhibitions to unify exhibition content and make it more compelling. The coherence of a theme serves to support visitors' perception of the abstract concept behind an exhibition. Some studies show that visitors rarely make explicit links between content. Allen suggests that adding thematic clarity by staging environments can increase visitors' understanding of the structures and concepts behind an exhibition's content.

Constructivism has influenced the museum sector to believe that exhibitions should support a diversity of learners and learning styles. The evidence from visitor studies shows that museums today accept that visitors make meaning on the basis of individual motivations and learning styles. However, Allen argues that there is an inherent difficulty in applying constructivist learning principles to the transmission of scientific knowledge in particular in museum exhibitions, more research being needed to establish what is

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257 Ibid., pp. 49-50.
possible here while noting that exhibition design is 'multifaceted and hard to prototype and test'.

The discussion of constructivist education has several implications for the design of museum exhibitions. Exhibitions provide physical settings for mainly environmental experiences, potentially exercising a significant influence on the learning experience of museum visitors. Constructivism holds that tasks or questions should sit at the core of a learning environment, suggesting that exhibition spaces should raise visitors’ curiosity and willingness to explore the exhibition as a whole. A space that is unwelcoming or difficult to access is unlikely to provide much meaningful information to visitors. In seeking to understand how the spatial dimensions of museum exhibitions can encourage visitors to engage with exhibition content, research in the field of environmental psychology establishes four factors that influence people’s experience of space: movement, comfort, competence and control. The literature of environmental psychology suggests that if these conditions are well considered, visitor learning is more likely to take place. Secondly, if people learn by progressing from the known to the unknown, it is important to provide visitors with information about the spatial dimensions of an exhibition before they enter its environs. Information telling museum visitors about the spatial nature of an exhibition environment can help them grasp the organisation of an exhibition since spatial organisation typically reflects designers’ interpretation of an exhibition’s themes and content. Spatial graphics in the form of floor plans and perspective drawings can provide this preliminary information before museum visitors enter an exhibition space.

Constructivist learning principles suggest flexibility should be a primary characteristic of exhibition space, the open-ended provision of content and experience enabling individual visitors to exercise choice in their interaction with space and information. They imply that visitors to an exhibition should be able to gradually build up a cognitive picture of an environment. Rigid paths and cramped space will likely hinder museum visitors’ individual and social construction of space and content, but exhibition designers need to achieve a balance between the free exploration of exhibition space and the understanding of spatial structure. Every exhibition space represents a new experience for the museum visitor. Simple and clear spatial organization should help visitors quickly adapt to a new environment.

258 Ibid., pp. 54-56.
Spatial intelligence

Spatial ability is a major cognitive capacity essential for living in three-dimensional environments. Key expressions of this ability are spatial orientation, navigation and way finding. Closely tied to visual perception, spatial ability is often called visuo-spatial ability to emphasise the processing of two and three-dimensional images even though mental images can be evoked by other sensory information. Due to the manipulation of complex imagery, spatial ability is often considered a higher part of visual ability. Many studies do not separate the two. As studies in psychology have advanced, recent research now suggests that spatial ability operates autonomously in people, making a significant contribution to human life.

As a growing field of research, spatial ability is widely explored in psychology and neuroscience, creating knowledge of considerable relevance to fields relating to this research, including architecture and environmental behaviour. In some theories of human cognition, such as Multiple Intelligences theory, spatial ability is considered as a discrete, problem-solving capacity and is defined as spatial intelligence. Some researchers now use the term Spatial Intelligence to give a broad definition to this mental capability, counting it as a subset of human intelligence. The study of Spatial Intelligence provides some useful directions for environmental design, but there are few theories of exhibition design based on it. Since visiting an exhibition involves significant spatial exploration, the investigation of spatial ability is vital to this thesis.

A museum visit is fundamentally an environmental experience. Visitors start from disorientation when they step into an exhibition. Spatial information constantly surrounds visitors, demanding that spatial learning occurs. To assist this learning, published knowledge on spatial ability and its implications for environmental behaviour suggest new directions for supporting spatial learning through exhibition space design. Exhibition designers can learn from the study of Spatial Intelligence to harness museum visitors’ spatial cognition and learning in the aim of supporting effective learning from exhibition content in museum exhibitions. This section of the thesis examines human spatial capacity to establish a connection between spatial ability and learning processes. It investigates current understandings of Spatial Intelligence, including its definition, development and cognitive functions. The section concludes with a discussion of the implications of spatial intelligence for the design of museum exhibition spaces.
**Spatial intelligence: a definition**

The field of psychology intently debates the definition of Spatial Intelligence. Most discussion focuses on the delineation of intelligence. Some researchers question whether spatial ability is a discrete intelligence, although spatial ability is generally regarded as one pool or factor of mental ability. Spearman, who initiated the mental testing protocol called ‘factor analysis’, claims that human intelligence or mental ability can be categorized into factors: general factor \( g \) and several specific factors \( (s_1,s_2,s_3...) \).\(^{260}\) The development of factorial analysis has posited some distinct groups of factors as significant aspects of human mental ability, including verbal factor \( v \), spatial factor \( k \) and numerical factor \( n \). A characteristic of this factorial view of mental abilities is its hierarchical structure. Figure 8 represents Smith’s rendering of the hierarchy of human abilities:

![Figure 8: Smith’s hierarchical structure of human abilities.](image)

Spearman’s two-factor theory, \( g \) and \( specific \), is popular in psychological studies and has influenced many methods for testing intelligence. The two-factor theory considers the spatial factor to be a sub-factor of intelligence. Thurston opposes the idea of a singular general intelligence and suggests seven primary mental abilities.\(^{262}\) Spatial visualization is one of the abilities in his model. Later, Gardner nominated spatial ability as a specific type of intelligence in his theory of Multiple Intelligences. Gardner proposed his theory of Multiple Intelligences in 1983 in opposition to the established idea that people have a single holistic intelligence, arguing instead for the presence of discrete human cognitive capacities.\(^{263}\) According to Gardner, there are nine intelligences: Bodily-Kinesthetic, Intrapersonal, Interpersonal, Linguistic, Logical-Mathematical, Musical, Natural, Spatial

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\(^{263}\) Gardner.
and Spiritual. Each individual possesses these capacities in different strengths. His theory has had major implications for education, both formal and informal, suggesting the need for different forms of teaching and learning contexts to cater for the diversity of an individual’s intelligences, each supported by divergent presentation methods of learning materials. As well as describing nine human capacities as intelligences, Gardner flattens the traditional hierarchical model of intelligence. There is ongoing debate about whether there is one intelligence or many variants of intelligence, meaning the term Spatial Intelligence is still open to significant discussion and investigation, significantly expanding scholarly thinking about the nature of spatial ability and human intelligence.

One way to define Spatial Intelligence is to define the characteristics of SI. For Gardner, there are four related capacities to Spatial Intelligence: the capacity ‘to recognize instances of the same element’, ‘to transform or to recognize a transformation of one element into another’, ‘to conjure up mental imagery and then to transform that imagery’ and ‘to produce a graphic likeness of spatial information’. These capacities work together under Spatial Intelligence, although Gardner suggests they are not found in equal measure in all people. He also argues that, ‘practice in one of these areas stimulates development of skills in related ones’. Hence, there are two major reasons for defining ‘spatial thinking’ as a whole aspect of intelligence. Firstly, spatial capacity meets the criteria that Gardner suggests for an intelligence following his studies in human competence. Another reason is the mutual enhancement of spatial capacities.

Although this intelligence is described as ‘spatial’, the competence actually encompasses the broader processing of two and three-dimensional information. Each Spatial Intelligence capacity requires a person to recognize or imagine forms. It surmises that people can identify simple distinct forms from different perspectives, providing a more memorisable impression. This suggests that exhibition spaces should provide identifiable spatial forms and organization, so that visitors can easily recognize their position in relation to exhibition content. A clear image of space helps people connect location and content, suggesting that uniform white walls may not provide the best background for exhibitions.

Several other key conceptions support theories of Spatial Intelligence and spatial ability. In examining the criteria of Spatial Intelligence, Eliot surveys research approaches,

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264 Ibid., p. 176.
265 Ibid., pp. 173-74.
enabling him to distinguish between spatial ability and Spatial Intelligence. Spatial ability, he writes, ‘refers to one of several domains of human abilities within factor structures’ of human abilities and ‘spatial intelligence refers to a very broad range of capacities which are associated with our awareness of the relational distribution of things and our ability to use that awareness to solve spatial problems’. The American Psychological Association (APA) also defines spatial ability and spatial intelligence differently. According to the APA definition, Spatial Intelligence is ‘the ability to mentally manipulate objects in space and to imagine them in different locations and positions’. By contrast, spatial ability is defined as ‘the ability to orient or perceive one’s body in space or to detect or reason about spatial relationships’. For the purpose of this discussion, I define Spatial Intelligence as the mental ability to perceive, retain, manipulate and conceive images of three-dimensional forms to resolve spatial problems.

Since the thesis explores the relationship between exhibition spaces, spatial learning and general learning processes, the investigation of Spatial Intelligence seeks to accommodate spatial and other intellectual activities. Yet limits need to be placed on the extent of Spatial Intelligence here. Gardner uses examples of extreme spatial ability in rare individuals as evidence for the presence of Spatial Intelligence. These include the precise recognition and drawing ability of three-dimensional objects found in blind and sighted individuals. This thesis addresses the role of SI in the experience of general museum visitors, discussing only those theories that relate to normal capacities of SI.

The development of spatial intelligence

Piaget’s research includes an early study of the development of spatial capacity in children. In reviewing Piaget’s work, Gardner concludes there are four different stages of spatial development in children: ‘the infant’s ability to move around in space’, ‘the toddler’s ability to form static mental images’, ‘the school child’s capacity to manipulate such static images’ and ‘the adolescent’s capacity to relate spatial relations to propositional accounts’. Spatial Intelligence in adults incorporates the four capacities described in Gardner’s theory. The extent of Spatial Intelligence in individuals varies greatly according to individual difference, training and living environment. One research area that focuses on the difference in Spatial Intelligence among groups shows some patterns in its

268 Ibid.
269 Gardner, pp. 185-90.
270 Ibid., pp. 178-80.
distribution. In examining the relationship between age, spatial abilities, learning environmental layouts and way-finding behaviour, Kirasic confirms the finding from previous studies that spatial ability differs between younger and older adults. Sex differences in spatial ability can be also found in Kaufman’s research, reconciling many earlier studies.

For the purpose of this research, the discussion of Spatial Intelligence focuses on adults, who represent a high proportion of museum visitors. According to a report from the Australian Museum Audience Research Unit, ‘the demographic characteristics of museum visitors have remained fairly stable’. There are several characteristics of typical museum visitors. They are ‘more highly educated, with post-secondary education likely in the humanities or arts; either primary school aged children, or adults aged between thirty and fifty; visit with the family or other social groups; in a higher socio-economic class; and visited museums as children’. Some exhibitions may be targeted to specific groups, but this thesis considers the behaviour and needs of typical adult museum visitor. Future studies, however, should look at the needs of children in terms of the space design of museum exhibitions, especially in those dedicated to children. Despite focusing on children, the many studies on the development of Spatial Intelligence still provide basic understanding of Spatial Intelligence. Piaget’s and Gardner’s developmental stages suggest that basic spatial capacities should be considered to be developed in adults.

**The cognitive functions of spatial intelligence**

The study of Spatial Intelligence is expansive and examines human spatial ability from different perspectives. Eliot’s review of Spatial Intelligence research bases the criteria of Spatial Intelligence on the different approaches in Spatial Intelligence research. His survey proposes five approaches: physiology of sensory systems, the coordination of movement, perception, psychometrics, knowledge acquisition and social role. In considering the relationship between space and learning experience, this thesis focuses on knowledge acquisition. This section discusses the cognitive aspects of Spatial Intelligence, spatial cognition being the most important step in acquiring spatial knowledge. Firstly, I

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272 S. B. Kaufman 2007, ‘Sex Differences in Mental Rotation and Spatial Visualization Ability: Can they be accounted for by differences in working memory capacity?’, *Intelligence*, vol. 35, no. 3, pp. 211-23.
274 Ibid. viewed
275 Eliot.
clarify the definition of spatial cognition and then discuss the working elements of spatial cognition, including sensory bases, working memory and cognitive map.

The study of human cognition, often referred to as cognitivism, reaches back to ancient Greece and Rome, but became an established field of scientific research in the 1960s. The idea that understanding people’s thinking processes would lead to a better understanding of human behaviour drives cognitivism. The field incorporates insights from earlier theories such as structuralism, functionalism and Gestalt psychology. Investigations into the content, processes and results of human thought have generated many models of human cognition and include research into the connections between the various levels and aspects of human systems in information processing. Environmental information is central to daily life and contributes significantly to how people conceive and experience the world. Spatial cognition is an important aspect of cognition studies in psychology and interest from many others fields. The diverse disciplinary basis of spatial cognition studies has seen the development of diverging theoretical approaches and models, blocking the development of a uniform definition of the area. Even so, in reviewing the various definitions of spatial cognition by eminent psychologists such as Piaget, Werner and Laurendeau, Hart concludes that, ‘spatial cognition is the knowledge and internal or cognitive representation of the structure, entities and relations of space; in other words, the internalized reflection and reconstruction of space in thought’.

The first function of Spatial Intelligence is the acquisition of spatial information, which is channelled through different sensory pathways. The visual sensory channel is the primary channel for receiving spatial information. People then recall spatial information from the memory, creating mental images that are used for navigation or solving spatial problems. Other senses, such as touch and hearing, assist in the acquisition of spatial information, the case of blind people who can travel independently being a prime example of gaining spatial information without visual ability. In discussing the capacity to acquire spatial information, Foulke sees three perceptual systems coming into play: the visual, auditory and haptic-proprioceptive systems. In examining spatial information processing, Hermelin suggests that spatial information received from the

senses is internalised through a coding process. Hermelin’s experiments on spatial
coding in children show that, ‘simulation in different sensory modalities results in
different coding strategies’.

The visual system is more significant than the other senses
in coding spatial aspects of stimulation, as the visual system can receive more spatial
information. Another example of spatial information that relies mainly on the visual
system is Foulke’s study on the mobility of blind pedestrians. Although there are
certain techniques and electronic travel aids for enhancing mobility, blind pedestrians
still cannot gain enough spatial information to travel as independently as sighted
pedestrians. The derivation of spatial information through other sensory systems may
provokespacial learning, but this research focuses on the visual impact of exhibition
spaces on visitors’ spatial learning and its implications for engagement with and
retention of exhibition content.

Short-term and long-term memories have long been considered as the fundamental
dichotomy in the human system in respect of storing information. The concept of working
memory assumes that information is stored temporarily and processed simultaneously.
Initially proposed by Baddely and Hitch, the concept of working memory has produced
several different theories. According to Baddely’s multi-component model, working
memory consists of two slave systems for temporarily storing information and a central
executive for coordinating and executing information. There are several subsystems
related to specific types of information. The subsystem dealing with visuo-spatial
information has been named the visuo-spatial working memory and is ‘characterised by
the capacity to maintain visuo-spatial information in a temporary memory system and
process it regardless of the stimuli source’.

Due to its storing and executing functions, working memory is the focus of spatial
cognition in some research. Cornoldi suggests that, ‘mental imagery and visuo-spatial
processes should be considered part of memory functions or, more specifically, working
memory functions’. Many studies have been conducted that explore the extent of
working memory, but the structures of working memory and visuo-spatial working

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281 Ibid.
282 Foulke.
284 C. Cornoldi and T. Vecchi 2003, Visuo-Spatial Working Memory and Individual Differences, Psychology Press,
Hove.
285 Ibid., p. 7.
memory are still unclear. Most of the debate in this area of cognitive psychology focuses either on the presence of the one unitary system or the existence of several independent subsystems. In summarising the research on visuo-spatial working memory, Cornoldi favours a continuity model of working memory to accommodate the continuous and discontinuous perspectives of working memory as set out in Figure 9.

![Figure 9: Cornoldi's continuity model of working memory.](image)

Research has gradually revealed the relationship between learning and visuo-spatial working memory. In investigating the role of learning in enhancing visuo-spatial working memory, Olson's experiments suggest that learning from repeated information can achieve better performance in visuo-spatial working memory. Olsen, Moore and Jiang argue that research findings show that the performance of visuo-spatial working memory 'increased significantly when the same location changed across display repetitions, but not at all when different locations changed from one display repetition to another'.

To navigate space, environmental cognition processes the spatial information received from real world settings. The theory of the cognitive map describes the phenomena of animals' mental understanding of environmental information. Cognitive maps, a concept first introduced by Tolman, form as a result of the brain actively searching for and collecting contextual data in a three-dimensional environment. Although often used interchangeably with the term 'cognitive map', the idea of the mental map carries a

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286 Ibid., p. 122.
broader meaning in also incorporating personal experiences, cultural influences and individual feelings. The cognitive process that enables the acquisition, coding, storage, recall and manipulation of environmental information is called cognitive mapping. Some environmental behaviour such as orientation and way-finding rely heavily on the formation of cognitive maps. Some studies show that verbal descriptions, which provide spontaneous information for directing people on their journeys, can be used for non-visual learning and way-finding in large-scale environments, but most people navigate spaces by retrieving place memory. Specific studies have sought to understand the formation of cognitive maps. In responding to an individual’s active absorption of environmental information, the formation of a cognitive map involves a process of trial and error.

This aspect of people’s navigation behaviour poses a challenge for the designers of physical environments, who need to consider the legibility of environments to assist the unfolding of cognitive human processes. Besides the interest in the idea of the cognitive map to the field of psychology, the presence of cognitive map has been the subject of many studies in architecture and urban planning. Psychological research has developed many measurement techniques to reveal the existence and nature of cognitive maps, including ‘spatial priming and recall, distance and pointing judgments, mental scanning operations and map reproduction’. One of the most influential studies here is Lynch’s study on the imageability of the city. Propelled by the attempt to provide verifiable principles as a basis for the practice of urban planning, Lynch’s study has influenced the mapping methods used to probe spatial cognition in experimental psychology.

**The measurement of spatial intelligence**

Numerous methods exist for testing and measuring Spatial Intelligence, including means for selecting students for space-related courses such as architecture and engineering. In advocating the concept of spatial ability, Smith considers the results of many spatial tests to argue that people have excess spatial ability that can be developed. Various psychological tests show the relationship between spatial ability and other abilities, such as mathematics, abstract thinking and temperament. As a better use of visual or spatial

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291 Giudice, Bakdash and Legge.
293 Smith *Spatial Ability: Its educational and social significance*. 

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aids in teaching mathematics is possible, Smith argues for the validity of spatial tests as a predictor of success in mathematics.294

The results of spatial tests suggest differences in spatial ability relating to age and gender differences and indicate that spatial ability can be inherited. Various studies in psychology and neuroscience seek to identify differences in spatial ability between the genders, different age groups and special groups such as gifted children. For example, the Object-Spatial Imagery Questionnaire is designed to assess individual differences in visual imagery preferences and experiences.295 In a study of the relationship between people of different ages, spatial ability, learning environmental layouts and way-finding behaviour, Kirasic suggests that psychometric testing of general spatial ability can predict age-related decline in learning. For example, in a study investigating 120 younger and 120 older adults, Kirasic concludes that the 'knowledge of environmental layout was the exclusive mediator between general spatial ability and way-finding behaviour'.296

A basic model of visual-spatial activity

Based on the investigation of spatial ability, Figure 10 illustrates the process of visual-spatial activity.

![Figure 10: The process of visuo-spatial activity.](image)

294 Ibid., pp. 135-55.
296 Kirasic.
People channel spatial or environmental information through their visual sensory apparatus and encode it in their working memory. They store, recall and create visual information as mental imagery and process spatial information in the working memory as an internal representation. Behavioural decisions based on the processed internal representation influence body movement and allow people to note other environmental information. The loop continues to take in and make sense of information until an individual goal is reached. Visiting museum exhibitions presents people with rich visual information and a range of tasks involving body movement and navigation, demanding heavy visuo-spatial processing. There are two areas in which exhibition design can enhance spatial learning processes. Firstly, exhibition spaces can provide a vivid impression, so that visitors can easily formulate and recall them as mental images. Secondly, exhibition designers can arrange exhibition spaces to support ready understanding of internal presentation and enable museum visitors to make easy connections. This section of the thesis discusses how the design elements and characteristics of exhibition spaces can potentially enhance spatial cognition.

**The development of spatial cognition**

Investigations into the development of spatial cognition have the greatest relevance to the design of exhibition space. In researching how people acquire and develop knowledge about spatial environments, theories of spatial cognition suggest a range of potential supporting strategies. Psychology, geography, urban planning and computer science all investigate how humans interact with environments at the psychological level as well as seeking real-world applications for these studies. The study of the development of spatial cognition has generated many theoretical frameworks. These studies can be divided into three main directions. The first focuses on the different stages of spatial cognition, with major studies, as I outline below, by Carssirer, Werner and Piaget dominating the field. The second direction mostly occurs in the fields of environmental psychology, urban planning and geography and considers the formation of cognitive maps or internal representations. The third direction arises in neuropsychology and studies the physical organization of relevant cognitive functions in the human brain. The discussion of theories of spatial cognition in this thesis focuses on the first two directions: the developmental process of spatial cognition and the internal representation of spatial cognition. Neuropsychology concerns the different functions of human cognition and the corresponding areas in the brain and is outside of the scope of this section.
Interest in human conceptions of space reaches back to Descartes and Kant, but substantive theories describing the cognition of spatial experience emerge in the 1940s. In studying the process of coming to know spaces, Cassirer, one of the earliest theorists, identifies three main stages: organic or active space, perceptual space and symbolic or abstract space. He ranks these from low to high order. Later, Werner posits his organismic-developmental theory that also orders the development of space cognition in a sequence from action-in-space to perception-of-space to conceptions-about-space. Viewing all forms of organismic development as the differentiation and subordination of parts to the whole, Werner considers the development of spatial ability as a process of differentiation and reintegration between the organism and its environment.

Extending Werner’s organismic-developmental theory, Piaget proposes the notion of the active organism that represents the human organism as actively engaging with the environment to structure its experience. In addressing the question of epistemology, Piaget surmises that the construction of knowledge is the result of the interaction between an organism and its environments and a resultant series of equilibrations. People achieve progressive equilibrium by assimilating the external world into already known schema, or readjusting the schema to the external world. Piaget conducted numerous studies to understand children’s intelligence and psychological development. As discussed in the previous section, Piaget’s theory of cognitive development has profoundly affected later studies in developmental psychology and epistemology, particularly constructivism. The research of Piaget and his colleague Inhelders identifies four developmental stages and three types of spatial relations in the development of spatial cognition. These four stages are the sensorimotor (birth-age 2), preoperational (ages 2-7), concrete operation (ages 7-12) and formal operations (ages 11-12 to 14-15 and beyond). In terms of developing spatial relationships, there are three progressive stages from topological to perspective to Euclidean relations.

These early theories of spatial cognition each describe the development of cognitive spatial ability as progressing from the capacity to conceive physical to abstract space, spatial orientation transferring accordingly from egocentrism to perspectivism. Hart and

300 Ibid.
Moore, in their review of the literature of spatial cognition since the early twentieth century, demonstrate that the Wernerian-Piagetian theory of structural development frames much research and theory in the area. Five areas of parallel spatial development are proposed: 'levels of organization of spatial cognition (sensorimotor, preoperational, concrete operational and formal operational); types of spatial relations (topological, projective and Euclidian); modes of representation (enactive, iconic and symbolic); systems of reference (egocentric, fixed and coordinated); and types of topographical representations (route and survey)'. Hart and Moore suggest that these parallel the four periods of general intellectual development set out by Piaget and Werner and show corresponding functions and relations (See Figure 11).

Figure 11: Hart and Moore's schematic representation of the ontogenetic development of topographical representation.

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302 Hart and Moore.
303 Ibid., p. 288.
304 Ibid., p. 278.
Another group of studies in spatial cognition concerns the internal representation of environmental information. Various terms define this mental representation, including cognitive map, mental map and spatial representation. Researchers generally consider that spatial cognition unfolds through a learning process, spatial information being formed in cognitive maps. Siegel and White identify three elements that support the formation of cognitive maps in large-scale environments: landmark knowledge, route knowledge and survey knowledge. Hart and Moore identify two types of cognitive map: route and survey. The way in which spatial knowledge forms is still much debated. Some studies suggest it develops as a sequence, but others show that the three stages operate simultaneously.

Essential to the development of the three types of knowledge—landmark knowledge, route knowledge and survey knowledge—is a reference system, or frames of reference, which individuals use to locate and orient themselves in environments. Hart and Moore identify three systems of orientation in the literature on spatial cognition: egocentric, fixed and coordinated. Citing Piaget and Werners’ developmental models, they suggest that the development of reference systems for location and orientation parallels the development of spatial knowledge, both happening sequentially. An egocentric orientation system uses the body as the origin of referencing axes or planes, Hart and Moore reporting that research reveals it to be a system 'based on a sense of localization through bodily movements. For instance, by turning the head and perceiving, one aligns oneself with an environment.

A specific system of reference relates the human position and movement to fixed elements in the environment. Hart and Moore note that many researchers including Freeman, Werner, Piaget and Brown observe the transition from an egocentric to a fixed system of orientation. Landmark knowledge is an important element of a fixed system of orientation, people incorporating landmarks as part of the spatial representation of an environment as they travel through it. Several researchers identify landmarks as vital fixed reference points. Piaget, for instance, suggests that in the early concrete operational stage of children’s development, children only partially use landmarks as their spatial reference system, being unable to appreciate the link between landmarks and the totality

306 Hart and Moore.
307 Ibid.
308 Ibid., pp. 278-79.
of an environment. On the basis of human maze-learning experiments, Brown highlights the value of landmarks in fixed systems of spatial reference, noting that ‘the nucleus of any locality is an object’. Much research focuses on how children develop a fixed system of spatial reference, the home appearing to be the first and most important point of reference in a child’s spatial representation. Research suggests this understanding only extends a certain distance from the home. Lee’s research on school children indicates that children develop various schemata for different locales, their system of fixed spatial reference being fragmented and not fully integrated. The capacity to develop topographical representations of large-scale environments depends on the development of a higher system of conceptual processing.

A freely transferable system for reading spatial reference points and incorporating spatial knowledge develops gradually in individuals. Hart and Moore represent a coordinated system of reference as the highest system possessed by people. As a system of spatial knowledge formulated externally to both the individual and the perceivable environments, such a system often appears to be abstract. A central aspect of learning orientation in large environments is cardinal direction. School children are often taught the directions of the compass, but some researchers suggest that the cardinal direction system is not a spontaneous, coordinated representation in children. Piaget and his associates found that school children who had reached the third developmental stage of concrete operation could construct topographical representations using a two-dimensional coordinate system based on important features in environments, stressing the importance of landmarks in a coordinated system of spatial reference. Later experiments showed the gradual maturation of the third developmental stage of concrete operation, as children made the transition from a partially coordinated system to fully equilibrated concrete operations. Trowbridge, Lord and Kabanova-Meller advocate the importance of education in the cardinal system, but Hart and Moore argue that the fundamental factor in using a coordinated system of spatial reference is the development of one’s ability ‘to recognise perspectives other than his own’. Whether taught or spontaneous, a coordinated system

311 Hart and Moore, pp. 279-80.
313 Piaget, Inhelder and Szeminska The Child’s Conception of Geometry.
314 Hart and Moore, p. 283.
of reference is crucial in developing one's concept of space, which allows one to incorporate spatial information in large-scale areas.

**Landmark knowledge**

In the study of Spatial Intelligence, landmark knowledge is generally recognized as a major component of cognitive maps. Landmarks are any prominent entity in an environment. In examining the nature of spatial coding, Newcombe identifies landmarks as 'long-term stable reference systems for specific areas'.\(^{315}\) Usually, part of an area becomes a landmark because of its 'salient, familiar, and/or functionally important entities'.\(^{316}\) The literature identifies two kinds of landmark—point and region—although Newcombe suggests that both exist on a continuum, true point landmarks only existing in the abstract.\(^{317}\) On a small scale, an area can become a point. Extrapolating several studies on the evolution of landmarks in human spatial cognition, Newcombe suggests that landmark knowledge increases as one becomes more familiar with new environments. This suggests that any object can become a landmark as one explores a space, accumulating spatial information.

Lynch’s theory identifies four other key elements as constituting the urban environment in addition to landmarks—districts, edges, paths and nodes—each potentially serving as a landmark of a different scale and order. Although Lynch's theory and subsequent studies suggest that various elements of a spatial environment can achieve imageability, research into the development of cognitive maps suggests that landmark knowledge is often identified as one of the major images acquired in new environments. Landmark knowledge facilitates two systems of externally referenced spatial coding: cue learning and place learning. Newcombe and Huttenlocher explain that, 'Cue learning specifies an association between the to-be-located object and coincident landmarks. Place learning (basically Tolman's idea of cognitive mapping) involves coding distance and direction from distal landmarks'.\(^{318}\)

**Route knowledge**

Route learning, or way finding, involves both bodily and mental activities that enable the individual 'to navigate within a spatial environment through the acquisition of specific

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\(^{316}\) *Ibid.*

\(^{317}\) *Ibid.*

Route knowledge allows individuals to move from one place to another, this being described as the development of ‘route maps’ by some researchers. Shemyakin, for example, identifies route maps as one type of topographical representation formed by mentally tracing the locomotion route through environments. The process of developing route knowledge begins as soon as an individual moves from a fixed position. The ability to use route mapping develops at an early age, when one starts exploring environments outside the home. It depends on two basic elements: landmarks and locomotion. Arising simultaneously to the development of a fixed system of reference, route learning accommodates more fixed features into a spatial representation, these features becoming landmarks. Landmarks are crucial navigation points in travelling through an environment, with the individual constructing links between landmarks and hence developing route knowledge.

**Survey knowledge**

Survey knowledge is the mental representation of an environment from a bird’s eye view in the form of a map. Shemyakin describes survey maps as mental representations of ‘the general configuration or schema of the mutual disposition of local objects’, Hart and Moore equate Shemyakin’s definition with Piaget’s ‘true topographical representation utilizing a coordinate reference system’. The formation of survey maps follows the development of route maps, but achieves a more complex and detailed order of representation.

**Spatial intelligence and environmental design**

Environmental design fields such as architecture and urban planning have shown much interest in the study of Spatial Intelligence in needing to understand how people engage with space. Although the scale of projects in architecture and urban planning is greater than those in exhibition design, insights and principles derived from environmental design can benefit exhibition design. Based on the basic model of visuo-spatial activity, most of the Spatial Intelligence research in environmental design falls into two categories: images and navigation. Designs seek to provide a vivid impression of an environment on the basis

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323 Shemyakin.
324 Hart and Moore, p. 277.
of research into how mental images arise in people. Such impressions seek to provide the ‘what’ information that relates to an environment. Navigation then provides the ‘where’ information, so that people can effectively perform orientation and way finding.

Based on the understanding of spatial memory, some studies in urban planning suggest that designers can provide legible and empathetic urban environments by linking the image and impression of the city to an understanding of Spatial Intelligence. Exhibitions also provide spatial information to museum visitors, serving a functional role and ideally also creating pleasurable and memorable experiences. There are precedent studies for this approach in the field of urban design. Lynch famously conducted research on people’s perception and mental image of three cities: Boston, Jersey City and Los Angeles.\textsuperscript{325} Focusing on the legibility or ‘imageability’ of the city form, his research analysed environmental images according to three components: identity, structure and meaning. Lynch employed two methods to determine the ‘image’ of the three cities in the study: interview and field analysis. He interviewed a small number of citizens in three cities, asking them to sketch a map of the city, to describe the details of several trips through the city and provide a list and description of their perception of the most vivid and distinctive parts of the city. For the field analysis, several observers were firstly trained to understand the concept of city imageability. The observers then conducted a systematic analysis of various areas of each city on foot, recording their journeys. From the basis of participants’ cognitive representations, Lynch identified several important elements of the spatial fabric of cities: paths, edges, districts, nodes and landmarks.

The term Spatial Intelligence does not appear in Lynch’s study, but it is based on concepts closely related to Spatial Intelligence. The research culminates in a set of design guidelines for the five city elements that seek to heighten the imageability of cities. There are two aspects to Lynch’s study that are relevant to this research. Firstly, one of Lynch’s fundamental principles is the existence and character of human place memory, which involves the first two functions of spatial intelligence, the recognition and retention of spatial images. Secondly, the development of design guidelines ensues from an idea that clarity is important in environmental images. Understanding Spatial Intelligence can advance practices in environmental design fields such as architecture and interior and exhibition design. Although Lynch’s study analyses the ‘meaning’ of spaces, overall his study focused on the visibility of spaces and the nature of direct experiences within them.

\textsuperscript{325} Lynch.
Following Lynch’s approach, many urban studies have been conducted to examine the idea of urban image. Lynch’s identification and codification of urban elements has been widely used in urban planning and environmental design, including in the design of virtual environments. Most of these cases apply Lynch’s concern for legibility and the imageability of elements in city settings. For example, based on the classification of urban elements, Cirik, Jim and Yeung analyse existing conditions in different cities and suggest design guidelines for their improvement. Ford uses Lynch’s theory as a structure to identify the potential of new urban planning. Recently, the development of virtual environments has started to incorporate Lynch’s concept for creating maps, layouts and tools so that users can easily navigate in virtual environments. These studies in urban design and virtual environments suggest that mental image or memory is crucial for making meaning of environments. Exhibitions provide novel settings for visitors, an understanding of the role of place memory in Spatial Intelligence and associated learning processes potentially providing a foundation for the design of interior spaces for informal learning.

Orientation, navigation and way finding are important human behaviours in negotiating physical environments. In architecture, the design of circulations within a building is a crucial consideration and needs to take into account how people acquire spatial information and position themselves. In establishing design guidelines for way finding, Werner suggests that consistent alignment of reference systems significantly reduces cognitive load as people position themselves. The ‘alignment effect’ is a cognitive principle that suggests that when people orient themselves in an environment, external reference systems such as maps, walls or axes align with the representation in our spatial memory. A common example is when tourists refer to ‘you are here’ maps to position themselves. The comprehension of environments is more easily achieved if the direction of maps coincides with the orientation of environments. Although maps appear external to the cognitive representation in this case, the same effect happens when one refers to a

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cognitive map in the working memory. After examining relevant research on alignment effects, Werner argues that the perceived spatial structures of environments strongly affect the storage and recollection of spatial information.\textsuperscript{331}

It is increasingly recognised in psychology that people use different egocentric frames of reference to process spatial information. Sholl has conducted two experiments to study the egocentric frames of reference used in retrieving survey knowledge gained from maps or through navigating environments. He concludes that an eye-centred system is used for retrieving map knowledge, but a body-centred system comes into play for processing knowledge of an environment.\textsuperscript{332} Werner confirms the use of a body-centred system for large-scale spaces such as cities.\textsuperscript{333}

Besides maps and reference systems, signs are an important way finding aid. Passini points out that the size, colour, lettering and illumination of signs each contribute to the comprehension of space.\textsuperscript{334} Some studies even suggest that signs work better than other spatial factors such as maps, circulation and space configuration in helping people find their destinations.\textsuperscript{335} Signs can provide clear directions and connections without imposing high cognitive load. Route knowledge, or the mental representation of connection between spaces, can thus be established by perceiving signage.

\textit{The implication of spatial intelligence for exhibition space design}

Two major factors can be derived from current understandings of Spatial Intelligence and its application in environmental design: imageability and navigability. Offering more memorable spatial elements creates more vivid pictures of spaces, achieving imageability. Connecting spaces in structurally more meaningful ways makes way finding easier, enhancing navigability. Greater imageability can be achieved by providing landmarks. Signage and well-referenced route and environmental maps enhance navigability. Spatial information recorded in vivid and meaningful ways supports spatial learning and develops spatial knowledge.

\textsuperscript{331} Ibid., pp. 114-16.
A major need in the design of exhibition spaces is the enhancement of spatial learning. Exhibition spaces designed to specifically accommodate spatial information build spatial knowledge as visitors engage with the exhibition environment. Based on the current understanding of human spatial cognition, the remainder of this thesis proposes a framework of spatial information to facilitate spatial learning and the development of spatial knowledge in museum exhibitions. The underpinning framework of spatial information uses the progressive structure of spatial development and hierarchical spatial representation suggested by Hart and Moore. Many of the terms for describing spatial representation in large-scale environments, such as landmark, route and survey, come from the study of human cognition and behaviour. These need to be redefined for the smaller scale spatial environments of museums and museum exhibitions. The elements of the design framework for the development of connected place memory are space cue, staging, space direction and space map. I explain each below.

The role of landmarks is widely studied in landscape architecture, urban planning and geography, although most studies in these fields concern landmarks in large, open spaces. The term landmark is not readily transferable to the development of spatial knowledge in the enclosed, small-scale environment of a museum exhibition. The concept of the 'space cue' is used in its place. A landmark provides an external reference point for the development of cognitive maps. A space cue is a special and memorable figure that assists in the cognitive mapping of exhibition spaces.

Like a landmark, a space cue provides a point in space that identifies and links spaces. To achieve identifiability, a space cue needs to provide a vivid image through its design elements. Lynch provides a useful insight into how this can be accomplished, suggesting that, 'the key physical characteristic of this class is singularity' and 'figure-background contrast seems to be the principal factor'. Lynch offers two ways of applying elements as landmarks, suggesting they be made 'visible from many locations, or by setting up a local contrast with nearby elements'. These methods can be also applied to exhibition spaces to give visibility and prominence to the intended space cues.

Exhibition space not only serves a background role, it also contextualises meaning. Space staging adds details to spaces and integrates design elements into an overarching theme. 'Staging a space' prepares an exhibition environment to provide an effective contrast for...
space cues. An additional aspect of space staging is consideration of the effect of contextual information for spatial learning. There is some research concerning the influence of context on perception and navigation in rich visual environments. Chun, for example, coins the term ‘contextual cuing’ to propose a new paradigm that describes how the information from a visual context influences visual behaviour.\textsuperscript{338} Contextual cuing suggests that observers implicitly record and learn the whole context when searching for targets, the context providing cues for finding target positions. Context may enhance search performance and visual learning. In a discussion of various studies on visual context, Brady concludes that, ‘objects are associated with the context in which they are usually found, helping to facilitate recognition of objects in their normal context’.\textsuperscript{339}

In exhibitions that span more than one exhibition space, the provision of directions from one space to another can assist the route learning process. Signs, forms, or symbols that signify the character and location of the next area of an exhibition or the next exhibition room in a museum can facilitate the linking process. To achieve this, relevant design elements need to be located at relevant entrance and exit points. Orientation is important for locating one’s position before taking the next step, so a transcendent reference system needs to be present to assist these key processes. Many museums confine exhibitions to enclosed spaces that have no visual link to the outside world, reducing the orienting role of cardinal directions for museum visitors. To aid the sense of direction and orientation, spatial elements such as a central core or axis should be perceivable in each space, allowing museum visitors’ continual accesses to spatial reference points. Since locomotion is an important element in developing route knowledge, exhibition spaces need to encourage active exploration. Exhibitions often allow visitors to freely navigate their exhibition spaces, but directional cues can help build route knowledge.

A space map is a general, abstract representation of an exhibition environment. It operates in relation to the human tendency to create an image of an area from a higher viewpoint, allowing the museum visitor to comprehend the whole layout and structure of an exhibition environment. To facilitate the formation of space maps, designers can include three elements into exhibitions: a floor plan, accessible space and a coordinated system of reference. Museums often provide visitors with floor plans of museum buildings on entering an institution. Floor plans of exhibitions are less common. A floor plan is a top view of an environment and aligns well with the angle of survey knowledge, suggesting the


Value of floor plans in the formation of space maps. Individual space maps are built up through visitors’ free exploration of exhibition spaces, the accessibility and imageability of space being important in an individual’s capacity to form space maps. To build a complete map of an exhibition, visitors have to experience every space. Any dead or uninviting corners will affect visitors’ experience and understanding. Like survey knowledge, a space map is only formed if visitors can grasp the totality of linked spaces and conceive meaningful routes through exhibitions. To facilitate the formation of space maps, a coordinated system of reference points needs to be provided in exhibition spaces. The system should be readily perceivable and easily comprehended, encouraging visitors to refer to it to keep track of their location and orientation.

**Mnemonic loci learning**

‘Mnemonic loci’ is a memory technique used since ancient times that imagines information as linked to place. In relating learning to space, it has clear relevance to the research, with principles of mnemonic loci suggesting that one can recall information more easily and hence enhance learning by offering vivid memory of imagined places as information containers. This section introduces the characteristics, concepts and procedures of mnemonic loci. It then argues that the human cognitive capacity implied in mnemonic loci can inform the learning aspects of space design in museum exhibitions. Lastly, I reflect on the implications of the loci method for the design of exhibition spaces.

**The technique of mnemonic loci**

Mnemonic loci or the method of loci is a memory technique that links complex information to places, enabling the recall of information through the production of mental images. A typical use of this technique is to link mental images with existing spaces. For example, one is prompted to travel mentally, several times, through a place or building to visualize and memorize the order and characteristics of its spaces. The mind then places symbols or pictures associated with the information to be remembered into the spaces. It is held that information can be recalled by revisiting the spaces in the imagination, the symbols or images providing strong cues for associated information.

collapse of a banquet hall, Simonides helped to identify dead bodies by remembering the location in which guests at the fateful banquet had sat. Cicero reports that the discovery of the power of place memory led Simonides to invent the principles of the art of memory. In ancient Greece, there were very few writing materials, the method of mnemonic loci being used to commit information to memory. Yates explains that in antiquity, the classical art of memory, 'belonged to rhetoric [being used] as a technique by which the orator could improve his memory, which could enable him to deliver long speeches from memory with unfailing accuracy.' Since antiquity, memory place has accrued many uses as well as various complex tools for its practice. These include Giulio Camilo’s memory theatre and Robert Fludd’s theatre memory system. Today, the technique of mnemonic loci is still used to memorize information and enhance learning. The studies in psychology and education reviewed below investigate mnemonic loci for its effectiveness as a learning tool for diverse age groups and the disabled.

It is generally argued that two main elements contribute to the successful retention of information by the memory: order and imagination. Svantesson, for example, describes memory as the combination of order and structure with imagination and creativity. Interestingly, although mnemonic loci techniques have been taught since the time of the ancient Greeks, the basis of such techniques has stayed the same, recommending that individuals:

- familiarize themselves with a place and several spots within the place;
- create vivid, mental images associated with the information to be memorised;
- place mental images onto the chosen spots in a place;
- use mental images as cues for remembering information;
- recall information by entering the imaginary place or building from different entry points.

The connection between mnemonic loci and exhibition design

Several important human cognitive capacities are intrinsic to the theory of mnemonic loci. Yates suggests that Simonides discovered the importance of order to good memory. The

341 Ibid.
345 Yates, p. 17.
fact that the technique has been taught for millennia suggests that place memory is a fundamental human capacity that can be trained. Remembering is a natural process in our daily lives and mnemonic loci is considered a form of artificial memory, since one consciously uses specific techniques to apply or develop it. Yet the psychological basis of the method indicates that one can recall information more easily if it is linked to strong place memory. This suggests that if places are designed to achieve both an ordered and vivid visual quality, inherent place memory will function more easily. Cicero speculated that Simonides' invention of the art of memory built on 'the discovery that the sense of sight is the strongest of all the senses'. The implication here is that if exhibition spaces are designed around ordered spatial qualities and strong visual cues, they will be memorable and meaningful, potentially offering visitors heightened levels of engagement with the themes and content of an exhibition and lead to learning.

Research in both psychology and education investigates mnemonic loci from the perspective that it enhances information recall in specific age groups. Robertson's study on people over sixty years old shows that older people can be trained to effectively use mnemonic loci. In comparing the effectiveness of mnemonics for memorising lectures or presentations, Beni's study identifies mnemonic loci as a technique for improving one's memory of presentation materials. Moreover, the study finds that the method works better when presentation is in oral mode rather than written mode, concluding that, 'loci mnemonics appear particularly useful for the orderly memorisation of information presented in lectures when unable to take advantage of other external aids, such as writing notes, using a tape-recorder, etc.'

Studies in neuroscience shed new light on environmental behaviour, exhibition design potentially benefiting from the new exploration of the environment/behaviour/neuroscience paradigm. Recently, researchers in neuroscience have begun to conduct environmental behaviour studies to extend the understanding of the human brain and its functions. Neural systems have been found to contribute to learning and memory. In the application of neurobiology, environmental behaviour studies explore the connections between neurobiology and environmental elements, with researchers such as Zeisel starting to investigate people's observable behaviour in specific environments and to

346 Ibid., p. 19.
348 R. D. Beni, M. Angelica and C. Cesare 1997, 'Learning from Texts or Lectures: Loci mnemonics can interfere with reading but not with listening', *European Journal of Cognitive Psychology*, vol. 9, no. 4, pp. 401-16.
349 Ibid., p. 413.
study the internal state of the human brain as it responds to environments. Some studies have been conducted to measure internal states.\textsuperscript{351} Mnemonic loci learning and visual memory reinforcement are emerging areas of research in environmental behaviour studies. In linking neuroscience approaches to concepts of environment and behaviour, hypotheses and design performance criteria, Zeisel draws from psychological findings and suggests that mnemonic loci learning, visual memory reinforcement and elaborate semantic learning are possible research areas.\textsuperscript{352} The assumption is that vivid place memory can enhance the capacity to remember complex events and environments that create associations with information can assist the recall of learning materials. These propositions have two implications for spatial design in the context of museum exhibitions. Firstly, the provision of strong visual cues should enable the linking of information encountered in exhibitions and enhance its recall. Secondly, the research suggests that space should be organized to interact with the conceptual structure of exhibition content to reinforce the recall of its structure, in turn reinforcing recall of exhibition content.

**Some studies in the memory of exhibitions**

Recently, interest has increased in visitors’ memory of their experience of exhibitions. Some studies in visitors’ long-term memory of world expositions have investigated the factors that influence these memories, especially those that make them more vivid. Building on relevant studies, Anderson and Shimizu argue that there is something about ‘leisure-time experience’ that has the potential to make its memory ‘rich and vivid’.\textsuperscript{353} They also argue that age affects ‘the vividness of episodic memories’, which vary as ‘a function of stage of life’.\textsuperscript{354} One interesting finding is that ‘the frequency of visitation to informal settings may decrease one’s ability to recall episodic detail’.\textsuperscript{355} In some studies, frequent visitors show lower levels of recollection than infrequent visitors.\textsuperscript{356} The most important evidence is that ‘the subsequent conversations, discussions and reflections that visitors (young and old) have about their experience positively influence the vividness of

\textsuperscript{352} Ibid., pp. 364-67.
\textsuperscript{354} Ibid.
\textsuperscript{355} Ibid.
those memories'. The research of Anderson and Shimizu reveals that in respect of long-
term memory ‘emotional events are more likely to be recalled than more neutral events . . . The emotional affect associated with experiences in leisure-time settings [being] a key
influence on the long-term recall of episodic and autobiographical memory.'

In their study of visitors’ long-term memories of the 1970 Japan World Exposition in
Osaka, Anderson and Shimizu identify four critical variables influencing vivid memories:
affect, agenda fulfilment, intentionality and rehearsal. Their paper does not provide details
of the physical exhibition elements recalled by visitors, but they conclude that one way to
produce vivid memories after a long period is to ‘maximize the positive affect associated
with science centre experiences and ensure that we minimize the potential for negative
experience’. In recent years, diverse areas of design have focused intently on user
experience and design emotion. Exhibition design within the museum context could learn
from these studies, with the aim of using spatial design to directly contribute to visitors’
positive experiences of exhibition environments, thereby enhancing their memories of
exhibition content.

The implication of mnemonic loci for exhibition spaces

The psychological concept of mnemonic loci suggests four criteria for the design of
exhibition spaces to support visitor’s informal learning: clear spatial organization, the
staging of spaces, the use of spatial cues and the importance of connected spatial order.

The first factor in providing for the development of strong place memory is to familiarize
visitors with environments. Unlike the first steps in mnemonic loci, most museum visitors
are unfamiliar with the overall physical setting of the museum and the exhibition space
more specifically. Most visitors receive spatial and content information at the same time.
Confronting too much information complicates the process of understanding, suggesting a
basis for the phenomenon of museum fatigue and ways of alleviating it. Steps can be taken
to quickly familiarize visitors with the spaces they are entering. Visitors can be given a
’space map’ of the exhibition area before entering it. A space map works as both a floor
plan for easier orientation and navigation and as a conceptual content map for connecting
information received in an exhibition. The underlying spatial organization of an exhibition

357 Anderson and Shimizu ‘Factors Shaping Vividness of Memory Episodes: Visitors’ long-term memories of the
358 Ibid., pp. 179-80.
359 D. Anderson 2005, in International Symposium on ”World Exposition and Urban Development: Comparative
Perspective’ Shanghai.
needs to be clear if visitors are to quickly make sense of the layout of exhibition content. Designers can use the application of other design elements to prevent any sense of dullness as a result of simple spatial organization. Design strategies need to make organisation understandable to visitors when complex organisation exits. Approaches like open-plan exhibition layouts or visually permeable partitions can support the process of understanding spatial organisation.

In the development of exhibitions, space should be considered as part of the exhibition content, not just a neutral void for containing exhibition content. According to the principles of mnemonic loci, configuring and then detailing space to allow visitors to easily distinguish different locations or 'memory spots' is an important step in supporting memory, uniform spaces making the recall of individual spaces and the connection of spaces more difficult. The spatial staging of exhibitions to lend character to exhibition spaces enables visitors to identify those spaces and recall the information presented within them. Many design elements can serve this purpose, from the colour and texture of walls to the shape of exhibition areas and the use of lighting. Staging has the scope to make spaces recognizable, but staging that is too dramatic may draw visitors' attention from exhibition content.

Principles of mnemonic loci suggest that the addition of a hook to information improves its memorability, whether this is an image, an object or a particular quality of an installation. An object used as the focus of or cue for a space forms a link between the space and content. Strong and vivid impressions created from unique and imaginative arrangements of information serve as landmarks or visual cues for the recall of information. In mnemonic loci, vivid images are created within the mind. A different approach is needed in museum exhibitions, but it is possible to encourage visitors to link mental images with information, creating strong impressions of critical spots throughout an exhibition.

Principles of mnemonic loci suggest that well ordered spaces that correspond to exhibition content enable visitors to better connect and understand information. The importance of orderly arrangement is emphasized throughout the literature on mnemonic loci. For Yates, Simonides’s discovery of mnemonic loci demonstrates the early recognition of the importance of place order. Mnemonic loci theory proposes the idea of a 'memory spot' as an important place in space, but also suggests that random memory spots are more difficult to remember, human minds needing patterns to engage
in meaning making. An easily recognized order enhances the memory process, enabling the connection of memory spots and information in the mind.

Mnemonic loci is essentially a technique for producing artificial memory, but the nature of human cognitive capacity has significance for framing learning experiences in exhibitions. Exhibitions designed as memory places potentially create vivid images that provide conceptual links to exhibition content. The four criteria discussed above have potential to support spatial design for better learning processes.

**Chapter summary**

The review of relevant aspects of the theories of constructivism, spatial intelligence and mnemonic loci has key implications for the design of exhibition spaces as set out in Tables 7, 8 and 9. Each table links theoretical principles to design elements and their implications for the design of exhibition spaces.

**Constructivism**

Constructivism identifies three priorities for exhibition space design: the need to create inviting spaces and to provide clear spatial organization and flexibility.

<table>
<thead>
<tr>
<th>Element</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inviting Spaces</td>
<td>Exhibition spaces need to satisfy visitors’ fundamental physical and psychological needs, so that exploration and learning are intuitive rather than being inhibited by the exhibition environment. Raising interest should be the first step in stimulating visitors’ engagement with exhibitions; staging spaces can help create this interest.</td>
</tr>
<tr>
<td>Spatial Organization</td>
<td>An early understanding of spatial organization allows visitors to quickly grasp the major ideas and components of an exhibition. Providing spatial graphics of exhibition spaces before visitors enter an exhibition can assist the understanding of the exhibition space and the linking of exhibition content.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Creating exhibition spaces that can be freely explored offers visitors the opportunity to immerse themselves in an environment. Visitors can gradually construct cognitive maps in a self-directed way, such as by exhibition space constituting an open-ended learning environment.</td>
</tr>
</tbody>
</table>

Table 7: Summary of the implications of constructivism for designing exhibition spaces.
**Spatial intelligence**

The investigation of Spatial Intelligence provides four key elements for designing exhibition spaces: space cue, staging, direction and cognitive map.

<table>
<thead>
<tr>
<th>Element</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Cue</td>
<td>Including memorable visual elements in spaces can assist visitors to create cognitive maps that identify spaces.</td>
</tr>
<tr>
<td>Staging</td>
<td>To enhance spatial learning and enable contextual cueing, space staging adds details and characteristics to exhibition space, creating thematic environments and noticeable contrasts between spaces.</td>
</tr>
<tr>
<td>Direction</td>
<td>Providing directional information facilitates way finding and the linking of spaces. Visitors build route knowledge through the linking spaces in cognitive maps. Frames of reference need to be present in each space to assist visitors’ orientation.</td>
</tr>
<tr>
<td>Cognitive Map</td>
<td>Cognitive maps are the mental representation of visitors’ survey knowledge, forming an image of an area from higher points in space. Visitors can understand the whole spatial structure once they construct cognitive maps in their mind. Three elements can facilitate the formation of space maps: floor plans, accessible spaces and a frame of reference.</td>
</tr>
</tbody>
</table>

**Table 8: Summary of the implications of SI for designing exhibition spaces.**

**Mnemonic loci**

The psychological principles of mnemonic loci provide four key elements for designing exhibition spaces: clear spatial organization, staging, space cues and connected spatial order.

<table>
<thead>
<tr>
<th>Element</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial Organization</td>
<td>To help museum visitors to quickly form images of spaces and make sense of them, clear spatial organization and the provision of graphical information is an advantage.</td>
</tr>
<tr>
<td>Staging</td>
<td>Giving exhibition spaces specific characteristics enables the creation of vivid place memory, helping visitors to differentiate spaces in their memory.</td>
</tr>
<tr>
<td>Space Cues</td>
<td>Strong visual elements in spaces lend a hook to spaces, facilitating the recall of information presented in them.</td>
</tr>
<tr>
<td>Connected Spatial Order</td>
<td>Clearly connected spaces create memorisable sequences that support meaning making processes. Connection can be</td>
</tr>
</tbody>
</table>
formed by the use of signs, including text and graphics.

Table 9: Summary of the implications of mnemonic loci for designing exhibition spaces.
Chapter Five merges theories of constructivism, spatial intelligence and mnemonic loci to propose a theory of ‘connected place memory’ and an associated framework for designing and evaluating exhibition spaces. Many studies in a variety of fields consider the relationship between learning and its physical context, proposing a range of perspectives on this subject. The theory of connected place memory advanced in Chapter Five draws on these studies to provide a holistic view of spatial learning in museums. The theory encapsulates the potential of exhibition space to support informal museum learning by providing a better understanding of exhibition space as a conduit for the understanding and recall of exhibition content. The opening section of Chapter Five relates ideas from previous chapters to the key positions in the museum sector on museum environments and visitors’ learning behaviours. The chapter then sets out the key elements of the theory of connected place memory and argues for its benefits for museum learning. From the studies of constructivism, spatial intelligence and mnemonic loci, I define the major elements and sub-elements of the theory and discuss their respective functions.

The stance of connected place memory

The theory of connected place memory seeks a more effective provision of spatial context and information in museum exhibitions through the adoption of specific design strategies. It aims to support the complex learning behaviour that takes place in museum exhibitions. Spatial information is conveyed through various elements of museum exhibitions, including graphics, exhibition space and the nature and disposition of objects. I base the theory of connected place memory on two main views of museum environments and visitors’ learning behaviour. The first is that museum exhibitions are special learning environments, exhibition visits constituting a particular set of environmental experiences. Visitors may come to exhibitions for other reasons besides learning, including entertainment, relaxation or socialising, but exhibitions present visitors with a novel environment that requires a certain degree of spatial learning as they explore their surroundings, making spatial learning integral to museum learning.

Spatial experience is the first experience that visitors encounter when they start their journey through an exhibition. Visitors start this journey from a state of disorientation and constantly seek spatial information throughout their exhibition experience. Space should
be considered a part of exhibition content. The arrangement of exhibition content within space significantly affects visitors’ movement and their perception and understanding of space. The organization of exhibition space indicates the structure of exhibition content, with the understanding of space being linked to the understanding of content. All design elements of museum exhibitions add visuo-spatial quality to spaces, space being an active rather than neutral element of exhibitions. Even white walls lend a visual quality to an environment and become part of its content, affecting experience. Exhibition content is mostly the focus of exhibition development, but the whole exhibition environment should be considered as a complete learning object. Visitors may not view every item in an exhibition, but they engage with the general exhibition environment throughout their visit. Visuo-spatial information thus constitutes an important part of visitors’ mental image of an exhibition. Since content is contained within space, visuo-spatial memory contains all other information provided in an exhibition space. As learning environments, museum exhibitions are characterised by the integration of objects, activities and space. Visitors need to make sense of both content and space.

The second key aspect of the theory of connected place memory considers visitors as active learners. Studies of museum learning and visitor studies suggest that visitors make meaning from their own explorations of exhibitions. Museum exhibitions also provide a special behavioural setting. Although storylines and routes are often planned for visitors to follow, visitors mostly direct themselves through space, actively choosing their own pathways through exhibitions and selecting their own viewing spots. In a free-choice learning environment, visitors’ memory of exhibition content links to particular points in an exhibition. To gain a better understanding of space and content, the link between viewing points and the construction of cognitive maps is important. Poor connection between spaces may lead to misunderstanding of exhibition space and content. Besides engaging with spatial context, visitors also construct their own knowledge from a museum visit based on the combination of personal and social contexts. This complicates museums’ capacity to predict visitors’ learning behaviours and hence their perception and understanding of both space and content. Principles of constructivist learning argue that the meaning making process is a two-part process, spanning assimilation and accommodation, suggesting that museum visitors continually take in new information and change their schemata throughout the exhibition viewing process. Based on these two propositions, the theory of connected place memory holds that exhibition visits result in place memory from navigating novel exhibition space being imprinted in the viewer’s mind and the
cognitive structure of new environment combining with exhibition content to greatly influence visitors’ active learning experiences.

The concept of connected place memory

The concept of connected place memory acknowledges both the characteristics of museum exhibitions and visitors’ learning behaviours. It seeks to provide enhanced spatial context through specific design strategies to support spatial learning processes on the basis that these influence the reception of exhibition content. The design of spatial context harnesses the visuo-spatial information, including 2D, 3D and space, that is integral to exhibition spaces. Spatial context targets visitors’ mental images of exhibition spaces. It seeks to create vivid place memory and strong understanding of spatial organization so visitors might more readily recall exhibition content and find exhibitions meaningful.

Exhibition space can create two specific experiences for visitors: sensory and intellectual. The design of the spatial context focuses on the visuo-spatial aspect of these experiences. In respect of visitors’ sensory experience, the treatment of the spatial context aims to enhance the imageability of exhibition space. This is accomplished by giving strong figures and characteristics to spaces, space cuing and staging being proposed as the two elements that create vivid place memory. In respect of visitors’ intellectual experience, the treatment of the spatial context aims to establish clear cognitive maps. The proposed framework for designing spatial context supports the creation of cognitive maps in two layers of spatial information: point and route. The point layer establishes the understanding of each individual area or space within an exhibition. Elements that help visitors to identify and remember the space of an exhibition provide point information. Space cuing and staging help here, but are perceived at eye level by visitors. Other spatial information, such as floor plans or perspectives, can further aid the formation of point layer by providing views from higher points.

Route information provided by the framework for designing spatial context enables museum visitors to make the connection between points in an exhibition. To assist this intellectual process, visitors need to understand the underlying structure of the spatial organization of an exhibition, especially if it is comprised of many subsidiary areas. Only when the relationship between different spaces is established can visitors form a complete picture of an environment. Principles of constructivism, spatial intelligence and mnemonic loci suggest that design elements such as signage, spatial graphics and the clarity of spatial
organization can assist the mental linking of spaces. Figure 12 is an example of a cognitive map formed by the two layers: route and point layers.

Figure 12: Point and route Layers of a cognitive map.

The combination of point and route layers comprises the mental image of an environment, since people build their understanding of space from points to routes and then to an environment as a whole. In a discussion of studies related to the psychology of place, Canter uses the notion of place to describe the environments people experience and the cognitive systems developed from their experience. The definition of place in this thesis reflects Canter’s definition of place. Canter suggests that a place is an experienced space and ‘the goal of environmental design is the creation of places’. He proposes three aspects for the effective elaboration of places: their identification, the expression of the qualities and attributes of places and the highlighting of the relationship between places. These principles parallel the goal of the proposed framework for treating the

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361 Ibid., p. 163.
spatial context of museum exhibitions, which seeks to make exhibition spaces imageable and comprehensible.

By providing point and route layers of spatial information, the concept of connected place memory seeks to enable museum visitors to recall content along with spaces. Spaces become information containers and the understanding of spatial organisation leads to the connection of content. The ultimate goal is to support visitors' meaning making in respect of spaces and exhibition content.

The design framework

In light of research in the areas of constructivism, spatial intelligence and mnemonic loci, the design framework addresses the role and design of the spatial context in museum exhibitions. Research in these three areas strongly suggests that incorporating vivid and meaningful spatial information in museum exhibitions supports engagement with exhibition content, facilitating informal learning. The review of relevant literature also suggests that a design framework for the development of connected place memory needs to address four essential considerations: orientation, space cuing, organization and staging. In the design framework, I base designing for enhanced visitor orientation on two elements: spatial graphics and frame of reference. Organization depends on three elements: clarity, flexibility and connection. Figure 13 sets out the elements for designing spatial context and their relationship to each other.

![Figure 13: The framework for designing spatial context.](image)
Orientation

The first need in developing connected place memory is to orient visitors. In the novel environment of a museum exhibition, visitors need to orient themselves at the beginning and throughout their journey. The absence of adequate orientation information at the entrance and throughout an exhibition may mean that visitors spend more time on wayfinding, contributing to museum fatigue. Orientation information helps visitors establish their position in relation to the whole exhibition environment, to connect spaces and to form a stronger mental image of spatial organization within an exhibition. Many exhibitions are situated in enclosed environments, disconnecting visitors from the outside world and making the provision of aids for locating oneself in such autonomous environments vital. Within enclosed environments, visitors may not gain a clear sense of the whole spatial organization of an exhibition, which may reduce the clarity and power of cognitive maps.

Spatial graphics are images that depict spatial organization. They can be floor plans, perspective drawings or images of spaces. What matters more is that graphic information shows visitors their location and the overall layout of an exhibition. Three-dimensional models can be a useful way of representing spatial organization, but graphic representations are more practical in exhibitions.

The provision of graphic information showing exhibition layout before visitors enter an exhibition initiates spatial learning. Spatial graphics can include some information on exhibition content, quickly familiarizing visitors with an exhibition space. Serving as orientation and an advance organiser prior to entry into a novel environment, spatial graphics can help form conceptual frameworks for processing the characteristics of spaces and building cognitive maps. In their Contextual Model of Learning in the museum, Falk and Dierking list orientation and advance organisers as two of the major elements to consider in developing exhibitions. They emphasise the significance of advance organisers in improving visitors’ ability to make meaning from an exhibition experience, meaning making being a first step to the acquisition of new knowledge. Spatial graphics serve the role of advance organisers and provide a frame of reference during a museum visit where cardinal direction and external reference are hard to establish. Where museums provide information about exhibition content, the linking and content learning process may occur simultaneously.

Museums can represent spatial graphics as floor plans, isometric views or perspective views. No matter what format is used, information should be clear, simple and comprehensible so that visitors can readily build cognitive maps. The physical media for presenting spatial graphics may include wall panels, brochures or electronic devices, the development of strong conceptions of exhibition space being the goal. The placement of spatial graphics should consider the entrance as the first and most important location, but should also be provided at the entrance of each sub-space.

The provision of a specific frame of reference in the form of a transcendent element that visitors can visually relate their position to helps orientation in the novel or complex environment of a museum exhibition. Although two or more frames of reference may be used, one system is easier to grasp. The sun and the cardinal system are the two reference systems people commonly use for orientation in their daily lives. As exhibitions are often situated in enclosed spaces, spatial design needs to compensate for the absence of these two systems to ease the way finding process. A frame of reference allows visitors to relate different spaces to each other, supporting the intellectual experience and route layer of spatial context. It may then help the understanding of content structures.

Exhibition designers can use architectural elements such as major axes and central cores in exhibitions to provide a frame of reference. Spatial graphics such as exhibition floor plans offer a reference system, but museum visitors may not refer to them. Frames of reference are best integrated into the physical nature of an exhibition, allowing visitors to retrieve and use the reference whenever necessary.

**Space cuing**

Space cuing is arguably the most important aspect of the theory of connected place memory. Much like a landmark in an outdoor environment, a space cue is the strongest visual element in an exhibition space and serves to identify and distinguish a space. Diverse design elements, such as two or three-dimensional forms, space itself can contribute to the provision of space cues, their nature and effectiveness being principally determined by the contrast between a space cue and the general exhibition environment. Contrast needs to be high enough to make the element distinguishable, but should not overly intrude into the engagement with exhibition content.

The study of developmental psychology and environmental psychology shows that space cues or landmarks are the first element developed in a cognitive map. The technique of
mnemonic loci recognises the need for a strong spatial image to facilitate information recall. Space cues work as hooks for evoking place memory. A strong space cue can help visitors create vivid place memory and contribute to the formation of the point layer in a cognitive map. Space cues can also assist in orientation and in the identification of spaces and locations, this being crucial for both sensory and intellectual experiences. In the design framework for the development of connected place memory, space cues are the major element for establishing the point layer of spatial information. Without the presence of effective space cues, it is unlikely that the point layer and route layer of the museum visitors’ cognitive map can strongly develop.

Effective space cues require two key aspects in their design, a clear character and a strong figure-ground effect. These qualities can be achieved through design elements such as forms, colours, texture, or lighting. The following figure provides an example of a space cue in abstract exhibition space, using shape, colour and contrast to mark its difference.

![Figure 14: An example of a space cue.](image)

Space cues do not need to be the focal point of a space, but need to create a strong impression. Museum visitors’ understanding of exhibition content may be enhanced if space cues relate to major ideas underpinning an exhibition. The scale of space cues can range from a small object to the whole space of an exhibition. If space cues are small in scale, the background environment becomes more important in creating the figure-ground effect. Here, a higher contrast in the relationship puts more emphasis on the space cues, resulting in enhanced orientation and spatial identification.
**Organization**

Spatial organization has a direct affect on museum visitors’ experience of exhibitions, potentially affecting the comprehension of both exhibition space and exhibition content. Spatial organization is often the first step in planning exhibitions. Considering how museum visitors will move through exhibition spaces is a normal part of the exhibition planning process. Rather than focusing on visitors’ navigation behaviours, the design framework for creating connected place memory uses spatial organization for the development of effective cognitive maps. It highlights the need for clarity, flexibility and connection in the design of exhibition space.

Enhancing the clarity of exhibition space seeks to achieve comprehensibility of space for visitors. Mnemonic loci and constructivism suggest that clarity and simplicity support the understanding and memorization of space and exhibition content. The following figure shows two spatial organisations. A straight, linear arrangement is easier to understand than a curved one, where visitors have to turn and change direction.

![Figure 15: Examples of spatial organisation.](image)

As the cognitive load in an exhibition increases, museum visitors may not immediately obtain a clear understanding of the relationship between individual exhibition spaces. Clear spatial organization allows museum visitors to build effective cognitive maps, spatial clarity contributing to the intellectual experience and route layer of spatial context.

Arguably, simple spatial organization is more comprehensible than a complicated ordering of exhibition space, irrespective of the scale of an exhibition environment. Exhibition designer should seek to achieve a balance between the two. Detail and atmosphere arouse visitors’ interest, but when complex organization exists, the design strategy needs to consider how visitors might easily grasp the whole environment. Open plans, proper
openings and transparent partitions that allow visitors to visually penetrate and connect different spaces are all ways of making spatial organization comprehensible.

According to principles of constructivism, flexibility is especially important in supporting active, informal learning. Exhibitions with limited open space are most likely to constrain visitor movement and inhibit free-choice exploration. Exhibition space is composed of solid and void areas. Solid areas contain exhibition content and void areas enable visitor movement through an exhibition. Spaces with higher flexibility allow visitors to navigate more freely, supporting their construction of personal meaning and resulting in better place memory and enhanced cognitive maps. Flexibility is not the main element in the formation of place memory, but it reinforces visitors' impression of an exhibition by immersing them in an environment. Visitors are unlikely to develop a strong impression of a whole environment if they simply follow restricted paths.

The design of flexibility depends on whether spatial arrangements allow visitors to explore space, or tightly control their movement. Flexibility is not simply a fixed numerical ratio between the number of visitors and the extent of positive and negative space in an exhibition. Spaces with pre-determined routes do not offer visitors many choices in their journey around exhibitions, even where there is a significant proportion of negative space. Although exhibitions often direct visitor movement along story lines, flexibility needs to be balanced in the design framework for the development of connected place memory to enable visitors to operate as active learners. Figure 16 shows two potential paths through an exhibition, which provide different proportion between positive and negative space and different flexibility of movement and engagement despite following the same storyline.
Well-connected exhibition spaces enable visitors to see the links between spaces, between spaces and bodies of content and between different bodies of content in the various sections of an exhibition. The sequence of spaces transmits linking information to visitors. According to principles of mnemonic loci, the sequence of spaces one visits in the mind enables a sequence of information to be ordered and remembered. In museum exhibitions, the sequence of exhibition spaces indicates the links between areas of exhibition content. To achieve connectedness through exhibition design, a directed path offers a solution, but may restrict the scope for visitors to make their own connections, semi-structured spaces being perhaps the best at facilitating informal learning. Exhibition designers need to provide information when visitors move from one space to another. Besides a clear sequence of spatial order, signs or directions that show what is coming next, enabling visitors to make the links between spaces.

Providing connecting information in the form of text, graphics and objects offers museum visitors direction, guiding them from one exhibition space to the next. Linking spaces and orienting visitors are two main purposes for the provision of space direction in museum exhibitions. Direction builds the route dimension of cognitive maps. Constructivism privileges the free exploration of exhibitions. Although the sequence of exhibition viewing is important, it is space direction that guides visitors through the space and content of an exhibition. Designers can provide space direction at exits or entrances to spaces.
To help visitors construct vivid place memory, space staging works with space cues in forming spatial identity. By providing details and atmosphere, staging approaches exhibition spaces as performance stages with a distinct character. This is not limited to visuo-spatial elements. Staged spaces can be multi-sensate places that stimulate all visitors’ sensory dimensions and extend their bodies into space. Memory derived from sensate places is arguably the clearest information that can be received through experience.\textsuperscript{363} Staging spaces has two major goals: to encourage immersion and to provide a suitable context for the recognition of space cues. Constructivist pedagogy implies that visitors develop knowledge from individual interaction with an exhibition. The staging of exhibition spaces through design should seek to invite visitors into space and enable longer immersion in novel environments.

Whether raising visitors’ interest or curiosity, prolonged engagement with spaces can foster holistic mental images. The second role for staging spaces is to create atmospheric contexts in which a strong environmental image is formed along with one that draws attention to space cues. Although staging can turn a space into a strong figure and a space cue in itself, it mainly provides a context to associate with space cues, enabling contextual cuing. Proper staging spaces can reinforce the imprint of space cues on place memory and consequently museum visitors can construct the point layer of their cognitive maps. Space staging works on sensory experience and supports the formation of the point layer of cognitive maps.

Staging spaces aims to make spaces identifiable or distinguishable. When an exhibition consists of many spaces or areas, the character of each individual space enables visitors to differentiate between spaces. Designers can implement space staging through design elements such as form, colour, texture and lighting. Figure 17 shows space staging for different spaces by using green colour as the major colour. Although curators often conceive exhibitions around a consistent theme, individual sections of an exhibition need to be staged differently so visitors can distinguish between them. Memory of individual spaces and the point layer of cognitive maps are hard to establish if a single backdrop continues throughout an exhibition.

The design framework for the development of connected place memory embeds spatial information in exhibition spaces with the aim of supporting informal learning processes. Cognitive and learning theories support the idea that design elements can help form vivid place memory and strong spatial knowledge, the combination of strategically designed space and spatial aids providing clear orientation and connected order. Four major elements and their sub-elements support the formation of cognitive maps, including point and route layers of spatial information. Spatial context embodies both visuo-spatial sensory and intellectual experiences and approaches space as an information container that supports spatial learning and links exhibition content to environmental experience. Chapter Six examines the design of exhibition space by considering what museum professionals know and think about the practice of exhibition design, how they translate that knowledge into practice through the analysis of actual museum exhibition spaces and by conducting a redesign exercise for one of these exhibition spaces.
CHAPTER 6

RESEARCHING THE DESIGN OF EXHIBITION SPACE

Building on the theoretical framework for designing exhibition space for connected place memory, Chapter Six reports on the findings of the interviews with seven museum professional. It also uses the design framework presented in Chapter Five to analyse the strengths and weaknesses of the exhibition areas of three museums and to propose a program of exemplary design based on the redesign of one of these areas. I frame this discussion in the light of relevant theories of human cognition and learning from the fields of learning theory, spatial intelligence and developmental psychology to reveal the deficiencies and knowledge gaps in the practice of exhibition space design. Understanding current practice provides evidence of the need for a design framework for the development of connected place memory. It indicates how the proposed design framework could be applied in museum settings. Relevant studies in learning theory, spatial intelligence and developmental psychology provide many insights into human learning and spatial capacity. These insights are not readily accessible to practising designers and other museum professionals. Chapter Six demonstrates the application of theoretical know‐ledge to design practice. It synthesises the findings of the interviews, the analysis of examples and the program of exemplary design to arrive at key conclusions regarding the value of the design framework for the development of connected place memory.

Interviews

The interviews with designers provide evidence of designers’ knowledge of exhibition design and reinforcing the existence of the knowledge gap found in the literature of exhibition design and museum studies. Between February 2008 and February 2009, I conducted face-to-face or e-mail interviews with seven designers or exhibition planners from five Melbourne museums. The interviewees’ experience ranges across the development, design and management of exhibitions in art, history and science museums. Table 10 lists the interviewees and their institutional roles and experience.
Table 10: List of interviewees.

<table>
<thead>
<tr>
<th>Designer</th>
<th>Professional Role</th>
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</thead>
<tbody>
<tr>
<td>Diana Dzelalija</td>
<td>Exhibition Designer, National Gallery of Victoria.</td>
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<tr>
<td>Simon Gregg</td>
<td>Curator, the City Museum.</td>
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<tr>
<td>John Kuzma</td>
<td>Freelance Exhibition Designer, Cando Display &amp; Design. Former exhibition designer,</td>
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<td></td>
<td>Performing Arts Museum, the Victorian Arts Centre.</td>
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<tr>
<td>Mark Patullo</td>
<td>Senior Exhibition Designer, National Gallery of Victoria.</td>
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<tr>
<td>Ingrid Rhule</td>
<td>Exhibition Designer, Museum Victoria.</td>
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<tr>
<td>Georgia Rouette</td>
<td>Manager, Regional Exhibition Touring Initiative, Museums Australia (Victoria).</td>
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<tr>
<td>Daryl West-Moore</td>
<td>Exhibition Manager, National Gallery of Victoria.</td>
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Table 11 lists the main questions asked. Georgia Rouette is an exhibition developer who works with designers. I modified some questions to suit this role, indicating the changes in the analysis of her response.

Table 11: Interview questions.

1. What is your role in the museum?
2. How much responsibility do your clients or organization give you in relation to exhibition design?
3. How did you learn about exhibition design?
4. What do you try to achieve with your exhibition design?
5. What principles do you use for designing the space of exhibitions and the organization of displays within that space?
6. How important is the educational role of exhibitions to your clients or organization?
7. How often are you asked to respond directly to the educational aspect of exhibitions in your design? How do you approach this?
8. Do you ever think about the space of the exhibition in relationship to its educational aspect?
9. Would it be beneficial to have some criteria for space design for an educational perspective?

The interviews sought to understand designers' and other museum professionals' tacit knowledge in respect of exhibition space design. Establishing what each knew and thought is important to this study, given the limited discussion of exhibition design in the museum studies literature. The interviews are significant in revealing the principles that designers
use for designing exhibition space, especially for educational purposes, and the contradictory and conflicting forces under which exhibition designers and developers act.

**Analysis of the interviews**

As semi-structured interviews, the interviewees responded directly and freely to my questions, without significant prompting from me. To begin the analysis process, I transcribed the interviews. Appendix 3 contains the transcript of each interview. I then condensed each interview to extract its key points. In the conduct of qualitative research, there are three main approaches to analysing interview material: meaning coding, meaning interpretation and meaning condensation.\(^{364}\) Meaning coding is recommended for identifying key concepts or categorising statements in large bodies of data. Meaning interpretation is recommended when the structure of interview statements is not clear or meanings are not apparent, enabling the researcher to go beyond the interviewees’ statements and interpret them according to a broader contextual framework. Meaning interpretation may lead to the expansion of a text through the elucidation of statements.

Meaning condensation is recommended for the analysis of the text of complex interviews in the aim of identifying and investigating their main units of meaning. It enables researchers to extract the key points and principles in interviewees’ statements, reformulating these as shorter thematic statements. The researcher then further interrogates these statements in terms of the key questions underpinning the research. I have used meaning condensation to analyse the interview data on the basis that the amount of data gathered from the interviews was not large and the interviewees’ expressed clear opinions in response to each question. Tables 12 to 18 summarise the central themes of each interviewee’s answer to the nine main questions posed to them.

| John Kuzma |
|---|---|
| **Question** | **Central themes in interviewee’s response** |
| 1 | Kuzma was a senior designer at the Performing Arts Museum at the Victorian Arts Centre. His job was to design and install the exhibitions at the Museum. |
| 2 | Working together with curators, he was in charge of designing exhibitions, especially considering how the aesthetic and interactive sides of exhibitions would work within a given space. |
| 3 | His background is in the design of commercial exhibitions, including visual merchandising and trade shows. His first museum job was |

with a travelling exhibition developed at the Hobart Museum of Art Gallery.

4 In achieving his exhibition design, Kuzma seeks to engage visitors in exhibitions through interactivity and develops exhibitions to appeal to a broad spectrum of people. He suggests that the Performing Arts Museum did a lot of survey to see how their exhibitions work on visitors.

5 His first principle of exhibition design is to balance creating an exciting exhibition with the protective nature of museum environments. His second principle of exhibition design is to incorporate a sense of discovery into each exhibition so that museum visitors don't know what is around the corner. His third principle of exhibition design is to produce exhibitions that are legible under the low light condition and aesthetically pleasing. Interaction and engagement are also important interests in his design.

6 He considers the educational role of an exhibition to be very important. He tries to communicate with museum visitors through different media and to provide a total experience rather than static displays.

7 His approach to the educational aspects of exhibition design is much guided by the perspectives of curators’ on the educational aims and communication guidelines.

8 For considering the relationship between space and the educational aspects of exhibitions, he believes that exhibition space has to work hand-in-hand with the theme, storyline and presentation of an exhibition.

9 Kuzma suggests that the major challenges for designers are meeting limited budgets and working with curators. For evaluating exhibitions, he mentioned that the Performing Arts Museum at the Victorian Arts Centre used headcount and questionnaires and hired other professionals who had their own evaluation process. However, he is not quite sure about the details of the process. The museum's exhibition evaluation often concerns the educational aspect of exhibitions. In terms of organising exhibition space, he suggests there are two main ways of ordering exhibition space: a chronological order and a mixed approach. However, even with certain orders, exits and entrances, he has found that museum visitors are hard to control because they choose their own ways when moving through exhibitions.

<table>
<thead>
<tr>
<th>Table 12: Analysis of interview with John Kuzma.</th>
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<tr>
<td><strong>Simon Gregg</strong></td>
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<td>Question</td>
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Gregg considers that a set of criteria for designing exhibition space will be tremendously helpful. His understanding of exhibition design is mainly based on his own works and observations of visitors' behaviours. Rather than relying on computers, he prefers approaching his design process through hands-on activities.

Table 13: Analysis of interview with Simon Gregg.

<table>
<thead>
<tr>
<th>Question</th>
<th>Central themes in interviewee’s response</th>
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<tr>
<td>1</td>
<td>West-Moore’s role at the National Gallery of Victoria is to oversee all aspects of exhibition design, which may include loan and touring arrangements. He works closely with other key stakeholders in developing exhibitions as well as with the gallery’s executive team in strategic development of the exhibition program.</td>
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<td>2</td>
<td>He has full responsibility for exhibition design and reports directly to the gallery’s deputy director and director. He also suggests that the gallery values the role of exhibition design.</td>
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<tr>
<td>3</td>
<td>His interest in working in museums developed at a very early age. He studied industrial design at university and started work as a volunteer at the NGV. He then became a designer and is now the manager of the exhibition design department.</td>
</tr>
<tr>
<td>4</td>
<td>What he tries to achieve for exhibition design is to provide visitors with unique experiences that respond to the curatorial rationale of an exhibition and the art works in them. The gallery also has concerns about the sustainability of its exhibitions program and often uses modular walls for reconfiguring exhibition space.</td>
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<tr>
<td>5</td>
<td>In organising exhibition space and the display of exhibition content, West-Moore suggests that the curators, art works and designated exhibition areas dictate spatial organisation at the beginning of exhibition development. Art works are arranged in thematic, chronological or media-based groupings. Designers propose what they want to achieve in an exhibition and then work with curators to negotiate the development of design concepts and strategies for presenting exhibition content in the gallery space. Art works are presented in a sequence to help visitors navigate in space or to draw visitors through space.</td>
</tr>
<tr>
<td>6</td>
<td>West-Moore considers the educational role of exhibitions is becoming more and more important at the NGV. Nowadays, his department works closely with the educational and curatorial departments to carefully consider the presentation of content to an exhibition’s target audience. The gallery also tries to link exhibition content with the structure of school curriculum. To understand visitors, the gallery conducts market research and visitor studies, especially for big exhibitions. A strategic objective for achieving educational impact is</td>
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to focus on family groups and children and provide them with plentiful activities and other scope for engagement. In terms of measuring visitors' learning outcomes, West-Moore is aware that the educational department of the gallery many surveys, but he is not informed of the details.

West-Moore suggests that the frequency of designing exhibitions for educational purposes is increasing. His approach is collaborative. The presentation of information has started to focus more on the needs and preferences of an exhibition's target audience, instead of the NGV as a whole, or the curator’s voice.

West-Moore considers it is difficult to evaluate the performance of exhibition space in respect of how the educational intention of an exhibition is approached and whether gallery visitors understand and remember this. He suggests that the best way to evaluate exhibitions is to observe visitors’ behaviour in exhibitions, collect their responses to exhibitions and adjust exhibitions immediately on this basis. The NGV has a formal response system to allow visitors to record their comments. He believes that achieving a balance between didactic information and the focus of an exhibition poses a challenge for designers. There are no clear answers as to how to approach the presentation of exhibition content so that visitors can gain legible, clear and concise information.

West-Moore suggests that a set of criteria for designing exhibition space from an educational perspective would be beneficial. The gallery is heading towards providing more educational engagement within exhibitions. More educational activities will be introduced within space in the future. He suggests that space needs to allow for diverse types of activities and engagement. The design criteria need to be flexible and adaptable. He confirms that the gallery’s strategy is to provide more learning experience. He learns about the evaluation of exhibition space from other staff or published sources, but has not conducted evaluation by himself.

Table 14: Analysis of interview with Daryl West-Moore.

<table>
<thead>
<tr>
<th>Question</th>
<th>Central themes in interviewee's response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dzelalija's role at the National Gallery of Victoria is to work collaboratively with other museum professionals in developing exhibitions and providing experiences to visitors.</td>
</tr>
<tr>
<td>2</td>
<td>Dzelalija carries considerable responsibility in her position since the gallery considers exhibitions as vital for attracting visitors, for creating a rewarding experience and for generating revenue. She works with a team in the role of senior designer. Most of her design aims come from curators, but in some exhibitions there are no curators involved.</td>
</tr>
<tr>
<td>3</td>
<td>Dzelalija studied fine art for one year then majored in furniture design and photography at a fine art school in Tasmania. Later, she studied</td>
</tr>
</tbody>
</table>
interior and exhibition design at Swinburne University of Technology. She considers that learning by doing and seeing are the major ways she has developed knowledge of exhibition design.

4 Dzelalija tries to achieve an attractive exhibition, but also strives to allow exhibition visitors to focus on the art works. In considering the goals of exhibition design, she believes that the design needs to consider the character and needs of the target audience and help them to understand the exhibition content. For children, content needs to be simplified or broken up into small pieces. Content can be more sophisticated for adults.

5 One of Dzelalija’s primary concerns in organising exhibition space is to control traffic flow. Visitors should be able to comfortably move in space without distraction from art works. In relating space to content, she often follows aesthetics and curatorial decisions.

6 Dzelalija thinks the educational role of exhibitions is very important to the gallery and that education is a natural part of exhibitions. The gallery has extensive programs and support for achieving educational outcomes. Exhibition design plays a part of this function for the gallery.

7 Dzelalija considers the educational aspect is essential to exhibitions. She considers visitors will naturally learn something from their visit and exhibition design tries to help visitors learn. Chronological format or grouping may be used to facilitate learning processes. Spatial organisation and other design elements all contribute to the learning process. She designs the environment to be sympathetic to the art works so visitors can focus on art works instead of on other things. Design needs to complement the art works and make them look better.

8 For Dzelalija, the educational aspect of exhibition space is a difficult question. She considers that exhibitions are to help visitors learn more about the topics. Each exhibition needs to be approached differently. Booklets can be designed to help visitors navigate through space. Obvious headings and subjects in conjunction with distinct environment can help visitors identify different sections of exhibitions. Other media, such as multimedia, audio guides, labels and didactic panels can also be used for guiding visitors. In evaluating exhibitions, the gallery collects visitors’ feedback and conduct surveys or focus group. She also routinely gathers feedback from visitors. She suggests the most important thing within an exhibition is the artworks. Everything else needs to support the artworks. Her job is to make the museum visit enjoyable, so that visitors can focus on the artworks. Visitors’ feedback on exhibition space can be extensive. For a recent Art Deco exhibition, for example, visitors commented on the colours, materials, multimedia elements and navigation of the design. In organising the content of that exhibition, she breaks the content into groups, fit objects within space and controls traffic flow.
Dzelalija is interested in criteria for the design of exhibition space and considers these could be benefit her work, but she suggests that the criteria need to be broad so that they can be used in different settings.

**Table 15: Analysis of interview with Diana Dzelalija.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Mark Patullo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patullo joined the National Gallery of Victoria as a senior designer. His role is to organise all aspects of exhibition design and signage systems. He oversees the installation and production of exhibitions. Although he has a leadership role in the exhibition department, he has no responsibility for managing the design staff. He considers the curators in the gallery have more direct influence over the forming of design concepts.</td>
</tr>
<tr>
<td>2</td>
<td>Patullo’s responsibility in exhibition design varies between exhibitions. In his previous role at Museum Victoria, he often needed to interpret scientific concepts for a specific target audience. He considers the Museum Victoria has a stronger educational focus than the NGV. At the NGV, exhibition design can sometimes simply involve the provision of a blank space for hanging artworks. His main job is to absorb information, propose design concepts and translate information into effective visual presentations.</td>
</tr>
<tr>
<td>3</td>
<td>Patullo studied graphic design at Swinburne University of Technology and started to work in the museum field in the 1980s. He learned about exhibition design through on-the-job training and liaising with other museum professionals.</td>
</tr>
<tr>
<td>4</td>
<td>When approaching exhibition design, Patullo tries to satisfy the objectives of the design brief and communicate creatively and effectively with visitors. He comments that the NGV does not carry out the same level of exhibition evaluation as Museum Victoria. The gallery has little formative evaluation data available in developing exhibitions. Patullo has conducted some evaluative surveys to test the effectiveness of exhibitions.</td>
</tr>
<tr>
<td>5</td>
<td>Patullo’s approach to designing exhibition space is first to examine the given space for an exhibition, space often being predetermined for exhibitions at the NGV. He then considers how content can be presented within the space. In considering whether a blank space works for an exhibition, he suggests that this really depends on the content of individual exhibitions. He compares the NGV with Museum Victoria and comments that sometimes a simple environment can satisfy the NGV’s needs while the approach to exhibition space at Museum Victoria tends to be more complicated.</td>
</tr>
<tr>
<td>6</td>
<td>Patullo considers the educational role of exhibitions is important for many cultural institutions in Victoria. All have a connection with school curriculum. He explains that museums and galleries are mandated to provide educational experience to the public.</td>
</tr>
</tbody>
</table>
Patullo has found that the gallery is less focussed on the integration of educational aspects into the design process than Museum Victoria. He has worked with the education department and integrated educational programs or activities in exhibition design. He believes that integrating educational aspect into a design process will become more important in the future. The gallery has specialists in education. Sometimes they bring in their expertise the exhibition design process and advise on how to effectively present information in exhibitions.

Patullo suggests that he absolutely considers the educational aspect of exhibition space for his design. When considering educational function of exhibitions, he tends to relate to school education. He would consider the goal of exhibitions and present information in a way that visitors can understand and appreciate. He also suggests that there is a lack of explanatory text assisting designers to understand how space can support learning. Understanding visitors’ expectations, evaluating exhibition space and developing a set of criteria can assist exhibition design. There is definitely room for research on the topic.

Patullo suggests that a set of criteria for considering the educational aspect of exhibition space will be beneficial for the field. Exhibition evaluation can help inform the criteria. Designers can use some criteria for developing exhibitions.

Table 16: Analysis of interview with Mark Patullo.

<table>
<thead>
<tr>
<th>Question</th>
<th>Central themes in interviewee’s response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rouette is currently the Exhibition and Touring Services Manager for Museums Australia. Her primary role is to advise museums and galleries on all aspects of exhibition development, both static and touring. She also runs grant and development programs to assist institutions in developing exhibitions. Her background is in art history and she has experience as curator and exhibition manager in various museums.</td>
</tr>
<tr>
<td>2</td>
<td>How much responsibility do you give exhibition designers in relation to exhibition design?</td>
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<td></td>
<td>She suggests that designers need to be involved in exhibition development as early as possible. She values and encourages designers’ creativity, but argues that curatorial objectives need to be respected. Exhibition design needs to enhance the appearance and objectives of exhibition, but should not overpower exhibition content. She has had the experience that exhibitions were not adequately considered and design conflicted with content.</td>
</tr>
<tr>
<td>3</td>
<td>She learned about exhibition design on the job and through her own research. With the help from exhibition technicians, she has designed exhibitions for regional galleries. She suggests that regional galleries now tend to find professional designers for developing exhibitions.</td>
</tr>
<tr>
<td>4</td>
<td>What she tries to achieve in exhibitions is to create particular</td>
</tr>
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</table>
environments and assist visitors to navigate exhibitions, learn content and feel enriched.

5 Are there any basic considerations you give to the designers for designing exhibition space?

She would provide designers the basic characteristics of exhibition space in her design briefs. It may be based on factors including exhibition theme, exhibition goal, exhibition message, target audience, sizes of space, and the nature of the objects in an exhibition.

6 How important is the educational role of the exhibitions?

She suggests the educational role of exhibitions depends on the intended message to be conveyed, but all exhibitions have an informal educational function to a certain degree. Museums can achieve informal learning environment through objects, interpretation, a strong message and design.

7 How often are you asked to respond directly to the educational aspect of exhibitions in your design?

She always asks designers to respond to the educational aspect of exhibitions. She considers exhibitions should be built from the goals of exhibitions, intended messages and curatorial rationale. Understanding target audience is also important for designing exhibitions. She suggests that visitors are all learners whether they are conscious of it or not.

8 As a curator, she does consider the educational aspect of exhibition space. The principles she suggests to help visitors remember exhibition space include clearly interpreted messages and provision of a memorable introduction and conclusion to an exhibition. There are some key principles for visitors to make sense of the whole environment, including the use of various media for communication, subtle, but unique themes, engagement with the environment, and linked and hierarchical information.

9 She suggests that some criteria for designing exhibition space would be beneficial for exhibition design in the museum field. That would assist designers’ understanding of learning, interpretation methodologies and audience development in exhibition space. It would then inform exhibition design.

Table 17: Analysis of interview with Georgia Rouette.

<table>
<thead>
<tr>
<th>Ingrid Rhule</th>
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<tbody>
<tr>
<td><strong>Central Themes</strong></td>
</tr>
<tr>
<td><strong>Answer</strong></td>
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<tr>
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<tr>
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process from the determination of main concepts to final design forms. In this process, she also needs to work with other museum staff and external professionals.

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<tbody>
<tr>
<td>3</td>
<td>Rhule has a Bachelor of Arts in Interior Design from RMIT. She has strong interest in arts and likes visiting museums and galleries.</td>
</tr>
<tr>
<td>4</td>
<td>For Rhule exhibitions, she aims to create a unique spatial and intellectual experience for visitors through design. She expects that space will inform, delight, inspire and surprise visitors.</td>
</tr>
<tr>
<td>5</td>
<td>For designing space and organising content, Rhule starts the design process by reading the proposed curatorial concept and exhibition content of the exhibition, and then researches relevant information. Design concepts gradually evolve during this process. She translates content into space, paying attention to how visitors encounter exhibition space. She also responds to the existing space so her design can complement or comment on that space. Following the development of the design concept, Rhule designs the placement and display of objects.</td>
</tr>
<tr>
<td>6</td>
<td>She considers the educational role of exhibitions is extremely important for her institution. The museum also provides information or programs to school groups, tourists and local people.</td>
</tr>
<tr>
<td>7</td>
<td>She works closely with curators and other staff on the educational aspect of exhibitions and is concerned with the needs of the visitor. Currently she is designing a special space for educational purpose. That space would sit independently to the exhibitions but allows for visual and physical connections to the exhibition spaces. The space will allow public programs, such as gathering school groups for presentation, to be held within.</td>
</tr>
<tr>
<td>8</td>
<td>In considering the educational aspect of space Rhule tries to accommodate different groupings and learning activities. She designs moments for interacting, observing and relaxing. Rhule aims to provide a sense of rhythm and flow between these moments. Different spaces are needed for large groups of people and for fewer individual viewers.</td>
</tr>
<tr>
<td>9</td>
<td>In considering criteria for designing exhibition space as informal learning environment, Rhule suggests there are certain things that need to be considered in public buildings, such as access, health and safety and audience. However, she considers that a set of criteria for designing exhibition space may lead to generic, repetitive exhibitions. She suggests that design should be fluid and need to respond to particular limitations or requirements.</td>
</tr>
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</table>

**Table 18: Analysis of interview with Ingrid Rhule.**
The interview findings

The findings of the interviews enable me to make several observations. They confirm that museums now consider themselves as educational institutions, with education being an integral part of their activities. They show that the educational aspects of exhibitions have become important for exhibition designers. Even art museums, which have traditionally provided simple displays of art works, have started to consider the learning role of exhibitions and to provide more interaction and learning activities within exhibitions.

Daryl West-Moore, for example, comments that 'education into the future will play a more important role in everything we do, especially education activities that relate to family and children'. It is clear that exhibition designers now need to consider not only the look and feel of exhibitions, but also visitors’ engagement with exhibition content to achieve specific educational goals. Designers can work with education staff and gain their insights for achieving effective education, but they are the people who realise the final exhibition product according to the exhibitions’ educational goals. It is thus important that designers have a strong understanding of visitors' learning behaviour and how it might be translated into design language.

When discussing the educational aspect of exhibitions, the interviewees tended to conceive of educational programs as something for school groups. In seeking to cater for the general public's learning experience, the interviewees emphasise the provision of a unique or particular environment that gives visitors a special impression, encouraging them to learn something from their journey. For example, Kuzma uses his 'principle of discovery' to creating learning experience. Gregg tries to 'offer an experience that people can't get anywhere else'. West-Moore aims to achieve 'an experience that is specific to the curatorial rationale and also sensitive to the art work'. Most of the interviewees do not clearly specify mechanisms for this, especially in respect of how visitors' learning experience can be affected by a distinct environment or the elements needed for achieving that environment, neither are explicitly identified in the interviews.

The difficulty in specifying a clear set of elements or principles for exhibition space design may partly rest on the fact that exhibitions are quite diverse. Dzelalija suggests that 'each exhibition needs to be approached in a completely different way'. More significantly, designers' understanding of visitors' spatial cognition and meaning making process has not enabled the development of specific elements for designing exhibition space. The participants showed partial understanding of visitors’ learning outcomes and of how the design of exhibition space might relate and contribute to learning. Some of their
understanding is limited to their own observations of visitors' outward behaviour and to feedback from colleagues. Although their institutions often undertake visitor studies to a high level, most of the designers are not fully informed about the studies' findings. Other museum staff and departments conduct visitor studies and exhibition evaluation programs, without designers' involvement in the process.

As designers do not receive or follow up on the findings of visitor studies, the interviews did not establish whether questions concerning exhibition design are part of these evaluations. The lack of involvement from designers in institutions' exhibition evaluation programs makes it unlikely that this is the case. The cognitive and experiential dimensions of visitors' understanding of exhibition space and the content they view within space are not clear to the interviewees. Consequently, designers may lack specific elements and principles for designing exhibition space towards learning purpose. Mark Patullo comments on the lack of published knowledge for designers on the relationship between exhibition space and learning, validating the knowledge gap this thesis addresses. He comments that 'there is definitely a room for more research to be done, for that research to provide extra guidance to meld the audience educational expectation, being able to define what is the expectations are, and obviously most importantly evaluating them and coming up with a set of criteria that can assist us'.

In discussing the use of common strategies for organising exhibition space, the designers I interviewed report that the development of exhibition space and the organisation of content within it mainly follow curatorial dictates. West-Moore describes his design as initially 'dictated by the curators'. When Rhule explains her design process, she describes it as starting from 'reading the curatorial content of the exhibition'. Routte provides a clear view of the situation that designers need to achieve, commenting, 'A clear understanding of the goal of the exhibition is a priority with the intended message or curatorial rationale as its core from which the exhibition is built.' To facilitate learning, the designers seek to organise exhibition space to affect how visitors navigate and interact in exhibitions and where they stop. Materials, such as booklets and signage, can further assist visitors to navigate exhibition environments, but museum exhibitions also have diverse experiential qualities that can affect movement through space, cognition and ultimately learning.

The designers I interviewed had a common goal of seeking to create unique exhibition environments. This can contribute to the imageability of exhibition space and stimulate visitor place memory, but this is not a conscious intent on the part of the designers and
may mostly reflect the designers’ will to express their designerly creativity, authorship and professional involvement in an exhibition. Uniqueness is a vague concept when considered in the light of principles of spatial and museum learning. The designers were unclear about whether the design of space and the provision of supporting spatial information would enhance visitors’ intellectual experience in understanding space and content, remembering exhibition content or converting it into knowledge. Indeed, the interviews show that the museum professionals have greater familiarity with visitors’ behaviour in exhibition space than with visitors’ internal construction of spatial meaning and its potential relationship to learning processes. West-Moore argues that it is difficult to evaluate spaces for understanding 'how they work or whether they work practically or whether the education intention is delivered and remembered'. He considers the best way of evaluating exhibition space can be achieved by 'standing in the space, watching people interact and how they interact'.

Most of the designers I interviewed agree that a set of criteria for designing space from a learning perspective would be beneficial for the field. Three designers, West-Moore, Dzelalija and Rhule, consider that the criteria need to be broad and flexible, so that it can be adapted to diverse exhibition settings. Based on the interviews, it seems that the educational role of exhibitions and visitors’ learning experience are increasingly important to museums, seeing designers facing institutional demands to create comprehensible and meaningful experience for visitors. Certainly, my question about the need for criteria for designing exhibition space prompted the interviewees to acknowledge its potential usefulness. Without the inclusion of this specific question in the interview, the interviewees may not have presented this view voluntarily. Nevertheless, their responses to the question establish that none were aware of the existence of relevant information on the cognitive underpinnings of exhibition space design for informal learning.

Exhibition design is currently a practice-driven rather than evidence-based enterprise. However, it is unfair to represent it as little understood. The interviews I conducted show that exhibition designers reflect intently on the ways in which exhibition design generally and spatial organisation in particular may influence experiences and relationships, ambience, flow, movement and hierarchies of value and meaning in museum exhibitions. The designers show significant thought about how design language gives form to ideas about the museum experience and how it may support learning. Yet with this knowledge residing in tacit form with individual designers and in exhibitions themselves, or being
transmitted through conversation and practice among limited professional networks of
designers, there is little scope for a corpus of exhibition design knowledge to be built
and tested.

The interviews reinforce the knowledge gap identified in Chapter Two and the need of a
design framework for developing exhibition space as informal learning environments.
In terms of exhibition space, a unique experience is a common goal suggested by the
interviewees. This study into how museum learning could be supported and enhanced
through the design of exhibition space will provide designers with a tangible knowledge
base to assist them to develop effective exhibitions. The design framework proposed in the
thesis, in building on published knowledge of museum visitors’ internal meaning-making
process, will assist the work of exhibition designers in the development of exhibition space
to support museum visitors’ learning.

The analyses of three examples of exhibition design

The second source of data for the thesis is the analyses of exhibition design practices in
three museums using the framework for creating connected place memory. The analyses
apply the framework as an analysis tool to highlight the deficiencies and strengths of the
examples. The examples are the 17th and 18th Century European Art Gallery at the
National Gallery of Victoria, the interior of the City Museum, Melbourne, and the Human
Body Exhibition at the Melbourne Museum. This section presents the results of the
analyses of the panorama images described in Chapter Three.

I introduce each example with a brief discussion of the institutional context, location,
characteristics and spatial arrangement of each exhibition area. I then present a summary
analysis of each exhibition area against a checklist of elements from the design framework
for the creation of connected place memory. The evaluation grades spatial characteristics
according to the levels, ‘none’, ‘limited’, ‘moderate’ and ‘strong’. Figure 18 shows the
checklist table used for the summary analysis. Appendices 4, 5 and 6 of the thesis provide
a full analysis of each exhibition space for further consideration. I use annotated panorama
images taken of each space to highlight problem areas in each and indicate any
deficiencies in terms of the capacity to create connected place memory. Figure 19 shows
an example of the annotated panorama images. I include a full set of the panoramas in
Appendices 4, 5 and 6 of the thesis for further reference.
<table>
<thead>
<tr>
<th>Area</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td></td>
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<td></td>
<td>Flexibility</td>
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<td></td>
<td>Connection</td>
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<tr>
<td>Staging</td>
<td>Frames of Reference</td>
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<tr>
<td>Orientation</td>
<td>Spatial Graphics</td>
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<td>Space Cuing</td>
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</table>

Figure 18: The checklist table for analysing exhibition space.

I use bar charts to present a comparative assessment of the presence or absence of elements that create connected place memory for each exhibition area. The bar charts indicate how museum professional might evaluate exhibition areas in their institutions in terms of their potential to create connected place memory. Figure 20 shows one sample bar chart from the evaluation. I then discuss each of the three examples, basing the discussion around the seven elements of spatial context as represented in the bar charts, arguing for the capacity of the framework for connected place memory to enhance the effectiveness of museum exhibitions as contexts for informal learning.

Figure 19: An example of annotated panorama images.

Figure 20: A sample bar chart for evaluating exhibition space.
**The 17th & 18th Century European Art Gallery, the National Gallery of Victoria**

The gallery of 17th & 18th Century European Art is one of the permanent exhibition areas at the National Gallery of Victoria International. It represents an orthodox art gallery environment. Founded in 1861, the NGV is a major Australian public art museum. The museum has two campuses. The Ian Potter Centre displays Australian art. The St Kilda Road campus displays a broad survey of international art. Recently, the NGV renovated its St Kilda Road premises according to a design by Mario Bellini. The St Kilda Road gallery opened in 1967, having been designed by Roy Grounds as a rectangular building with three internal courtyards piercing through the three floors of the building and open to the sky. Bellini's redevelopment saw new galleries built into the courtyards, creating extra exhibition space, but resulting in a more complicated internal layout for the gallery. The 17th and 18th Century European Art Gallery is one of new exhibition areas and is located on Level 2 of the NGV International building. The gallery comprises eight rooms, showcasing painting, sculpture, furniture and decorative arts around four major themes: Dutch and Flemish Painting, the Rembrandt Cabinet, 17th-18th Century European Painting, and 17th-18th Century Decorative Arts & Painting. (Figure 21)

*Figure 21: Floor plan, the 17th & 18th Century European Art Gallery.*
The display of objects in the 17th & 18th Century European Art Gallery is static. Paintings hang on the walls and glass display cases hold small objects. Lighting is kept low for conservation purposes. The interior environment of each room is very similar, only being differentiated by subtle changes in the muted colours of the walls. The rooms are arranged around a mezzanine, with five rooms being entirely enclosed spaces. To get to the 17th & 18th Century European Art Gallery, the visitor to the NGV also needs to follow a circuitous route. The combination of the disorienting path to this exhibition area and the lack of a frame of spatial reference challenge visitors to understand the viewing environment and orient themselves within it, especially those who do not refer to a printed floor plan. The analysis of the exhibition space of the 17th & 18th Century European Art Gallery in relation to the framework of connected space memory comprises a checklist of characteristics and a set of annotated panoramas, which reveal typical problems of spatial understanding in large art museums with many rooms. The checklists and annotated panoramas are included in Appendix 4 for further reference. A major problem of the 17th & 18th Century European Art Gallery is insufficient provision of design elements to establish spatial connection in the enclosed exhibition spaces. Moreover, the imageability of each space is poor, though this could be enhanced by the addition of space cues.

Orthodox art museums present two-dimensional art works on the walls of box-like spaces, making the organisation of each exhibition space easy to understand and navigate. Figures 22 and 23 show that the gallery provides strong clarity and flexibility in spatial organisation.

**Figure 22:** Levels of clarity, the 17th & 18th Century European Art Gallery.

**Figure 23:** Levels of flexibility, the 17th & 18th Century European Art Gallery.
Although clear spatial organization makes each exhibition area comprehensible, the similarity of the different exhibition areas and the lack of linking information create considerable difficulties for museum visitors in grasping the environment of the 17th & 18th Century European Art Gallery as a whole. Figure 24, charts the poor connection between the various rooms in the gallery, which is a result of the absence of signage or directions.

![Figure 24: Levels of connection, the 17th & 18th Century European Art Gallery.](image)

Information panels exist at the entrance of each area in the 17th & 18th Century European Art Gallery, but these identify the area in which visitors is standing, instead of the area they will be moving into. Figure 25 shows an information panel that lacks the provision of direction to the next room. The panel bears the title ‘Dutch and Flemish Painting’, but the space that the visitor is about to enter is the ‘Rembrandt Cabinet’.

![Figure 25: An example of heading panels.](image)

The same issue is found throughout the whole 17th & 18th Century European Art Gallery. Not only do the information panels provide an inadequate link between spaces, the lack of other orientation elements further affects the establishment of spatial connection. The bar
charts in Figure 25 and 27 assess the frames of reference and spatial graphics in the 17th & 18th Century European Art Gallery.

Figure 26: Levels of frame of reference, the 17th & 18th Century European Art Gallery.

Figure 27: Levels of spatial graphics, the 17th & 18th Century European Art Gallery.

Three of the rooms in the 17th & 18th Century European Art Gallery have windows. This allows visitors to relate their position to the centre mezzanine, but five rooms have no visual contact to the mezzanine, which means visitors are unlikely to recognise the mezzanine as a central reference. None of the exhibition spaces have spatial graphics, meaning there is very little information to help visitors orient and make sense of the environment of the 17th & 18th Century European Art Gallery as a whole. Visitors are unlikely to be aware that the eleven linked exhibition spaces that form the 17th & 18th Century European Art Gallery are arranged around a central core. The difficulty of understanding the organisation and orientation of the gallery may obstruct the formation of cognitive maps and connected place memory, affecting engagement with exhibition content and overall learning within the gallery.

My interviews with designers suggest that exhibition space in art galleries and museums is often designed to be neutral and low key. The 17th & 18th Century European Art Gallery reveals such an approach to ambience in the gallery. Figure 28 shows the spatial staging of the gallery is generally moderate. The subtle changes in colours and atmosphere are unlikely to enable visitors to clearly differentiate the individual rooms in the gallery. The lack of strong space cues in most of the rooms also hampers visitors to create strong place memory. (Figure 29)
I assessed the imageability of half of the rooms to be very limited, which may affect visitors’ impression of the exhibition content placed in those rooms and reduce their engagement with and retention information about the whole exhibition. The analysis of the 17th & 18th Century European Art Gallery suggests significant scope to change the spatial characteristics and information of the gallery to enhance connected place memory in support of informal museum learning in the gallery. Space cues could be added to some rooms to increase imageability of the gallery. The formation of cognitive maps can be enhanced by reinforcing the connection of the rooms in the gallery and by the provision of orientation information.

**The City Museum at the Old Treasury, Melbourne**

The City Museum is a history museum situated in a historic building, occupying a large section of Melbourne’s Old Treasury Building. Built in the 1860s, the Old Treasury stored the colony’s gold and housed offices of Victoria’s colonial government. The three-story, neo-classical building was restored in 1994. The City Museum opened in 2005, providing a starting point for exploring Melbourne’s development, including its art, architecture and popular culture. The museum is located in the basement and on the ground floor of the Old Treasury Building. It hosts three permanent and one temporary exhibition in its twenty exhibition spaces. The ‘Making Melbourne’ exhibition and a temporary exhibition area are located on the ground floor of the building and ‘Built on Gold’ and ‘Growing up in the Old Treasury’ are located in the basement. (Figure 30)
The City Museum poses a challenge for the design of exhibitions, especially those with a pedagogical function. The museum must fit into the existing interior architecture of the restored building, which limits the available space and provides a set of rooms with fixed and very specific aesthetic and spatial characteristics. The former offices and gold vaults that form the museum’s ground floor and basement areas are small and many in number, challenging visitors’ capacity to identify and remember each room. Figure 31 and 32 show the long corridors with exhibition rooms on sides. I examined the City Museum as a critical case in the analysis of spatial issues surrounding exhibition space in museums as a typical history museum.
In analysing the exhibition spaces of the City Museum, I took panoramas of most of the exhibition spaces in the building, annotating these to identify their major features and problems. In some spaces, however, it was hard to produce a panorama. For the temporary exhibition space and the rooms comprising the ‘Growing up in the Old Treasury’ section, I provide a series of interior pictures to describe the exhibition environment. The ‘Built on Gold’ exhibition, in the building’s basement, comprises eight rooms, all former gold vaults. These rooms are very small and the installations that occupy some of them take up significant space. I judged panoramas to be unnecessary for recording the whole environment of these areas. Instead, I use one wide-angle image to
document their character. The checklist of spatial context and annotated panoramas are listed in Appendix 5 for further reference.

Since the City Museum is situated in a historic building that was not designed for holding exhibitions, differentiating and connecting the many, near-identical rooms poses a challenge for the institution. Each room on the ground floor is a rectangular box, its content mainly arranged around the walls, which makes the organisation of each room easy to understand. Figure 33 shows a strong clarity in each space.

![Organisation-Clarity](image)

**Figure 33: Levels of clarity, ground level, the City Museum.**

Most of the rooms are quite small, being approximately four metres by four metres square, and can only accommodate four people at a time if they are to have enough space to effectively explore exhibition content. Therefore the flexibility of spatial organisation of the ground floor is considered to be slightly below moderate (Figure 34).

![Organisation-Flexibility](image)

**Figure 34: Levels of flexibility, ground level, the City Museum.**

The lack of information connecting spaces makes it very difficult for visitors to make sense of the spatial order or gain an overview of the museum as a whole. The museum provides no signs, titles or spatial graphics at the doorways where exhibition spaces connect, as exemplified in Figure 35 and 36. There are no spatial graphics to assist visitors to understand the layout and order of the rooms in the museum. (Figure 37) The museum is small,
but the absence of spatial information suggests that museum visitors may be more likely to focus on where they are going than on what they are seeing, making retention of information less likely.

Figure 35: An example of the entrances connecting two rooms, the City Museum.

Figure 36: Levels of connection, ground level, the City Museum.
The only element that assists visitors to understand the relationship between the rooms is the central corridor, which acts as a frame of reference. (Figure 38)

Figure 39 indicates that the ground level provides a very strong frame of reference, since visitors can easily relate their positions to the corridor. Visitors’ understanding of the spatial order of exhibition areas could be enhanced if the doorways between two adjacent rooms were closed, requiring visitors to return to the corridor to access the next room.
Figure 39: Levels of frame of reference, ground level, the City Museum.

Figure 40 shows the staging of the ground floor to be moderate. With historical artefacts, slightly low lighting and shaded colours on the interior walls, the environment has a consistent historical atmosphere.

Figure 40: Levels of staging, ground level, the City Museum.

The display style is consistent in all the rooms in the City Museum, with only the wall colour changing, which may create a difficulty for visitors in differentiating rooms. Figure 41 shows that the small, cluttered rooms provide limited scope for the identification of rooms. Although there are interesting objects in each room, each lacks some dominant element that could serve as a space cue. As a result, the ground floor may not provide enough visuo-spatial information to support the formation of distinct place memory for each room and throughout the floor as a whole.

Figure 41: Levels of space cuing, ground level, the City Museum.
The analysis of the basement of the City Museum reflects that of the ground floor. The ‘Built on Gold’ exhibition is presented in a series of identical, former gold vaults, the lack of connection and distinction between these small spaces limiting visitors’ ability to form cognitive maps. Like the rooms on the ground level, the spaces in the basement are small cubes. Figure 42 shows that the clarity of each space is very strong, but this detracts from their differentiation and affects visitors’ orientation. The installations make the most of the cramped spaces, but likely result in a short stay for visitors in each space, flexibility being much more limited than on the ground floor. (Figure 43)

As on the ground floor of the City Museum, there is a lack of spatial graphics to show the layout and connection of exhibition spaces in the basement. (Figure 44, Figure 45)
Other than in the ‘Growing in the Old Treasury’ exhibition, visitors to the basement exhibition area can use the corridor as a frame of reference for orientation. (Figure 46)

One characteristic of this level is the use of mixed media as exhibition content. These mixed media installations create special atmospherics and moderate to strong staging effects. (Figure 47) However, about half of these spaces lack strong space cues. (Figure 48) Visitors’ place memory might be enhanced if space cues existed in every space.
Figure 48: Levels of space cuing, basement, the City Museum.

The City Museum represents a range of typical spatial problems in history museums that occupy historic buildings. With many similar spaces, the identity of each space and the information that allows visitors to better connect spaces needs specific attention. An abundance of historic objects is equally a challenge and designers need to consider how particular objects or architectural features can be used as space cues. The staging strategy is consistent in the museum, lending unity to the exhibitions, especially on the ground floor, but this may not help visitors comprehend the exhibition spaces. Space cuing is especially important in this museum in the formation of connected place memory. To assist visitors make sense of the spatial order, titles and floor plans should be added at the entrance to each exhibition room even though the corridors on both levels of the museum to provide a frames of reference for orientation.

The Human Body Exhibition, Melbourne Museum

The Human Body exhibit at the Melbourne Museum exemplifies the contemporary science exhibition. Melbourne Museum is one of four sites of the umbrella organization, Museum Victoria. It provides a mix of cultural and scientific experiences and houses an internationally significant collection of natural history artefacts as well as supporting important research. The museum attracted seven hundred thousand local and international visitors in the year 2007-2008, accounting for approximately half of the ticketed visits for the four sites of Museum Victoria. The diversity of visitors represents a challenge for this major museum.

The museum is a three-level complex housing eight galleries. The Human Body exhibition is located on the upper level, being one section of the permanent exhibition in the Mind and Body Gallery. Figure 49 presents a floor plan of the exhibition, which consists of eleven distinct areas within a roughly rectangular space.

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Figure 49: Floor plan, the Human Body Exhibition.

Space 2 and 4 are more enclosed, but the other areas have open plan layouts, meaning that the experience of one area blends into the next for the visitor, challenging them to orient themselves. The Human Body exhibition employs many of the latest techniques for engaging the visitors, including mixed media and digitally responsive displays and hands-on activities. Besides the deployment of text, still and moving image and sound to explain the workings of the human body, many models and human specimens reveal the internal components and processes of the human body in great detail. This combination of open plan layout and rich information has significant potential to overwhelm the museum visitor, especially as a result of the exhibition’s lack of overt and clearly organised spatial characteristics. Figure 50 and 51 show two interior views of the gallery.
Figure 50: Interior view (1) of the Human Body Gallery

Figure 51: Interior view (2) of the Human Body Gallery
My analysis of the exhibit suggests that the Museum needs to provide more spatial information to better support visitors’ understanding of the exhibition space and content. The checklists and annotated panoramas of the spatial context are presented in Appendix 6: Research Data, the Human Body Exhibition, Melbourne Museum. Like many open plan exhibitions, the gallery is divided into various small areas without clear division or perimeter. The objects exhibited define each of these exhibition spaces, or cabinets and display walls provide tacit demarcation. Visitors can visually contact other spaces from within each space, except for Space 2, the first space on the left of the floor plan. As the perimeters of the exhibition spaces are not well defined, the clarity of spatial organisation is limited in some spaces (Figure 52). On average, the clarity is moderate and allows visitors to understand the organisation of each space. However, the small sizes of some spaces may limit free exploration by visitors and cap the time they feel like spending in these spaces, especially at times where many people are visiting the exhibition. As flexibility is limited in half of the spaces in the Human Body exhibition, visitors may not gain a good place memory in these areas. (Figure 53)

![Figure 52: Levels of clarity, the Human Body exhibition.](image)

![Figure 53: Levels of flexibility, the Human Body exhibition.](image)

The great advantage of an open plan exhibition is that it provides strong orientation, the frames of reference being easily accessed. For orientation, visitors can refer to either the core of the Mind and Body Gallery or the centre area of the Human Body exhibition. The frame of reference chart, Figure 54, shows that Space 2 is the only space that does not provide any reference points. Otherwise, visitors may obtain a strong cognitive map because of the clear orientation.
Despite the provision of good frames of reference by the exhibition, spatial information could be improved. The connection and spatial graphics charts show the extreme lack of information to help visitors connect the spaces. (Figure 55, Figure 56)

The exhibition reveals the problems of differentiation and imageability that characterise many open plan exhibitions. The information pollution from adjacent areas is obvious in most of the spaces. This obstructs the staging effect of many spaces and the formation of vivid place memory within individual spaces. (Figure 57)

Most exhibitions spaces lack clear space cues exist, especially those spaces next to the core of the Mind and Body Gallery, further reducing the imageability of the exhibition (See
Figure 58). Space cues play the main role in making space identifiable, but achieving good staging and a distinct atmosphere can be difficult in open plan exhibitions.

The main challenge in the Human Body exhibition is in forming clear place memory in its individual exhibition spaces. Although visitors can easily orient themselves in the gallery because of the clear frame of reference, the vaguely defined perimeters and information pollution greatly affect the staging of most spaces. The provision of rich content in the absence of strong and effective space cues may overwhelm visitors. Without the scope to develop distinct connected place memory, it may be hard for visitors to recall exhibition content.

**Conclusions to be drawn from the example analyses**

The above analyses show the need for a framework for the development of connected place memory in the design of museum exhibitions as informal learning spaces. Each of the three examples demonstrates scope for better spatial information and more effective strategies to help visitors understand the nature and order of exhibition spaces. Dividing space into small areas is a common practice in planning space, as is evident in the three examples. Typically, the clarity of each small space is quite high, but the clarity of the parts of an exhibition does not necessarily contribute to the apprehendability of the exhibition environment as a whole. The three examples lack effective spatial graphics and information on spatial connections. In each case, more and better information would help visitors make sense of the whole exhibition environment. The addition of signs, headings panels and floor plans at the entrances of each space is possible in the three exhibitions and would help in the formation of cognitive maps. An useful element for understanding spatial order is the presence of strong frames of reference, although this may present different challenges in different situations. Exhibition designers need to exercise considerable creativity to introduce frames of reference in restricted conditions like the 17th & 18th Century European Art Gallery at the NGV. It is easier to achieve in open plan exhibitions like the Human Body exhibition at the Melbourne Museum.
To achieve a vivid place memory, it is necessary to improve staging and space cuing. Each space in my examples needs to be staged differently, so that visitors can easily identify individual spaces. This requires careful planning, because the balance between the unity of an exhibition and the differentiation of specific areas within an exhibition needs to be considered. The three examples share the problem of creating a distinct atmosphere for each space. Making only small changes in environmental settings, such as subtle changes of colour and lighting, to distinguish individual exhibition areas may unify a whole exhibition, but the quest for unity can affect the imageability of space. Space cuing is rarely discussed in the exhibition design literature, but can complement the imagability of an exhibition space. Space cues are especially needed for exhibition spaces containing rich content, but no visual focus, as is an issue in some areas of the City Museum and Human Body exhibition. As a hook for the recollection of a space, a space cue is not necessarily the focal point of exhibition content, but when a focal point also represents a space cue visitors’ may link spatial experience more readily to exhibition content.

**Exemplary design**

The following program of exemplary design explores the use of the framework for the creation of connected place memory in the redesign of an existing exhibition space, suggesting how a designer might put the theoretical principles into practice and reflect on the process. The following section proposes a redesign of the 17th & 18th Century European Art Gallery at the NGV. The redesign uses the floor area of the existing gallery and addresses the problems identified in the analysis of the gallery. It focuses on the provision and revision of spatial graphics, space cuing, connection and frame of reference.

Existing conditions in each space of the 17th & 18th Century European Art Gallery are modified to incorporate new elements or information. The two major problems in all the spaces are a lack of clear connection between the spaces and the need for space cues to support the development of connected place memory. To address these problems, the redesign firstly adds spatial graphics and connection information to the information panel at the entrance of each space. Information panels are placed at the left side of entrances for a consistent system. The spatial graphics include a floor plan and ‘you-are-here’ point to let visitors relate their locations within the whole of the 17th & 18th Century European Art Gallery. I provide the name of next room to allow museum visitors to mentally connect two adjacent spaces. Fonts and colours follow the style on the original panels. Figure 59 presents a typical example of the information placed on an information panel.
The presence of strong frames of reference also supports the connection of spaces. In the 17th & 18th Century European Art Gallery, the spaces sit around a mezzanine, but visitors cannot use the mezzanine as a frame of reference because five rooms are fully enclosed spaces that lack visual connection to the mezzanine. To introduce a frame of reference into the existing architectural structure, I have given the walls that sit between the mezzanine and exhibition areas some special visual characteristics so that visitors gain a sense of circling around a central object as they move through different spaces. In forming a sense of the 17th & 18th Century European Art Gallery surrounding a rectangular box, these interior walls become a frame of reference. (Figure 60)
To further enhance the sense of the walls as one central, unified object and differentiate these walls from the other walls, I include glass joint walls at places where other walls meet the reference walls. (Figure 61) Figure 62 shows a perspective view of a reference wall and joint wall.
I provide three propositions for adding visual character to the reference walls without significantly disturbing the exhibition designers’ subtle, unified colour scheme in the 17th & 18th Century European Art Gallery. The first proposition is to paint the reference walls in a different colour to that of the colours of the general environment. Figure 63 shows one reference wall painted in light grey. Although this proposition presents a simple way of providing a frame of reference, the choice of colours needs careful consideration. Neutral colours can blend harmonically with the whole setting. Other colours are possible, but to meet curatorial principles exhibition designers often have to achieve a balance between a strong visual reference and the rest of the exhibition environment.
My second proposition uses different materials for the reference walls in the 17th & 18th Century European Art Gallery. To provide a stronger contrast between the reference walls and other walls, I replace some existing walls with back-lit glass walls to give the sense of a glass box in the centre of the gallery as visitors navigate through the exhibition. (Figure 64)

![Figure 64: Glass reference walls.]

The back lighting suggests that light is coming from the central core area, reinforcing the role of the glass wall as a single, special feature and frame of reference in the gallery. (Figure 65) It also suggests that the 17th & 18th Century European Art Gallery is formed around a light well, adding a sense of connection in this enclosed space to the world beyond the gallery, which can aid spatial understanding. Figure 66 shows one simulated scene of the glass reference wall.

![Figure 65: Perspective, glass reference walls.]

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The third proposition for the reference walls is to introduce distinct forms. Figure 67 shows a plan of curved walls situated in the gallery.
The curved walls are obviously different from other walls, meaning visitors can easily identify the curve walls and obtain a sense of reference. (Figure 68)

![Figure 68: Perspective, curved reference walls.](image)

Figure 69 shows the use of a curved wall in a light grey colour to reinforce the special character of the wall.

![Figure 69: A simulated perspective of a curved reference wall.](image)

To create vivid place memory, space cuing is an important element of the redesign. The strategy for creating space cues is to place a special visual figure in each space. Figure 70 shows the addition of a glass with a distinctive shape into each space to allow visitors to generate vivid memory of each space by linking the space cognitively to the distinctive visual figure.
In the following sections, I redesign the 17th & 18th Century European Art Gallery using glass reference walls to differentiate them from other walls in the gallery. The design strategy adds three layers of new elements to the gallery: improved information panel, reference walls and space cues. This is set out in Figure 71.
I change the colours of the rooms to group them into three. In the existing gallery, the two rooms of the 17th-18th Century European Decorative Arts and Painting section are painted grey to distinguish them from the green rooms. For better staging, I use a green colour for the two rooms of Dutch and Flemish Painting rooms and the Rembrandt Cabinet, yellow-green for the three 17th-18th Century European Painting rooms and blue-green for the two 17th-18th Century Decorative Arts and Painting rooms. Figure 72 is a perspective view of the exhibition area with redesigned spatial information and a new colour scheme.

**Figure 71: Three layers of spatial information.**
Each room is given a name and number to improve identification. The following discussion of the eight rooms starts from the Dutch and Flemish Painting (1) and follows a counter clockwise order. Figure 73 shows the sequence of rooms. Within each room, the redesigned information panel, space cue and frame of reference is further explained.
The Dutch and Flemish Painting (1)

Visitors start exploring the whole of the 17th & 18th Century European Art Gallery in this room, making its design fundamental to their formation of an effective cognitive map. I add an information panel at the entrance to the Dutch and Flemish Painting (1) room, the inclusion of the room’s title and floor plan providing visitors better scope to connect the room to subsequent rooms and to identify their location. (Figure 74)
The original panel provides directions to several next coming rooms, but there are no spatial graphics to allow visitors to gain an overview of the entire environment and orient themselves within it. (Figure 75)

![Figure 75: Existing heading panel, the Dutch and Flemish Painting.](image)

Currently, the situation of the panel means the arrows on the panel point in the wrong directions, potentially leading to disorientation. (Figure 72)

![Figure 76: The directions on the original panel.](image)
I convert the wall that sits between the room and mezzanine into a reference wall. (Figure 77) I rearrange some art works to fit the new design. To begin establishing a frame of reference, the colour and material of this wall is different to other walls in the room.

Figure 77: The reference wall in the Dutch and Flemish Painting.

The original walls so enclose the room that visitors have no reference point to establish their location. (Figure 78)

Figure 78: The original condition of the east wall in the Dutch and Flemish Painting.
To introduce a space cue into the gallery, I have replaced the original display walls in the middle with glass walls to form an oval shape. The light green tint of the walls continues the gallery’s green colour scheme, but its variation adds a further distinguishing feature to the walls in their role as a space cue. The present walls extend to the ceiling, dividing the room. The proposed wall is shorter and gives the wall the sense that it is a freestanding object in the gallery, adding to its presence and recognisability. Figure 79 and 80 show these aspects of the redesign of Room 1 of Dutch and Flemish Painting.

![Figure 79: The space cue in the Dutch and Flemish Painting (1).](image1)

![Figure 80: The original display unit in the Dutch and Flemish Painting (1).](image2)

**The Dutch and Flemish Painting (2)**

An interior wall separates the second room of Dutch and Flemish Painting from the first, but as Figure 81 shows, there is no information panel at the entrance to the room.
In the proposed redesign, I have added an information panel at the entrance to the room. Figure 82 shows the addition of the title 'Dutch and Flemish Painting (2)' to help identify the room and support the connection with room (1).

Working in conjunction with the openings in the original wall, I have connected the glass reference wall to the north wall. This continues the reference wall from room (1) and provides connection with the mezzanine. The glass material reinforces the sense of light coming from the core area. (Figure 83)
Figure 83: The reference wall in the Dutch and Flemish Painting (2).

Although the openings on the original wall already allow visitors to visually retrieve the mezzanine, this room is one of the only three rooms that can provide the visual connection. (Figure 84)

Figure 84: The original reference wall in the Dutch and Flemish Painting (2).

The existing dark columns in the second room of Dutch and Flemish painting do not contribute to the visual character of the room. (Figure 85) Wrapping the two concrete columns in glass, the material used for all the space cues in the redesigned gallery, provides a space cue for the room, the new columns providing a distinctive and recognisable element in the room that acts as a visual hook. (Figure 86)
The Rembrandt Cabinet

The walls of the Rembrandt Cabinet are the same colour as Rooms 1 and 2 in the Gallery, unifying the Dutch and Flemish Painting area. Figure 87 shows the presence of an information panel at the entrance of the Rembrandt Cabinet, but it bears the title ‘Dutch and Flemish Painting’, failing to provide appropriate connecting information.
The new information panel displays the name of the next room, the ‘Rembrandt Cabinet’, alerting visitors to the content of the room they will be entering. (Figure 88)

As a totally enclosed room, the Rembrandt Cabinet lacks any frame of reference. (Figure 89) The redesign turns the north wall into a glass wall, continuing the reference walls from the previous rooms. (Figure 90)
The present environment of the Rembrandt Cabinet is very similar to the previous two rooms, with the same colour scheme and lighting. To lend imageability to the room, I have provided a space cue. I have changed the present display wall in the middle of the room into a curved wall. Much like the space cue in the Dutch and Flemish Painting (1) room, the curved display wall does not extend to the ceiling, providing the sense of a stand-alone object in the room as shown in Figure 91 and 92.
17th – 18th Century European Painting (1)

17th-18th Century European Painting occupies three rooms. In the redesign, I use a yellow green colour to differentiate the three rooms from the other rooms in the 17th & 18th Century European Art Gallery. The present information panel provided immediately before entering room 1 of 17th-18th Century European Painting bears the title ‘Rembrandt Cabinet’, disturbing visitors’ orientation within the gallery. (Figure 93) Figure 94 shows the new panel bearing the name of the room the museum visitor is about to enter and floor plan to support spatial connection. I have made the placement of the information panel consistent with that of all other information panels in the redesigned 17th & 18th Century European Art Gallery.
As a totally enclosed room, the first of the three rooms of 17th-18th Century European Painting presents a great challenge for the museum visitor in locating their position and connecting the room to other rooms in the Gallery. (Figure 95)
To provide a point of reference, I have slightly moved the north wall to reveal the reference wall, which is now of only six-metres in height to make it stand out from the other walls in the room. (Figure 96)

The paintings presented in the first room of 17th-18th Century European Painting are some wonderful examples of painting from the period, but the even distribution of paintings in the room means that it lacks recognisable features. The staging of the room is also identical to the two other rooms of 17th-18th Century European Painting, the lack of memorable spatial information making it difficult for visitors' to remember what they
have seen in each of these spaces. Figure 97 shows the existing condition of the south wall of the room.

![Figure 97: The south wall in the 17th-18th Century European Painting (1).](image)

Figure 98 shows the addition of a space cue to the room in the form of a curved display wall at the south end of the room. The curved wall occupies one end of the axis connecting the three rooms of 17th-18th Century European painting, providing a strong visual connection for the three rooms. To enhance this effect, I have placed a highly recognisable painting in the centre of this wall.

![Figure 98: The placement of space cues at the end of axis.](image)
A simulated view of the space cue is shown in Figure 99.

Figure 99: The space cue in the 17th-18th Century European Painting (1).

17th – 18th Century European Painting (2)

A metal door-frame surrounds the entrance to this room, its width enabling the placement of a new information panel rather than add a free-standing panel. The present information panel sits on the left side of the door-frame, presenting confusing spatial information. It bears the general title 'European Painting, 17th-18th Century', not distinguishing which of the three rooms of European Painting of the 17th-18th centuries the visitor is about to enter. (Figure 100)

Figure 100: The entrance and heading for the 17th-18th Century European Painting (2).
The proposed redesign uses the same position for the information panel, but adds more spatial information, as is shown in Figure 101 and 102.

![Figure 101: The new heading for the 17th-18th Century European Painting (2).](image1)

![Figure 102: The detail for the new heading for the 17th-18th Century European Painting (2).](image2)

In lacking significant spatial information, visitors may find Room 2 of the European Painting 17th-18th Century section to be the most difficult space for orientation. The room is far from the start of the 17th & 18th Century European Art Gallery. The enclosed space makes connection to the outside world and orientation all but impossible. I have added a
glass reference wall on the west side of the room for better orientation. Figure 103 and 104 enables comparison between the proposed and present design.

To provide a space cue, I propose the addition of a glass floor at the centre of the room. To create a strong connection with the exhibition space as an aid to remembering exhibition content, the glass floor is combined with the rearrangement of paintings in the gallery to provide a visual hook. The glass floor only exists in this room of the 17th & 18th Century European Art Gallery, affording a special sensory experience. Figure 105 shows the glass floor located in the middle of the room. Figure 106 shows the room’s present state for comparison with the proposed redesign.
17th – 18th Century European Painting (3)

The spatial context of the third room of 17th-18th Century European Painting is clearer than that of the other two rooms. The corridor leading to the next room, the 17th-18th Century European Decorative Arts and Painting (1), provides some visual connection to the mezzanine and the video playing on its south wall acts as a strong space cue. However, as in room (2) I have added a modified information panel that now bears the title of the room the visitor is about to enter and a floor plan of the 17th & 18th Century European Art
Gallery to enable better cognitive connection of the adjacent two rooms. The new and old information is shown in Figure 107 and 108.

Figure 107: The new heading for the 17th-18th Century European Painting (3).

Figure 108: The original heading for the 17th-18th Century European Painting (3) room.

Figure 109 shows existing conditions in the third room of 17th-18th Century European Painting, indicating its lack of spatial reference. To address this lack, part of the west wall that surrounds the mezzanine now becomes a point of reference. Visitors can gain a sense of the continuity through the extension of the reference wall into the next room. (Figure 110)
To provide a space cue in the third room of 17th-18th Century European painting, I have added an isosceles trapezium glass wall. The shape of the wall echoes the perspective of the painting on the north wall and creates a focus for the room. In being placed at one end of the axis connecting the three rooms of 17th-18th Century European Painting, the trapezium works with the curved wall in the first room to provide a strong visual link. Figure 111 and 112 present the redesign and present conditions of the north wall.
Two rooms present a collection of 17th-18th Century European Decorative Arts and Painting. To differentiate these two rooms from other groups of rooms in the 17th & 18th Century European Art Gallery from the other series, I have selected a blue green colour to differentiate them. To access the first room of the 17th-18th Century European Arts and Painting, visitors need to walk along a corridor that connects with the south wall of the room and provides visual contact to the mezzanine. To maintain a consistent frame of reference, the glass reference wall continues on the south wall of the corridor.
The present panel sits at the right hand side of the entrance to the 17th-18th Century European Decorative Arts and Painting (1) without showing the name of the next room. (Figure 113) Figure 114 shows the new situation for the information panel on the left hand side of the opening into the next room, providing clearer spatial information.

Figure 113: The existing panel for the 17th-18th Century European Decorative Arts and Painting (1) room.

Figure 114: The heading panel for the 17th-18th Century European Decorative Arts and Painting (1) room.

I have placed a new reference wall on the south side of the room, continuing the reference wall that runs along the corridor. Figure 115 shows two views of the reference wall.
Figure 115: The reference wall in the 17th-18th Century European Decorative Arts and Painting (1) room.

Figure 116 shows the present state of the south wall. The existing openings provide connection with the mezzanine.

Figure 116: The existing south wall of the 17th-18th Century European Decorative Arts and Painting (1).

To introduce a space cue into the first room of the 17th-18th Century European Arts and Painting, two stepped glass display units replace the present display walls. (Figure 117)
Figures 117: The change of the display walls in the 17th-18th Century European Decorative Arts and Painting (1).

Figures 118 and 119 compare the present display walls to the use of new walls as space cues.

Figure 118: The space cue for the 17th-18th Century European Decorative Arts and Painting (1).

Figure 119: The original display walls in the 17th-18th Century European Decorative Arts and Painting (1).
17th-18th Century European Decorative Arts and Painting (2)

The second room of 17th-18th Century European Arts and Painting is the last in the suite of room in the 17th & 18th Century European Art Gallery at the NGV. The room has several comparatively strong spatial elements. For example, the entrance and openings to the mezzanine create a frame of reference. The circular display walls in the centre serve as a space cue. The addition of better spatial information would achieve consistency across the design and better spatial orientation for visitors.

The present information panel sits to the right hand side of the entrance in a dark corner. The general title ‘European Decorative Arts and Painting’ does not clearly differentiate rooms one and two. (Figure 120) The redesigned panel shown in Figure 121 stands at the left hand side of the entrance and provides better connection information.

Figure 120: The entrance for the 17th-18th Century European Decorative Arts and Painting (2).
I have added a reference wall on the east side of the room to reinforce the connection with the mezzanine, continuing the sense of a glass box sitting at the centre of 17th & 18th Century European Art Gallery. Figure 122 and 123 show the revised and present design of the second room of 17th-18th Century European Arts and Painting for comparison.
The present circular display walls are a strong visual element in the 17th & 18th Century European Art Gallery as a whole. The form itself and the sense of space it provides offer visitors a distinctive spatial experience. (Figure 124)

The redesign keeps the form of the wall, but uses the glass material of the other space cues to enhance these effects and to enable the wall to serve as part of a series of space cues enhancing imageability and identity throughout the 17th & 18th Century European Art Gallery. (Figure 125)
A Summary of the redesign of the 17th & 18th Century European Art Gallery at the NGV

The redesign of the 17th & 18th Century European Art Gallery at the NGV demonstrates the application of the design framework for creating connected place memory in museum interiors. All contemporary museums face cost pressures and need to contain the scale and scope of design work while providing the public with pleasant and effective exhibition spaces. As a revision of an existing space, my redesign proposal has demonstrated a range of minor changes that might be made to an existing suite of exhibition rooms to enhance museum visitors’ understanding of their spatial configuration. The design shows one possible solution to the need to create connected place memory in museum interiors, rather than a perfect solution.

In real museum settings, designers need to consider curatorial principles and a range of other constraints to meet the specific goals set for individual exhibitions. In creating an environment where museums visitors can develop connected place memory, the choice of forms, colours and materials for doing this will typically have to reference the whole environment. Design concepts for creating connected place memory need to support the general look and feel of an exhibition or exhibition space, yet lend distinct characteristics to each space within the exhibition. As the program of exemplary design work shows, simple changes executed in the aim of creating connected place memory have the potential to make a significant impact. The provision of effective spatial graphics and other connection information can help considerably in enabling visitors to make sense of spatial
organisation and derive a strong sense of the exhibition spaces they are moving through, enabling to devote more of their thoughts to engaging with exhibition content. The redesign of the 17th & 18th Century European Art Gallery at the NGV suggests that the concept of connected place memory and the proposed design framework for achieving it in museum contexts represents a new approach to exhibition space design in museums in the aim of supporting visitors’ learning experience.
CONCLUSION AND FUTURE STUDY

The thesis has proposed a framework for designing exhibition space to improve museum visitors’ scope to achieve connected place memory that is both practical in application and theoretically informed. Theories of constructivist learning spatial intelligence and mnemonic loci cited in the thesis suggest better connected place memory may result in the development of more effective informal learning environments in museums. The theoretical framework builds on museums’ now established educational role and the museum sectors’ ideas about the learning aspects of museum exhibitions. A comprehensive review of published literature in the museum studies in Chapter One revealed the poverty of exhibition design theories. The need for design theories for exhibition space in support of informal museum learning is also affirmed in the thesis by the review of exhibition design theories and interviews with museum professionals. Through the examination of the views of museum professionals and extensive analysis three examples of current exhibition design, combined with a program of exemplary design work involving the redesign of the 17th & 18th Century European Art Gallery at the NGV, the thesis has contrasted current practice in exhibition space design to what is achievable through the proposed design framework for the development of connected place memory.

The research results in a framework that comprises a theoretical perspective, a set of supporting design elements, sub-elements and basic design principles. The key elements include:

- Organisation—Clarity, Flexibility, Connection,
- Staging,
- Orientation—Frame of Reference, Spatial Graphics,
- Space Cuing.

The elements aim to support the imageability and comprehensibility of space. The thesis has shown how the use of staging and space cuing enhances the imageability of exhibition spaces. In emphasising the visuo-spatial experience of exhibition visit, the thesis has argued that staging and space cuing can assist the formation of vivid place memory. The thesis has indicated how elements of organisation and orientation work toward the comprehensibility of space. It has demonstrated how the provision of clear spatial order and information and designed elements of organisation and orientation support meaning making in space and the formation of cognitive maps. The thesis has argued that
exhibition spaces function as information containers. Equipping exhibition spaces with effective design elements for creating connected place memory potentially enhances the recall and understanding of space and exhibition content. By providing a holistic view of learning in space and the connection between space and content, the thesis has contended that the design framework for creating connected place memory can assist designers to create more communicative spaces that meet the increasing expectations of museum education and the diverse needs of museum audiences.

Based on the research results, the framework has proposed the key elements for designing the spatial context of exhibitions. It has stressed that there are several related principles that need to be considered here. Firstly, the thesis has argued that designers need to fully understand the theoretical foundation of the framework in order to achieve an imageable and comprehensible environment. The thesis has used the interviews to show that exhibition designers mainly acquire their understanding of the relationship between space and learning intuitively, observation of visitors' behaviour and exhibition evaluation primarily being conducted by other professionals. Designers and museums need deeper understanding of visitors' learning experience in space to arrive at more effective interior and exhibition design in museums. Designers especially need to fully comprehend the function of the various elements of spatial experience and how they might be effectively combined to develop connected place memory in support of informal museum learning.

Secondly, although the thesis suggests that exhibition spaces can best achieve imageability and comprehensibility if all the elements of the framework are strong, designers need to find an appropriate combination of the elements for individual exhibitions, which each have different objectives, content and spatial contexts. The example analyses have shown that exhibitions are highly specific entities, the framework and principles need to be thoughtfully adapted to work in individual settings. More importantly, in real settings some elements may not be fully realised. The analysis of the human body exhibition at the Melbourne Museum has shown the difficulty in accomplishing distinct staging for vaguely defined spaces in open-plan exhibitions. The analysis of the 17th & 18th Century European Art Gallery has indicated the significant challenge in introducing a frame of reference for the development of connected place memory in museum visitors in certain sorts of museums. When an element cannot be implemented, designers need to reinforce the other elements so the imageability and comprehensibility of exhibition space operates at an effective level. Designers need to balance the application of elements in specific contexts. Art exhibitions, for example, often require a neutral environment instead of distinct
staging. If designers are unable to enhance the imageability of space through staging, they need to use space cues to achieve imageability.

Lastly, the thesis shows that the most difficult task for designers is to balance the design framework for the development of connected place memory and other agendas for the design of specific exhibition settings. The interviews show that designers are always responding to a complex of expectations, any design framework inevitably needing to be applied within certain constraints. The strategies demonstrated in the redesign of the 17th & 18th Century European Art Gallery at the NGV build on the existing characteristics of that suite of exhibition spaces and are relevant to other museum contexts in a general rather than specific way.

**Limitations of the study**

Although the framework has incorporated many insights from different fields, especially the study of spatial intelligence, it does not examine how individuals make meaning of space and content within space designed using the framework for the development of connected place memory. The study does not investigate how museum visitors with different learning styles engage with the specific design of exhibition spaces. Proposing the new design framework of connected place memory and elucidating its supporting theoretical principles provide general principles and elements for considering museum learning and designing exhibition space.

Furthermore, the study cannot predict to what extent individual museum visitors will makes sense of and remember exhibition content given the highly specific nature of informal museum learning. The aim of the framework is to provide enhanced spatial information in support of learning process rather than to coerce visitors into learning. The effectiveness of the framework for creating connected place memory is not examined in the thesis. Future studies will be needed to determine its impact on museum visitors’ spatial understanding and learning experience.

**Implications and applications**

Besides the application in museum settings, the theory for creating connected place memory and its supporting design framework may contribute to the design of other informal learning environment. The framework concerns people’s connection to space, meaning that the design of all complex environments may benefit from the application of
the framework. The framework can be applied in other areas of environmental design, such as commercial exhibitions and even virtual learning environments. In virtual environments, such as e-learning platforms, space can be designed specifically for learning materials, especially where learners undertake self-guided study. These contexts bear similarities to museum exhibitions, suggesting that the theory and framework for creating connected place memory have significant potential for wider application.

As the interest of virtual museums continues to grow, the framework may contribute to the design of virtual exhibition environments. The continuing expansion of the Internet and information technology has encouraged many museums to build their on-line presence. Established in 1997, the ‘Museums and the Web’, an annual international conference, provide a forum for sharing on-line experience among museum professionals, indicating how museum web sites have become an integral part of museum practice. Although information and communications technology allows museums to expand their domain into the virtual world, transmitting knowledge and offering informal learning experiences remains a major function and challenge in these activities. In support of informal learning, the framework may have strong relevance in the design of virtual exhibitions.

**Future study**

The current validity of the framework derives from its use of established knowledge in cognitive psychology and learning theory. The framework now needs to be applied in specific settings and empirical visitor studies conducted to test its usefulness. Through its application in real settings, the relationship between the elements of the framework can be explored and its underlying principles enriched. Most importantly, visitor studies of actual design work can investigate what visitors actually learn in space and the impact of spatial context. Such study can experiment with visual elements, such as form, colours or graphics to establish the most effective in articulating the spatial context of a museum exhibition. The effectiveness of the framework can be examined against visitors' understanding of exhibition space and content and long-term recall of content.

As museums face increasing social demands and competition from other providers of leisure and information, the provision of compelling learning opportunities will only become a greater challenge. Although there is significant discussion in the museum literature on the nature of exhibitions, the physical environment of exhibitions remains their least explored aspect. Making museum exhibition spaces more memorable may
provide more than just effective learning: the most memorable and meaningful moments of our lives often arise as a result of the specific qualities of the environments in which events take place. However, John Dewey, a pioneer of experiential learning, argued, ‘each experience may be lively, vivid, and interesting, and yet their disconnectedness may artificially generate dispersive, disintegrated, centrifugal habits.’

Around the world, many new exhibitions are developed each year in the aim of providing museum visitors with rich experiences, but without any deep understanding of human learning and spatial capacities. This thesis has presented a foundation for redressing the shortcomings in exhibition design in the hope of harnessing exhibition space to meaningful, self-directed learning for museum visitors.

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APPENDIX 1
ETHICS CLEARANCE APPROVAL FOR INTERVIEWS

>> Anne Cain 02/13/08 4:56 PM >>
To: Dr Carolyn Barnes/Mr Wi-kuan Lin, Faculty of Design

Dear Carolyn and Wi-kuan Lin

SUHREC Project 0708/147 Designing Exhibition Spaces for Informal Learning
Dr C Barnes Design, Mr Wi-kuan Lin
Approved Duration: 13/02/2008 To 01/02/2009

I am pleased to advise that the Chair of SHEC3 (or delegated member) has
approved the revisions and clarification as emailed by you on 11/02/08 in
response to previous communication (SUHREC email of 05/02/08). Unless otherwise
notified, human research activity in the project may commence in line with
standard or any special conditions for on-going ethics clearance.

The standard conditions for ethics clearance include the following:

- All human research activity undertaken under Swinburne auspices must conform
to Swinburne and external regulatory standards, including the current National
Statement on Ethical Conduct in Research Involving Humans and with respect to
secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for
any personnel appointed to or associated with the project being made aware of
ethics clearance conditions, including research and consent procedures or
instruments approved. Any change in chief investigator/Supervisor requires
timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on
behalf of SUHREC. Amendments to approved procedures or instruments ordinarily
require prior ethical appraisal/ clearance. SUHREC must be notified
immediately or as soon as possible thereafter of (a) any serious or unexpected
adverse effects on participants and any redress measures; (b) proposed changes
in protocols; and (c) unforeseen events which might affect continued ethical
acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as
well as at the conclusion (or abandonment) of the project.

- A duly authorized external or internal audit of the project can be
undertaken at any time.

Please contact me if you have any queries or concerns about on-going ethics
clearance. The SUHREC project number should be cited in communication.

Anne Cain
Secretary, SHEC3

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Telephone +61 3 9214 8605
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2008 SWINBURNE CENTENARY
Celebrating A Century of Vision
www.swinburne.edu.au/centenary
The conduct of the interviews with exhibition designers and planners properly meets all the conditions pertaining to the ethics clearance. The research data, annual and final reports have been submitted to the Faculty of Design.

Wi-kuan Lin

Signed

07/04/2011

Dated
**APPENDIX 3**

**INTERVIEW TRANSCRIPTS**

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<th>Question</th>
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<td><strong>1</strong></td>
<td>I was the senior designer at the performing arts museum, at the Victoria Art Centre. My responsibility was to design and install the exhibitions at the performing arts museum, which changed every quarter. We had support exhibitions, which are smaller exhibitions but which changed more frequently every two months.</td>
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<td><strong>2</strong></td>
<td>The responsibilities I had in developing my designs were pretty widespread. I pretty much lived in conjunction with the curators and designed my exhibitions. Quite a free run-off. How the aesthetic side and interactive sides of exhibitions should work within the given space.</td>
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<td><strong>3</strong></td>
<td>My background is in commercial exhibitions and I was trained in Germany. Training involved visual merchandising as well as trade shows. I had my first museum job at the Hobart Museum of Art Gallery. There was a new project. We were taking the museum out to country schools. It was a travelling exhibition. You had exhibition components in there, which were easily assembled and dismantled, travelled from one school to another. There was a lot of preparation work in which I was involved all the way from producing imaging to text, text panels and graphic panels.</td>
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<td><strong>4</strong></td>
<td>What I try to achieve with my exhibition design is to engage the visitor to be in some sort of interactive ways because the museum has got the stigma attached to it, as being old and boring. At the performing arts museum, luckily we had some wonderful things, which ranged from rock exhibitions to opera, also to artists, photographers and even designers. In those exhibitions we also tried to engage families and ordinary people rather than producing exhibitions for specialised audience, being appealing to all spectrum of people. We spent a lot of time trying to work out what does work and what doesn’t work. We did a lot of surveys after exhibitions to pinpoint areas which do work.</td>
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| **5** | There are certain constraints and limitations in the museum environment of what one can do and what one allows to do. There are a lot of preservation issues which have to be observed, and the curators are making sure they are observed. Most designers need to find themselves in this space which has to balance between an exciting exhibition but still has the protective nature of museum environments, meaning costumes cannot be presented in such a way that everyone can touch them or be too close to them. Memorabilia obviously have to be behind glass. Security is another issue of it. 

The principles I always applied to my exhibition were the principles of discovery, not knowing what’s around the corner, what you could expect to see. I avoided open space exhibitions, but created passage ways which lead to somewhere. 

The space I worked in at the performing art museum was about 500 m². It has the state of the art light and sound equipment, which we tried to and did incorporate quite extensively in exhibitions. The other
principles were to present something which was legible despite the constraints, like working at times at 50 lux levels and yet still producing a display which would be legible and readable, and presented in such a way that is aesthetically pleasing rather than just here it is and this is what it looks like and that is all we are going to show you. The environments and atmosphere created in the space were important parts of design principles. I did quite a few successful children exhibitions, which created the feeling of adventure and discovery, included also interactive parts where, for instance, kids could dress up in costumes and see themselves in funny mirrors or being photographed on stage. We also had guest artists, who came and being engaged in performances. That was another standard way of producing interactive exhibitions rather than static exhibitions.

6 The educational role was obviously a very important part of exhibitions. We produced educational folders for schools which hold all the educational parts in it. In our communication through graphics, posters, labels and audio, we tried to educate visitors to have a total experience rather than just static displays.

7 My involvements to respond directly to the educational aspect of exhibitions in my design were really limited to the meetings I had with the curators, who created the exhibitions and set a theme, way or guideline of communication. I was very much guided by the curators about the educational contents that went on the exhibitions.

8 Space design obviously goes hand in hand with telling the story. I mentioned earlier about the discovery and experience of having interactive aspect of exhibitions. Space has to work hand in hand with the way it’s presented. As I said earlier we worked in a space which was quite large. We made the space rather than an open space. We had open spaces as well where the space really worked extremely well as an open space. It depends on the theme and exhibition itself, which need to be looked at and designed accordingly what is required for getting the feel and getting the theme going.

9 Please talk about your experience in general? The places I used to work in the budget was usually very low. We had to try to produce impressive exhibitions with very little money. It required a lot of creativity imported from various sources, maybe from lighting designers, stage designers and all kinds of professionals who were dedicated to exhibitions often providing amazing services. The other thing I was going to mention is that working with curators is often challenging depending on who you're working with. The constraints often post on the designers what is allowed and what is not allowed is really challenging, to reach a compromise way or win-win situation to all the parties and still come up with an exhibition which seems quite well received by the public.

Did the museum have any process for evaluating exhibitions? We had headcounts to see how many people come to visit. There were questionnaires. People filled in and at the end there would be a prize. We even tried to employ professional people, who had their own evaluation process. They researched all kinds of ways and means. But, I’m not quite sure what the detail. There were quite substantive reports written afterwards. Did all those evaluation ever touched upon the educational aspect of exhibitions?
All the time. Our biggest visitors were schools and other educational institutions, which came by the bus loads to see exhibitions. We had educational officers on board as well, totally responsible for smooth running-off of educational institutions.

*Any specific sequence you put the content in order?*
In some cases, there was a chronology which has to be followed. It was important for curators the chronology was there. The chronology was based on the year or contents. Other times there was no chronology. There was basically just a mix of ways. We did not bother having a particular order. Probably the most difficult thing designing space is when you want to create an order or sequence where it should follow a chronology. It directs the flow of people in certain ways. Even you break it up. You usually have to have an exit and entrance, even a corridor way leading you somewhere. Some people will enter through the exit even they were told that's the exit. People will just lean to go the other way. In some cases we overcome that by telling the door would only open one way so they could not enter through that way. In that way we were able to have people enter certain ways and exist through the other way. It varies from exhibitions to exhibitions. Sometimes in open space exhibitions you have to find the chronology yourself. Sometimes you can try to have arrows pointing where it’s going. The public are very hard chronologically controlled and directed. They do what they want to do.

*Are exhibitions within open space easier or more difficult for visitors to understand the content?*
Open space really reveals a lot. If it's well designed, there is still some discovery. It's not really easier. The demand of work which goes into designing exhibition is pretty much the same no matter what it is. As a matter of fact I always used to say that smaller exhibitions just take much energy and time as the bigger ones.

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**Simon Gregg**

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<td>1</td>
<td>I'm a curator of the museum. <strong>Do you do exhibition design work also?</strong> Because we have very few staff at the museum, I do exhibition design, content, research, writing panels, marketing. I do registration, which is condition reports, loans. I work on public programs as well. I give presentations and talks. I don’t do graphic design myself. We do have a graphic designer, but I'm very hands-on with the materials we produce. It’s really overseeing all the marketing development side of the museum. I also got sponsorship from some of the people who we can work with, who can provide us with products at a discount. I do media interviews. Actually I have very little time for exhibitions. It’s essentially what I’m here for, to put together exhibition programs and to deliver that to the museum.</td>
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<td>2</td>
<td>I get all the responsibility. I get given an allocated budget. For temporary exhibitions we get about 30,000 a year. For permanent it's also about 30,000, but it's more for maintenance. For the temporary shows it's more producing publications or for loan fees, but within that</td>
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I have to cover all the cost for exhibition design. Because it tends to be quite expensive, I do a lot of things myself. I do have a carpenter who helps me build walls. I don't do the walls myself, but I do all the painting myself. I do the vinyl lettering myself. I do the images, cut them out and stick them on. I'm very hands-on. I like building things myself. Partly true it's cost cutting and because I enjoy it. Because I'm an artist and like making things, I do as much as possible. I'm entirely responsible for those exhibitions. If I decided to I could pay an exhibition designer to come in and do something for us, but I just choose not to. It's my responsibility to come up with the ideas for the exhibitions, what I think will attract the audience, then to think about what information to put in there and to think about how to present the information. There many different phases to that. Of course at the end I do all the reporting and statistics, but then you got to be careful for the budgets. There are many different sides to it. It's one percent inspiration and ninety nine percent frustrations.

I'm probably a little bit different from most people. I never studied exhibition design. I studied painting. Then I studied curatorship at university. I go to galleries all the time. I tried to see all the exhibitions in Melbourne. I'm inspired by artists. My exhibitions have been art exhibitions with historical component. How do I learn about it? I guess I just taught myself. I probably have a very strong design aesthetic. I'm very interested in combinations of objects and colours, and how they make you feel when you enter a room. I like my exhibitions to be an immersive environment. When you move into them, you're no longer aware what building you're in. You're just surrounded by the environment I created. I didn't personally work on the gold vaults. That was done about ten years ago. I think it's wonderful what they have done down there. I have been inspired by that. I like the idea of walking into a space just animate around you. Our movement is able to modify or modulate the exhibition environment around us. I think it's really beautiful. I just learned by seeing other examples. I have some favourite exhibition designers. I think the current show at the ACME at the moment is really powerful. My personal feeling is that they could do a little bit better than the National Gallery because they got great works so they can do more to modify the space. For a particular show they could do a little bit coat of paint each time. I guess I'm lucky that I can work with art works and artefacts, and I like to use the space. Most of the rooms we have are four by four meter square, but the ceilings are five meter high so they are higher than they're wider. I like to use the height or if I'm going to have something at eye level I'll address the height by bringing or introducing a colour scheme that cuts the space in half. Just different techniques like that. I'm always looking at books and other exhibitions. That's how I learn. I'm always very hard to myself, thinking about what works, what doesn't. People often come to me and say the label is too small I can't or it's too low. I'm always listening to advice, and taking that on board for future shows.

I want to offer an experience that people can't get anywhere else. You can't get it just by reading magazines at home. That has to be something you experience by coming in. So I try to create physical sensation, and immersive environment within the museum. I concentrate on the two little temporary exhibition rooms we have because permanent exhibitions is a little bit beyond our budget at the moment, but I've got some ideas for that, to carry through some of the ideas I developed for
temporary exhibitions to the permanent. Basically my objective as an
exhibition designer is to make them really excited by the information,
and help them learn without even realising they're learning. You don't
want to feel like in a classroom or school. I want it to be more cinematic,
to be like going to a theatre or a play or something. You will be amazed
by all the things, lights, shapes, shadows and movement. When you
emerge and come away, you realise 'Oh! Look, I actually learn
something'. You can tell people about it. That's what I want to do.

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| Our exhibitions are really dictated by the space. I’m thinking mainly
about the ground level, which is the space I mostly work with. The gold
vaults are something else again. Although we’re thinking we want to fix
up the last two vaults, nine and ten, which are closed and not open to
the public at the moment, but we want to put new exhibitions in there.
Those shows will be dictated by the gold vaults. You can’t just stick
anything in there. They have to acknowledge the context. Those shows
need to be gold related because of the gold vaults. It would be nice to
have something that work in the space. On the ground level, they used
to be offices in the 19th century. They were never meant to be museum
exhibition spaces, but they work in a strange way. If it’s chronological or
thematic or if you present series of ideas and narratives, you can
present one idea at a time. Plus it gives the element of surprise. When
people move through the rooms, they have no idea what they’re going
to find in the next room. At the moment the walls change colours. We
have different objects and you encounter things that might be
unexpected. I like using the structure of the space in that way. You have
to work with it, not against it. In our case, it’s basically presenting a
series of small ideas showing the progression. It’s just the layout of this
building. There is no other way of doing it. I do exhibitions at some
other places, like an art gallery which just one big white room. I’ve
found it so difficult now. I just want to paint it all different colours and
build walls to make lots of small spaces. That’s how I start thinking
them. I’ve found big space is a big challenge.

Because you want to give your visitors some surprises, you probably do
not offer a lot of information before they walk into the next room. How do
you connect all the different spaces?
They are all part of the one overriding exhibition on the ground floor,
making Melbourne, so the presentation of information is consistent. We
have the same kind of panels all designed by the same person. They all
look pretty much the same just information changes. I guess when I
talked about surprises in the next room, I’m talking about things appear
to the senses. You might encounter new sounds. … The first room you
enter is painted red. It’s a more vibrant room. It’s a different layout as
well. As you enter it you will hit this very long case which got these
objects in it. You may have to actually move around that. I position the
bay and costume in such a way you don’t actually see them until you are
right there upon them. The way we present information is effectively
the same as the next room. You do feel it as part of one whole.

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| We see us as an educational facility. Since the school groups form a
large part of our audience, We get anywhere between 5 and 10 groups a
week sometimes more, comes fifteen, twenty groups just in two or
three days. I don’t do the school groups. Thankfully somebody else does
that. It’s very important the information we present is consistent with
what is in the school curriculum. It’s what students are learning. When
a teacher wants to teach her group about the gold rush, she can bring them here to experience the space where actually happened in the city exhibitions here. Even though the educational role is really important, I don't design exhibitions with school groups in mind. I have been often reminded that there will be school groups because I put things too close together. Our educational person says that, Simon, we need to be able to get twenty students in here. For me the most important thing is the exhibitions are exciting and interesting, and it's a pleasure to come in this space. The whole educational role I think it's less important for me. There are so many ways of learning. Because we're a museum, we do have the responsibility to represent information to schools. But I'm thinking more about the general public than schools when I design exhibitions. I'm thinking about one person who comes in by himself, got half an hour to kill and wants to see what's inside, and just take them on a journey where they've never been.

What's the major role of education department?
We've got one person who is part time and comes here with the school groups. There isn't really an education department here. He has also done an educational kit. His job is to make sure something in the museum that relates to schools’ curriculum and make sure school kids would be coming in. My last job at the art museum we had educational staff who worked with the curator. The curator would come up an idea and invite artists and design the exhibition. The educational staff would bring in additional elements that were often part of the exhibition. There was an exhibition about narrative paintings, paintings told a story. One of the thing she did was she had this big tube with little holes in it. Kids can come along and stick their hands in the holes and feel the objects in there. It was an object in one of the paintings and they had to try to guess what it was. I think that's fantastic. That actually gave the kids something physical to engage with. That makes us think about what we're looking at and makes connection in their heads. It's really a matter of resource here. We tend not to have so much of that now.
There is something I want to introduce actually. I want to bring more of the Melbourne people into the museum, biggest from the history. I'm going to have silhouette cut-outs of figures, just the black figure and saying on it "Who am I?". You have to try to guess who it is. When you look at the back, it says what the name is. Maybe something like that. Maybe with figures in each room you can look for the figure and that becomes a guessing game. We could do like a treasure hunt. During school holidays we always have holiday activities. For the exhibitions I do there need to be some activities that specifically relate to children. I try to do at least two or three shows a year that are specifically targeted to children, particularly in the school holidays. This summer is coming up for doing magic, magic tricks and magicians in Melbourne. We will have magicians come in for performing. Kids will learn what the life was like in Melbourne a hundred years ago. You go out on a Saturday night and see a magician performing at the theatre. Something people don't really do any more. That's the way I'm offering fun and entertainment and also people learn something about the history of Melbourne.

I've never been asked to do anything specific for educational groups. It's more an obligation than a responsibility. We do have visitor evaluations. It's an on-going thing. We have forms people can fill out. We can improve what they learn what they enjoy and what they did. We
collect that information. We have some interesting and helpful feedback. I do feel the kind of obligation to provide people with information. We do get requests from the public from e-mail saying 'we want to know how much this much gold would costs in 1960. Can you help us with that?'. We do provide that service. There is only so much information we can actually put into the museum. You can only really put three hundred words on a text panel. It's very limited. I try to provide additional resources for exhibitions, like catalogues. This becomes the resource. It's the whole history. Actually, this is probably more important than the exhibition itself because all the works go into this. The exhibition is just some of the objects that I looked at and researched. You run to have them brought in and made a fond for a show of it. In terms of what people take away or assimilate the information we put out there, often it's through the catalogue, internet or website more than the actual exhibitions. We try to provide variety of ways people can learn about what we're showing.

Do you think that creating experience is also a kind of providing learning experience?

Yes, if you look at some places like Sovereign Hill in Ballarat, the whole place is like an immersive environment. You go back to the 1850s gold rushes. Everyone wears in costumes. You go into the old houses. It's really amazing, I don't think we'll get up to the point where our volunteers dress up in costumes, but I would like to do more that kind of activity. Maybe we can have production or plays in the museum. People can play part of the people who were in this building hundred fifty years ago. The most important thing about having a site specific museum and getting people onsite is that you do provide a physical experience. Something that they can’t get from anywhere else, and through that you hope they learn. When school groups come in, there will be a guy taking them around. In a sense they're teaching kids, but for most people who come in, it's self-guided learning. You go to the areas you want to go to, you read about what you want to read about and learn what you want to learn. We're not teaching them A through Z. That's fine. That's really the advantage what we can offer here. It's that people can have some control in the environment.

How do you make sure the viewers actually learn something from the exhibitions?

I don't know if you can, really.

Are there some principles you use to make sure visitors have a good impression about the exhibitions?

I guess it's a different kind of learning. I'm thinking of academic learning and social learning. I don't want to limit the museum to just present academic information. I don’t want people just walking away reading off dates and statistics. In 1860 there were million people in Melbourne, something like that. There is possibility and opportunity for much crossover between what art galleries and what museums offer. When we go to an art gallery and engage with an art object, you learn something, but you're learning more about yourself. You're learning about the artist presenting a point of view or something. He's teaching how to relate an object. He's teaching us how to appreciate aesthetics and sensibility. That's something I'm trying to impart in the museum.
The way you present an object would not only teach someone about the object but also about how to appreciate it, either beauty or other aspects of that. Like a fine piece of timber from the nineteen century we might not know much about it, but it still has good value. Its value is derived from another time. We might not value the characteristics today, but you can look at it and say this is what we consider as fine art today. There're all sorts of different kinds of learning. I've never been consciously aware of that. Now that I'm actually thinking about it. I'm deliberately clear about the academic side of it.

Do you think if the viewers get lost, it would be harder for them to learn the content?

I think maybe they will learn different things. I like to present information in such a way it doesn't matter which way they go. Like a cheese and adventure book, you can choose which direction you go into the book. You move through in a random way. Some of my favourite galleries and museums do that. Some of my best experience in museums is being one ends up through the wrong door. When I went to the Melbourne Museum and the new Melbourne exhibition they had, they gave me a map and I tried to follow it, but for some reasons I came in through the back door of the exhibition. I thought that was a strange
way to do it. I started in the 1920s, went to the 1840s and then went back to the 1960s. I'm glad I had that slightly random approach to it. As I moved through, all the components started to make sense. I didn't immediately see it as a logical progression. It became a series of ideas and information. I was looking at the information for what it was, but I wasn't seeing it as a big picture. Only at the end I can see how it all fits together. I found it was very satisfying. I think it's just a different way of doing it.

*What was the information you used to make sense of the whole thing?*

It wasn't until I reached the actual entry point. I could look back on it and see the whole exhibition as a whole and say "Yes, I can see it now." They want you to start here and then move over to here. I can see that I did it in a backwards way. That meant that I could pull the exhibition apart and I could look at it from behind, back to front. For me I'm more interested in how they put exhibitions together than the information was in it. I was looking at how they designed it. I found it challenging. That's why I liked it. I had to think myself. It wasn't obvious. But I know that some people, probably most people, go to museums and they don't want to do that kind of thinking. They're looking for different things. They might be looking for specific things. They want to know about life in the 1880s. I feel that we should be able to offer that to people that you can say "Certainly you go down to corridor and it's just on the left." I don't want people to get lost when they're trying to find specific information. Ultimately you can't get lost in this building anyway. Each level has got a long corridor running in the middle and rooms coming up it. Actually there is no way of getting lost although some people do pretty good effort. I have visitors come into my rooms sometimes. That's OK, just seeing different parts of the building.

9 That will be really helpful. I'm not aware of if there're some guidelines already or you're probably going to write one. Yes, it would be tremendously helpful. Most of what I learn about exhibition design is being through trial and error. I'll do a show just see how people move through it. If they're not moving through the way I want them to move through it, I'll change it for future shows. Particularly the temporary show, I want them to enter through the front door because I want them to see a particular thing first. What might be in the second room is like a progression from the first room. If you enter the second room first, you spoil the surprise in a sense. I've never spoken to people about if they go into the second room, why are they doing it and how they felt that changed the way they understood Information. The whole with me going to the other museums, going into the wrong entry, and how that changed I read the information. In terms of criteria, I'll be very interested in that. I think that would be really helpful. How much will help us? I'm not sure because we can't really change the floor plan and layout. I do with other space as well. I do shows at other galleries. I would found it tremendously helpful.

*Generally, do you have any other suggestions for designing exhibitions or exhibition spaces?*

I don't use computers to design exhibitions. I know people who do it on CAD. They've got an object to come in. They get the dimensions, put that in a computer, design the space and know it's going to go exactly here. When it comes to place in the object, you've got an architectural plan
knowing exactly what the thing is going. I never work like that. I just like coming in with boxes full of stuff, and just play with it. I think it's really important to have that intuitive approach, a human approach to design. It's really hard to imagine an exhibition until it's there in front of you so it's difficult to be able to say exactly where things are going to go. I guess I think of an exhibition like I build it up an art work. If there is too much here, I'll remove it and put a little more there. It's up to the composition. I can show you how I actually do it. (Gregg showed some examples of his sketches and explained the ideas and processes.)

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| 1         | My role in the museum is to oversee all aspects of design, across both buildings but also beyond the collection that is lent to any other lender, regionally, nationally or internationally. There is a design support requirement for that art and we provide that. Sometimes it is in the form of basic object mounts and some data descriptions that might support our art works as tours or it might go to a point where we actually design a full exhibition. A key exhibition recently that we took through parts of Australia and up to Asia was a great example where the design travelled with that. Each institution was expected to implement the design we created in all forms, colours, materials and furnished details that needs to be followed. Sometimes we actually tour the materials and display furniture. Other times it's cheaper to recreate. There is a quite broad sweeping. As I said it earlier about the forty template exhibitions that we run. We generally delicate responsibility depending on the hierarchy of the exhibition in our program to either one or more designers on the team. We then work very closely with all the other key stakeholders, primarily the curator, registration, conservation, installation staff, educator, and public program staff to develop an exhibition. More and more frequently these days we're working with the multimedia team because we're finding that new media is a great way of adding dialect layer to an exhibition contents that we couldn't do in the past. References to other materials or films from a period. More and more frequently a lot of our exhibition space has been actually dedicated to media content to help develop description. My role is quite varied. I also work very closely with the executive team on strategic development, planning for the next five, ten or twenty years. One of our new objectives in the next five to ten years is to get a new building or extension to Federation Square so I put a lot of effort into that, putting submission into the government to source funding for works for current buildings also for potential future projects. We're also working on a project to enhance children and family groups. In this phase we're looking for funding sources to promote the idea of vindicate kids. That's both exhibition specific activities and programs in both buildings. Also Looking to dedicate formal spaces, permanent spaces to the idea of family children free engagement with arts. That can also mean that in the future we'll be lending art works specifically for those to ensure that interaction is possible, not just colouring exercise or building exercise. There is an art work there they draw from, and that's part of the environment. We're here to serve the collections. Fundamentally when someone needs something or wants something we're generally called upon to contribute. We're an environment that's rich in ideas in terms of
the designers here, amazingly creative. We appreciate it for that creativity, awareness of what’s happening because we have a lot of doctors, ranges of ages, recent graduates and people have been out there for a few years or decades or so. There is a knowledge base that’s huge. The gallery has a staff of two hundred and fifty people. As I said before there is a graphic team and new media design team. Not only they, because we’re a creative organisation, the staff is very aware of what’s happening and the potential for the future. A lot of times we’re restricted by budget and our time frames to be able to achieve an amazing and ambitious organisation. Sometimes I wonder how we manage to do what we do within the resource that’s available to us. We go hundred and thirty percents because we know that’s worth of doing

2 I have full responsibility. I report directly to the deputy director and director. They trust that my knowledge, skills, advice and expertise on design is appropriate, and support ninety nine point nine percent of the time what my recommendation. The gallery is very aware of the importance of design as an attractor to the audience so in that we have a lot of support to be innovative and try to do things differently. Again, the constraint there is time and money, usually. It’s not through a lack of real world ideas. We’re always the first who admit that we don’t know everything, but we always know someone out there who we can draw on. That’s the network we rely on heavily. For areas to introduce innovation, you just ask questions.

3 I grew up in Zimbabwe, and my parents are British. Every three years they used to take us up to the UK, primarily to visit family relatives. That always involved at least one visit through gallery or museum. When I was in the museum it was like "This is what I want to do." I knew from the very early age I want to do it in the field. I didn’t know there was such a thing called exhibition design. I always knew that I’d like to work in one of the environment. .. I always know I want to be involved in exhibitions. I learned specifically about exhibition design when I was doing industrial design degree, at that stage coming down here and pointing the gallery space and then finding the design department, forcing myself upon it as a volunteer. It’s a great way to learn about the profession. Specifically exhibition design related to museums is quite different to exhibition design that is related to more commercial aspect.

4 At the moment, we’re trying to achieve animation, a different experience, an experience that is specific to the curatorial rationale, and also sensitive to the art work. We don’t want people walking away overwhelmed by the design not remembering the art that they are here to see. Finding the balance, I suppose. Like all our society we’re also very keen to the nature, what we do is sustainable, recycling anything we build, being sensitive to the types of materials we use. Obviously with art there are quite specific requirements, the types of materials that you can’t have interacting directly with art. There has been sort of international standard that we conform to, but just with the amount of construction, the type of construction, the frequency of construction and demolition. During the redevelopment we had a fantastic opportunity to create a modular system. That allows temporary walls, the modular, and they work in both campuses. Looking at the down time when we were closed gave us the opportunity to do some R&D and prototyping, full scale prototyping of systems that we could reuse and simply modify to add to variations that we didn’t have before. A lot of the materials have been offered to the college of the arts and some of the design schools.
Nowadays we work within quite specific modules unless the artists have given us a specification that we need to follow. Most of our work is based on these wall modules and standard furniture that get recycled. We have an off-site storage facility at the Westgate Bridge. The material travels to and from occasionally. Most of the time we try to keep it in active service. That has been substantial benefit to us. It also allows us to reconfigure the space very quickly and simply to give the sense of you visiting a new environment even though the perimeters and volume don’t change. The subdivision allows you to create a different feeling.

Initially in a way it’s dictated by the curators and the works we display. They’re quite often presented in either thematic or chronological groupings or media based groupings that describe the very basic of how much space we require. We also have as a dictate of where a collection, especially a temporary collection, is given an area to work within. Depending on how the actual curatorial process is, we can then work with the curators to adjust the scope of works accordingly. Sometimes you can’t. Sometimes there’s an agreement that will take exhibition X. Exhibition X contains this amount of works and you have to make it fit. You do that by subdividing or suggesting double or triple hangs and grouping things in a dynamic way. Then you have fundamentally occupation and health safety, making sure they are simple and efficient, parts of ingress and egress, parts of access to space, making sure that occupancy number can be checked. With blockbuster exhibitions we want to get as many people into the space as we can. In a given period we also want to make sure we can present much art within those spaces. It’s ensuring there is adequate floor space for the visitor, but also for all the parts and equipment that come into to prepare and install those exhibitions. If you’re doing a big sculpture in an exhibition, for instance, you might require a whole crane to safely install that art work. Making sure that the turning circle, beam angles and ceiling heights are appropriate. The floor loading and the environmental system support the number of people that you’re hoping to visit. If it is media and heat built up from the equipment something like that, making sure that the air conditioning system is going to cope with that, but also create a space that’s comfortable and friendly, welcoming for the visitors. Sometimes you have to bring in a secondary system to create an artificial backup for those buildings’ mechanical and electrical services. The considerations of lighting, furnished materials, fundamentally it’s all driven by what you try to display and what you try to achieve in the display. Sometimes you have to negotiate with the curator to persuade them that maybe they’re asking for is unachievable or it’s probably better to be presented in a different way. Often the curators have these amazing backgrounds in specific subject matters. Their favourite works may not necessarily be the most visual work. The most important work to them academically by an artist might not be the most visually attractive work. Negotiating for a sequence of works that help you navigate the space, putting key vista points so you use the art works to draw people through the space as a mean rather than a number of systems pulling the duck’s feet that type of approach.

Increasingly more and more important. We traditionally have in the past as a gallery experience. Education has always been there. NGV does it incredibly well, but it’s been in the background to exhibitions. It’s been a series of support, events, programs and initiatives. Whereas nowadays exhibition contents are very specific. A current example is an exhibition
we're opening on Thursday next week, which is specifically aimed at children but has a very strong import from the educational department as well as curatorial department to develop a proper presentation. For the first time in the history of the Gallery we're presenting all art works at a lot of heights, a lot of interactive fans in the space. There's actually a children area within the middle of the space, which is normally put aside. You have to go into a classroom to do activity. Like the centre of the temporary exhibition space, there'll be children activities, screens, little identifying pictograms they need to look for. It's the beginning of whole load for us. Education plays a role in every single exhibition that we develop. We have what's called exhibition project group, which means eighteen months before the exhibition is installed. It means twelve months out. It means regularly from that on as you get closer to the exhibition the meetings become more and more frequent. Those meetings represent most of the departments within the organisation. From those you get all series of fragmented, smaller groups. The education staffs live in here all the time. They work with the graphic design team and exhibition design team to develop up the concept that they use specifically for their programs and to ensure that what we are hoping to deliver on the exhibition front is achieved and appropriate. We designers may not need the criteria they're establishing. We try to link a lot of our materials into the course structures within the various education levels, primary, secondary to tertiary and beyond.

Understanding who your audience is going to be and what you're trying to achieve with the audience is quite important. In line with that, with some of the big exhibitions we actually do market research. We'll present to a market research group a concept that we're thinking and developing as an exhibition. Those questions will be targeted around promotion and sponsorship but also education where the public feel the content is something they like to see and they know about it. With those major blockbuster exhibitions we do a market research program before the exhibition is formally signed off. But then we do a series of interviews throughout the life of the exhibition. The public are engaged by professionals to respond to a series of demographic questions. As designers we just often take up an image board up to the gallery space, one of the foyers. As soon as you do something like that, the public engage. It's very easy to ask questions, basic questions like 'what's your favourite image?', 'what would you like to buy as a catalogue?' 'If this is the catalogue front, what would you think?' We prototype a lot of things. When we select colours, we often get old boards, paint it up and walk them around the gallery. Because we're fortunate enough to have quite a diverse collection, generally something that we're going to borrow there is an example of it or a similar item from the period in one of our collection. We'll take these big sample boards up in the gallery spaces which haven't been created lighting condition, floor furnishes or something like that. You can see how colour and finish vary depending on the lighting source. Education into the future will play a more important role in everything we do, especially education activities that relate to family and children. It's part of our strategic objectives for future to engage more specifically with family groups and have that engagement quite prominent. One of the first things you experience when you come into each of our campuses would be a children and family activity, free of charge, linking to that, specific parts of interactivities within exhibition spaces. Some of those would be stand-alone, doing it on your own.
activities. Others would be guided by professional museum staff. The role of education in exhibition design is becoming increasingly important to a point next year I’m going with the head of education to the American Association of Museums annual conference in Philadelphia to look at how the rest of the world are doing things, more importantly and specifically how north America are doing things. That’s how important it is to us as an institution.

*Have you ever done any visitor study to really measure their learning outcome or what they actually they learn from the content?*

I don’t know specifically. But I know the educational department do a lot of survey work in what they do. ... They have to report to the government on their outcomes so they have to put a plan to the gallery. A lot of education staffs are actually supported by the education department not by NGV. Their salaries are paid by the government so they have to seek funding for their activities from the government. They would have a lot of qualitative and quantitative data to back up what they do. I know that every month they report on the number of programs and figures of what they have done for activities they conform to. I’m sure that part of the evaluation around that would be some evidence to the institute. We get 250,000 plus students booked into the gallery every year. People wouldn’t come here if the activities we’re providing were not substantial. Beyond that there are self-toured groups that come in from independent schools with their own teaching staffs, but in terms of booked school kids, at least 50,000 per annual come in to have one of our staffs take them through activities.

7 The approach is collaborative. The frequency is becoming more frequent. Every exhibition into the future and permanent collection is going to have a major overhaul in terms of how we use education tools and activities to enhance what’s on the display and show people’s memory relevant to the contemporary culture

*How does that affect your design?*

The way we post information traditionally is being the NGV voice, the curator. Usually the curator is giving you an interpretation of the works. At NGV Australia when we opened, we had a program where we asked whole lots of students to interpret the work, and we presented that as a secondary label. You get the curator’s interpretation, which is usually art historically correct, but then you get a whole series of variety of responses to the same work from students from all years of levels. In December, we’re launching the archive of those collective voices as a touch screen that will have initially just the Joseph Brown collection but eventually more widely spread throughout to our collections. It becomes quite a visual pollutant having too many labels on the wall. Some of them are incredibly poetic and insightful. Some of them are quite concise and succinct. Others are like essays. To have one work inspire so many people, and we’ve done this with the education team, is amazing. Recently I was reading through some of the comments. They were outstanding and I was quite emotional. It was that reading the materials comes to us and suggests that we put in an electronic archive that people can flip through. How can one piece of art inspire so many different responses? Aligned to that is this we also now with audio components had celebrity guests come in and pick their favourite art and talk about the art work. We can record that so that people can listen to the
differences of opinions again on the collection of our art works. We’re looking more and more at creating little pictograms that families and children can easily identify with. We might see a little cricket, for instance, and there might be children related question put with that. Rather than saying 'This is...', it's 'What do you think?' or 'Have you noticed...?' My idea would be to have exhibitions just the questions in it. Beyond that would be an exhibition without labels. I often feel that people come into an exhibition and walk through. If you just stand there and observe, they just read the labels. I’ve seen the Picasso. I’ve seen the Rembrandt. I’ve seen the Cézanne. If I would ask the same people 'What was in the painting in terms of composition or colour, I doubt anyone or few would be able to give me a decent description of what they’ve seen. They could tell you that they possibly can remember the title of the work, but actually what they’re seeing is a different story. We did some experiments here when we opened the building. The fibre-optic lighting system that we had in the display cases was incredibly sophisticated. It’s like a doll’s house system. The little micro fillings can focus down to 3mm diameters and can bundle and crop. For one of the display cases in the 19th century decorative arts gallery we exaggerated some of the shadows of some of the glass. The glass is quite ornate. There is etching and engraving. Some of the beautiful forms ensemble some of the horses that we have. We use an up-lighting system from the fibre-optics to project an over-sized shadow of the horse in the glass in the background so that people would visualise and remember the glass because of the horse shadow, not necessarily the glass. We experimented with looking at the detail, remembering the detail and varying some of the lighting methods within one display environment. It had an amazing effect. We did some informal survey. The one thing that people kept talking about was the case with the horse in it and the glass. Our curators weren’t keen on the idea. They were quite conservative or traditional in their approach. That was about consistency, flat light and we should be doing this. The theme of the object is important, but in terms of learning approach it is the way to do it. ... There are lots of technologies. The possibilities for us now with the advent of technology and wireless audios, something like that. People can pickup information on their mobile phones and have the additional layers coming into a space to help. You can choose options through one to five from your phones depending your age groups, family or interest in an art work, artist or whatever it might be. This whole layering of information could come up on part of our flowering. I look forward to the future and what we can achieve.

Yes, I think I probably answered that in some of the responses before. I suppose every time we do an exhibition the true evaluation of the exhibition is when the public get in there. For instance we just closed the Art Deco Exhibition. There were spaces that we designed and thought we're going to design better than they did. Getting back to the whole media thing, one thing that we haven’t accounted properly was the impact of some of the media layering, the film we put into the space, how popular that would be and what impact they would have on traffic flow. We were getting groups of people blocking access to the other parts of the collection, specifically within the Normandy film. The posts in the show, the placement of the screen and the audience who went to look at the film made that anyone who was going to see the posts behind it was trapped or couldn’t get access to them because of the configuration of the space. Also the number of people that we had through the exhibition, for
future exhibitions, the Salvador Dali for instance, we've already decided
the film will be presented much higher on the wall to allow a greater
audience to see from a distance. You're really going to have to look up to
see a lot of these things. I suppose formal evaluation of spaces and how
they work or whether they work practically or whether the education
intention is delivered and remembered, I think it's quite difficult to
evaluate. But in simple terms, standing in the space watching people
interact and how they interact for me is the best way to do it because you
straight away see the problems. We have a formal response system here
where visitors can place comments through the information desk. I know
within a moment of the exhibition opening if there's something wrong
because there will be someone who is kind enough to put in a visitor
response, lighting is too low or the labels are too small, not enough
seating, noisy environment. As an exhibition design manager, you have
to find a balance between providing information in space, we're talking
specifically about labels which are probably one of the most common
aspect. Designing a space for presenting a series of jewellery, for
instance, they are very small scale. You complement that with a series of
didactic explanations. Our labels are renowned to be one of the biggest
labels in the world in terms of the type faces and fonts that we use. The
balance between the integrity of the art work and the didactic material
that supports and the visual confusion can occur in terms of pollution or
possible pollution is quite a hard thing to track and measure. We know
we have to provide legible, clear, concise information. But we also know
that the information sometimes overpowers what you actually try to
present. It's that question about 'is it better to have this information in a
book? And try to encourage people to either purchase or you give away
the information for free?' I don't know what the answer to that one is. I
think it relates to a lot of things I've been saying previously. It's like any
process that's all interconnected. Everything relates.

Yes, it's a very simple answer to that. I think the important element to
add to that is that you have to prioritise education. To provide a space,
the idea of educative role has to be important to the organisation. I think
we're heading there. We're getting there. We're not there yet, but we're
definitely heading there. That means allowing for physical space for that
type of engagement to happen and making sure that it's prominent and
relevant within the overall experience of engagement you try to offer in
an exhibition. As I said it earlier our education experiences have often
been taken away from exhibition space and into a classroom
environment. Often the classroom environment is the back of your house.
What we're hoping to achieve in the future more and more regularly is to
have our audience engage with education activities within a space.
Whether that's basic a series of questions that are presented within the
space or as I mentioned earlier just a physical environment where
relevant activities are part of your visit. You go through a space and you
are asked to play or interact with a series of options. In terms of the
requirement to the space I think it's not any criteria sitting around it. I
think it needs to be flexible and adaptive. The important thing is to have a
space because I think it should hopefully evolve those parts of related
experience in exhibitions and should have some thread of continuity with
the design. In my opinion it shouldn't be like you go into a space that's
designed for Salvador Dali and you suddenly head off to an adjunct room
with whatever in there for you to play with. It should follow the design. If
you're creating a serial feel or approach as a design approach for
exhibitions, the activity centre should also fit in. Very important to have a space. I think the criteria should be flexible and adaptive. Make sure it's got enough power and data and environmental conditions to cope. It might also mean another layer to allow us to have ways of activities or something like that.

_Do you think in the future the exhibitions will provide more experiences and activities, and all the materials and design will go for the learning experiences?_

I hope that’s what we head. We always try to present as many examples as we can to our audiences. Whether that means providing fewer examples, better descriptions and interaction with those examples through educative engagement I don’t know how far we’ll go as an organisation. But the sign at the moment in 2008, I’m definitely saying 'We want to be there'. We’re telling the government our strategic plan, that's what we want to head. How we achieve that is up to us really. We just need to make it happen. Design has the strength in this organisation. We have the opportunity to help our colleagues in education to become more prominent. They deserve to be.

_Have you ever done any evaluations for exhibition spaces?_

We have a very big staff. The staff is quite fortunate. They get to travel a lot, especially the curatorial staff. Awareness of what’s happening around the world is one of the tools we use to test. Whenever someone comes back from a Korea trip or research grant or something like that, there is a lot of formal learning and formal discussion about 'What happened?', 'What did you see?', 'What was great?' or 'What was not good?' We go from there. Obviously there is always reviewing and researching anything that come out the publication or online. ... It is a continuous thing. Sometimes you just know. You do something and you thought it was going to be right. If you’ve got the chance to change it, you do, but if not, you just know that we may not stay there or it would be so much better if we did this. If we can, we make it happen. If it's not the first opportunity that we get, we do change it.

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<td>1</td>
<td>My role in the museum is to work collaboratively with other museum professionals; mainly curators would be the first step and obviously the other designers. Also conservation, registration, looking at protecting the art work. Aside from all of that, in reaching the visitor's experience when they come through the gallery in whatever capacity it may be.</td>
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<td>A lot of responsibility actually. In this current institution, a great deal of importance and weight is put on the exhibition design and experience to the visitors. Therefore, a lot of pressure. It's involved with that it sincerely believes the institution that the better an exhibition experience is a better look and the more people will come through. I suppose on the business side of things that is critical, because the more people come through, the more revenue you create and the more sustainable the institution is for the future.</td>
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_Are you in charge of the whole exhibition design, or do you do part of it?_
I'm part of the team. I'm working kind of a more senior role. Obviously Daryl West-Moore is the boss. When I work on projects, I lead them through work with the curators, directors, other institutions. All of that.

Do most of your missions come from the exhibition manager or from the other departments?
It comes from the curator really, most of that. Generally speaking on the projects we work with, the curator is the one that first inform me and research into the project. ... It's my turn to learn from them basically. But sometimes it’s different. As we were travelling the exhibition of Art Deco, we didn't have the curator in hand so we all starting fresh. That became a marriage of exhibition management and myself to get that show up.

I did a year of fine art, and majored in furniture design and photography at the School of Fine Art in Tasmania. I knew that I wanted to move on to the built things in environment. I didn't want to study architecture because I thought I would get frustrated by the long time frames of projects. I started looking at interior design and found the courses at Swinburne, which had exhibition design, and which I thought it was the perfect short term project solution as well as being art focused.

After you graduated, how did you learn?
Learning by doing was definitely the way it came across. Learning by visiting is also very important. Visiting not only other temporary exhibitions and permanent collection in museums but also theatres, things on the stage, short term kind of performances that things are knocked up and taken down. Just being aware of and seeing all those things, I think.

I think the thing with exhibition design is that when the visitor comes through they don't actually notice what has been done. The idea is that the art work is the primary reason they come. I suppose in a roundabout way what I'm trying to do is to make whatever the exhibition looks the best it can be.

Besides your own idea about exhibition design, do you get other goals from the institute?
No, not specifically I don't think. I think an important thing to know is who your target audience is when you design an exhibition, being aware of the broad aspects of who need to come and what they need to leave from the exhibition and what I need to try to achieve in the design. So if it's for small children, obviously the show is going to look completely differently with elderly audiences coming through. So yes, I suppose the institutional goal is in a sense of who is going to visit and what they need to learn.

Can you give me an example of how you design your exhibitions for adults and for children? How are they different?
For children, things need to be simplified in a sense of the hierarchy of information in a way presented to them so trying to look at breaking up the exhibition space into smaller sections so that they can concentrate. For example you have a cluster of small objects and a big graphic in it so that they can feel they discover a little bit more. Things will be at a lower height so that they would again feel like they're interacting a little bit more. Whereas with adults, the paintings would stand a little bit higher on the walls if there are paintings on the walls. Even with the languages
the didactic materials would be a little bit more sophisticated. Lighting, colour, all those things would be considered, but would be specific to the topic also.

A primary concern when organising a space is the traffic flow through it, ensuring you’re not going to bottleneck people. There won’t be a lot of traffic flow that you have to be waiting to get through a corridor space. Making sure that people don’t feel trapped in exhibition space, but you’re guiding them through it without thinking about it too much, so they don’t get distracted from the work.

How do you organise the space related to the content?
With the content, that varies greatly with exhibitions. Depending on what the content is and how much the curator has already grouped them. A lot of time there will be already a series of groups. The curator has come up with themes already apparent within their writing and research. That’s how you start. Filling those things in, playing a game of text. Essentially trying to work out where thing goes. Other times there isn’t an apparent reason. Sometimes the content is just organised to look good. Most of the time there is a curatorial reason, chronological. It varies.

Very important. I think that’s the nature of exhibitions. I think that the reason that people come to see exhibitions is to learn more about whatever the subject matter is. ... They just want to be seeing something that they think it’s beautiful, but they will be in reaching a day by coming to see an exhibition.

How does the institute emphasise the educational role? Are there any approaches or programs or anything?
The national Gallery of Victoria has extensive programs. We’ve got probably thirty or fifty people full time professionals all about the educational role. It varies between education for small children coming in on a holiday, school groups, adults, public programs, film series that come with the exhibition, books, literature, on-line content. It’s what the institute is about. It’s about education.

Do you think the institute is concerning more about the educational role of exhibitions? Do they think exhibitions can achieve the educational role? Do they put more pressure on exhibition designers?
I don’t think there is more pressure on the exhibition designer for the educational role because I think it’s one part of an exhibition that is supported by many other parts, which are the floor talks, public programs, and a whole series go with it. The full responsibility isn’t on the exhibition. It’s a whole suite of things the company get. The exhibition is formed part of that.

No, I never ask to do that. That’s just something that you do. That’s the intention of the exhibition that we put on here and one of the reasons we actually put exhibitions on already. It’s never spoken about. That’s what we’re doing. We take it for granted that the visitor will learn when they come to the exhibition and we will help them learn. That’s the organisation and the content. That’s where it starts. If it’s quite complicated then maybe that’s when it is chosen to go the chronological format because that would be the easiest for the visitor to understand. Otherwise there might be grouping that would make it easy for the visitor. Everything responds to the learning that needs to take place in the space. In approaching that, it’s about the way you group objects.
together, which objects go together, as well as didactic information that support what they see, background information put throughout the exhibitions as well. ... It comes down to everything, the colours you use, the way you design the space, section relating to the work, the way the space feels, the way it leads, all of those things contribute to the learning aspect.

How do you enhance the environment so the visitor can focus on the art work?
The interesting thing about what I do is that nobody has any ideas about what I do. People know that I work as an exhibition designer full time. They would come with me and see the art deco exhibition when it was on, but still not have any ideas what I have done. They would walk through the space and look at the work, at least the focus. But they're not seeing the way they walking through the space or the walls or the colours or the fabric treatment. They don't see any of that because they are looking at the work then I know I've done my job. The way all the colours, any graphic treatment, texture, whatever come into play needs to be sympathetic to what work is there and what that's about in that section, and that's why I don't think it takes away from the art work, just supports it and makes it look better.

It's a difficult question I think. I think that everything about the exhibition is to do with learning more about the topic. Each exhibition needs to be approached in a completely different way. In regards to that, really complex exhibitions, you might need to come up with a way of a booklet or something that visitors take through. We've done before. That helps them navigate through the spaces. Making really broad and obvious headings and subject matters to each different space and designing the show in such a way it becomes very clear when you moving through from one section to another section. It is another way that we help with that learning. It's like a timeline or subject matter that something else you do. Changing the way the space looks to let people know that they move into a different element of the exhibition is another way of letting them know what's going on. So they can focus on the work.

What are the other elements you use for guiding the visitor or giving them more information?
Sometimes little booklets with just brief description, sometimes the label copy people they can read when they go along, that's all holding onto materials. We also work very closely with our multimedia department. A lot of people who come through our exhibitions now use the archive as a form of learning. So it's a guide. I'm sure the exact statistic, but I think it's quite high, like sixty percent or something in temporary exhibitions. When go through, the audio guide just tells you everything about the section. We have stops that are carefully planned. So it's just whole lot of planning of the exhibition is to make sure that we don't have too many stops and we've got enough. At those stops it's not repeating information that we've got physically in the space. We work a lot with them and that does form a really big part. Didactic panels on the wall, paragraphs with text are also a primary way of letting people know what they're seeing. Also because they are much bigger in a different format to the labels or anything else, they're another way of saying 'Stop here now. We've got something else to talk about. We're moving onto another theme.' Also labels, text, and extended labels in the space.
**How do you evaluate your exhibitions? Does the institute have a procedure for evaluating exhibitions?**

We have almost every second visitor fills out a form to say what they thought. It’s great. Within the first week of exhibition opening you will know if you have many comments from the public, something saying like the label size, the lighting or whatever. It becomes really clear and quickly if there is something wrong and you need to fix it immediately. Then you fix it. Visitor coming through really provide a lot of feedback. In a longer term of how exhibitions are going, not only those people who fill those in but through word of mouth, everybody wants to have their opinion on how they feel about the show, which is really great. You get all of that for free, obviously people just telling you all the time. With the number that’s coming through, you can see if the people coming like it. That’s all about visitors basically. There’re people do conduct survey with the public and focus group, things like that.

**Do you do visitor study or evaluation for every exhibition?**

Yes. We always get visitor comments that they’ve chosen to give us for every exhibition. It’s really helpful. Like I said, in the first week after exhibitions open you’ll get a few comments. No matter how small, it can be a small exhibition in the corner of the building somewhere. You still get that feedback. So it’s really handy.

**What do you think the most important feature within exhibition space that can provide the deepest impression on visitors? What do they learn from exhibitions? What is the most important part of it?**

I think the art work is the most important thing they need to see. Everything else is to support that. That’s the primary reason. That’s the only reason I have a job in this building. That’s what we’re about here. I definitely think it’s all about the art work in this particular situation. I don’t think the visitor should go away thinking that the label was terrible because they shouldn’t even digest the fact they’re reading a label. They should be reading and getting information, but concentrating on the work. I think it’s my job to make sure they’re able to do that in a really pleasant way. Making it as enjoyable as you can, which can vary for every show.

**From the visitor, have you heard about how they feel about the exhibition spaces? What kind of thing they will talk about?**

Lots. For the Art Deco exhibition they thought it was beautiful. They thought it was amazing. They loved the colour. They couldn’t believe there was gold on the wall. They thought it was amazing. They couldn’t believe we had this. The multimedia component was great. They just go through everything. A lot of people thought the exhibition is a case study, the way they were able to move through the spaces and the groups and how moved from section to section. They really enjoyed that experience of learning, the way it was broken down into different sections. There was a lot of feedback from that, which was really positive, because it was far more specific feedback than we would normally get. Usually it’s a little bit broader when they come through. There’re quite a bit about that.

**From the art deco exhibition, can you talk a little bit more about how you put into different sections? What kind of order you put in there?**

The groupings of the exhibition started from the V&A, the Victoria &
Albert Museum, who lent us the show. We had a slightly different exhibition here, maybe seventy or sixty percent. Then we had moved that around. When we were starting off, we knew we had introductory section, ten objects, but that was a very small amount and the way they needed to fit in was very difficult. Then we knew that it needed to move onto a sources section so trying to work better. It was just all about fitting all these bits in and letting people flow around and allowing enough room between objects for large numbers of people. Normally that would not be a consideration; given it was such a huge exhibition and the number of people coming through. Letting people have enough room to actually view the work was crucially important with that exhibition, and it succeeded as much it could. You didn't have to line up to turn the corner.

Yea. I'd like to read it. I'd like to see what the criteria are. If there is any different from the way I work. I think it would be great, definitely. I think the problems with criteria is when you have criteria it needs to be so broad because exhibitions change. Every exhibition I've ever worked on is so different to the next and I continue to do that. That's why I'm interested to read these criteria to see how it can encompass the whole world of exhibitions.

Mark Patullo

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| 1         | I came in as a senior designer, which is part of the team with several other designers in the department. My role here is to basically handle all aspects of exhibitions related things like signage and so forth for the National Gallery of Victoria two campuses, which are NGV International and the much newer institution, Ian Potter Centre at Federation Square, which is basically a gallery of Australian Art. We manage both buildings and design all the exhibitions that go in them. We're also responsible for the signage elements, way finding signage, and the whole related areas, special exhibits and special events that we have involvement with as design roles. We also oversee the installation and production of specific components of all the exhibitions as well in terms of the building side of the structure work and of course the application of graphics. That would be interpretative graphics or signage, things like that. As such I have my own projects as the other designer does. We also work sometimes in tandem. Collaborative way we share the range of design tasks that need to be done on particular bigger exhibitions that might be more demanding in terms of various aspects you've got to consider, decide and work through, arrange production and supply. Most of the things you need to get the job from concept to completion. I don't have any specific direct responsibility for managing staff or anything like. I do have a leadership role to the design manager within the team. But I don't have a specific responsibility for staff for managing people.  

_Usually the design concept will come from the curator or designer?_  
It really varies. If we talk specifically about this particular institution, the curator has a much direct role because of the presentation of art works. Often the art works are two dimensional. The curator often has quite a strong opinion about the way those art works are presented. Some other projects you can work on in the gallery, yet there is a bit of more lee way |
for much more design intervention if you like. I would suggest depending on the individual personality of the curator you work with some are more collaborative than others. That really depends on the individual you’re working with and the nature of the project and the various aspects you need to consider. As an example, a large project like the recently closed Art Deco exhibition occupied three major spaces within the building included a whole court of installation, which is quite a significant job in itself with structure, engineering drawings, power and lighting. That was individual project that had elements in itself. The other designers within the team also assisted the principle designer (in this case it wasn't me) for the Art Deco exhibition, and assisted her in terms of documentation, resolving certain issues related to the structure that was provided for that particular show. There was quite a lot of built form required to be designed effectively and detailed up and how it was going to be produced. We also go out and deal with suppliers directly. ... There is quite a role there.

Certainly, design really depends on the show. In the museum context, those exhibitions, places like Museum Victoria, are quite different in a sense that they’re dealing with historical subject matters. Often you’re interpreting scientific concepts, assisting and interpreting scientific concepts and their explanation to the targeted audiences. The Museum Victoria has a much stronger direct educational responsibility as part of their brief. They work much closely to the school curriculum. Educational groups and families are one of their primary audiences. Whereas traditionally the gallery has more adult-orientated audience. Children have a much lower profile and have been catered for more discretely if I can put it like that. As more recent, the last year or so, the gallery is looking to chart a new strategic direction that deals with specifically broadening audience base and particularly aiming at children. That’s the new direction it’s going. In term of responsibility it really depends on individual project as to the degree of control. Ultimately there is aligned management decision here in terms of overseeing individual department. The design manager, Daryl West-Moore, will have overarching sight and guiding overview of the work of individual designer within the team produce. Also above him, the deputy director and director, in terms of the chain of command, ultimately observe what gets approved and what doesn’t get approved in terms of design approach whether they believe it’s going to work effectively or not. ... Some exhibitions in the gallery basically can be very simple shows. Basically what they want, in terms of design role, is to create a blank canvas to hang art works. The next level of detail is to provide some of the peripheral things that are required for that, which are like title signage, what is called the gallery didactic, which is some explanatory text that might go on the wall to introduce some contextualised words. There are obviously also some way finding signage we deal with. We don’t actually produce the banners, advertising or publishing. They are handled by the graphic department that does it here. Complicate shows like the Art Deco show where you’re dealing with three dimensional objects, in a way they might be presented showcasing structural elements. Usually not environments, like you might get it at museum. Often there are complex environments that replicate historic facade, a feeling of a room or something like that, or recreating some sort of elements that are rarely done here. This is much more about the art work, speaking for itself. If you like intrusive three dimensional elements, it is like a subtle backdrop for presenting the art without overshadowing.
it. Often with three dimensional objects in particular, it can be quite complex. ... The museum too has a lot of conservation issues that you need to be aware of and deal with, also the use of materials in a way that the object is supported and presented. There’re many ways to do it. That has to be approved by the relevant individuals here and other specific departments, like conservation. What I’m coming to is that many of the big shows are very collaborative. It’s pretty much team approached where most designers after absorbing all the information and content that are properly briefed and working with the curators on the project they’ve got to somehow translate that into some sort of visual representation that can be effectively created within a given space. We typically use models, three dimensional models, to communicate the basic fundamental concepts here. You might just sketch some ideas originally or computer-based visualisation, but generally we’ve found that the most effective tool is to actually have a three dimensional, physical model of the space with scale, art works and other structural elements and present that. Sometimes the curator can even take that away and play with layout with boxes themselves. Like I said depending on the complexity of the show, there might be cigarette space required and a whole range of other structural elements. All sorts of things need to be considered, and that’s even without getting into the graphic elements or colour treatment something like that. Basically it’s about physical forms and structures that make up the space. That’s based on absorbing all the information as part of the exhibition development process, liaising and consulting with all the other departments that have an input into any given exhibitions. Effectively getting all the information and then coming up a conceptual design that can be realised.

3 I originally started off as a graphic designer at Swinburne originally. In those days design faculty was based in Hawthorn, where is another major campus. I did graphic design originally. I did work for two years as a straight graphic designer, and I saw an opportunity to join the museum field in the 1980s. I always had a strong interest in architecture, but I ended up in graphics. I ended up getting back to interior architecture in a way by working in museums and basically focused more on the three dimensional aspect of museum design rather than the 2D or interpretive graphic element. I just continued on the role of three dimensional aspects. I already had a strong base in drafting and technical drawing. It wasn’t too much a leap to become more fully fledged. I started to do a post-grad course in the late 80s. I started a post-grad in exhibition design at RMIT and did it about a year. Then because of work and personal commitment, I ended up not completing the course. I found it quite interesting. It wasn’t great in some way because I had already been working professionally for significantly a period of time. It wasn’t like I was gaining a lot of new insights that was something coming out of the course. I thought I was doing it for more qualification, not necessarily greatly extend my design learning. I learned it basically on the job training and liaising with peers and colleagues and other museums. I also have been recently involved with the museum association, which is a professional association for not only museum professionals but also interested members of the public. They conducted series of talks. For the last couple of years I’ve been one of the guests. I talked about exhibition design. I’ve been doing that for a number of years. It’s very hands-on, very practically oriented shows, not very theoretical. I finished up with a reputation of being a person who understands how to do things
economically or cheaply and is quite knowledgeable on the practical aspect of putting together displays or exhibitions in museums or galleries.

Whenever you’re working you’re trying to satisfy the goals or objectives of the brief you’re given and that can vary from project to project. Of course it’s usually a target audience you need to identify. Who does the project aim at? Who are you trying to communicate to? It’s really an understanding of the objectives and goals of the project and then understanding of the content. In other words, what is the way to display or present? Obviously in the case of the National Gallery of Victoria, it’s art. You’re looking at understanding the curators’ objectives with the exhibitions and the artists presented and understanding a little bit about the art itself and then looking at the space where it’s supposed to go into and obviously coming up with creative responses to that will satisfy the brief and present the art in the most effective way as possible. So visitors can really appreciate it as much as they can and understand it. In museum context, the objective is perhaps more directly education in a sense of usually a much stronger learning objective behind what you’re presenting. In a case of doing an exhibition about for example the history of aboriginal culture in Victoria, it probably has more direct content and much more structure for its education purpose, not necessarily presenting it as art. I always try to be creative and satisfy those briefs and critical success whether that being from internally from peers, colleagues, within the institution, most importantly externally from visitors coming to and experiencing your show and enjoying it and coming away with the messages you’re trying to carry. In the case of exhibition about aboriginal culture, clearly it’s the message to have greater understanding of aboriginal culture and history. You test visitors after they come out the show to see if they really enjoy it and enhance their understanding. For me it’s been an effective design exercise because I communicated the idea I’d been asked in effective ways, whether that’s using graphics, exhibition structure, multimedia devices, lighting, colour, spatial aspect. All those things to varying degrees can obviously help enhance the presentation techniques, objects and the actual experiences that visitors walk into the space. If you can put all of that together at the end of it, when you talk to visitors you can see if they really enjoy the show or they really find it instructive. A good case here is the recently held Art Deco exhibition. It was highly successful, with a very broadly based exhibition that has lots of contents covered and lots of different areas. I think it constantly had a broad range of appeal as against a much narrowly focused subject, which could be very wordy. In a sense it should be an exhibition about its audience reach is much narrower. A much smaller number of people interested in seeing that artist’s works or something like because of the nature of his or her works. From my perspective is about to satisfy the brief, or satisfy the communication objective of the exhibition, and personally feel that I extend myself creatively and achieve the desired result at the end of the day.

Since you’re talking about evaluation, are there regular or normal evaluation processes? Or do you have some kind of exhibition evaluation? Once again I’m just drawing on a broad range of experience. The gallery doesn’t seem to do the same level of evaluation as the Museum Victoria does. Pretty hardly advance their formative evaluation prior to exhibitions going on. There’ve been involved focus group research, which
just looking at exhibition concepts that have been put forward and testing how effective it would be with the targeted audiences. I also had quite thorough evaluative surveys in a variety of ways, conducted them after exhibitions opened to test how effective in meeting the objectives of the exhibitions has been. Hopefully use some of the data gained from those surveys to modify future exhibitions. The gallery doesn’t seem to do it to the same extent of that. We do have, in fact there's one coming up project recently I worked on with other designers here, which was aimed specifically at primary-aged children. It was a project called Animals and Asian Art. That was specifically aimed at child audience and with a slightly broader aim at the family audiences on weekends particular. That particular project, for instance, had a deep brief. In the next few weeks we're going to an internal deep brief where we'll be analysing various aspects of the show. More for me from a process point of view, methodology and process point of view, that can be improved rather than necessarily how well it has met the audience's objectives. There're some groups here to do some evaluative surveys, but it’s not that extensive as Museum Victoria. It’s just a different policy and the way they conduct that. I think the opportunity will expand here, in terms of getting more information about audiences’ responses and using that data to guide certain activities that are undertaken here.

My fundamental principle would always be to look at any given space that we propose to amount the project in and look at the content that’s proposed to go in the space. There isn’t often, at least the National Gallery of Victoria, much opportunity to say that the content would go better in this space over here. Often the space is predetermined for a particular exhibition at a high level here. The design manager has an input to the process, but the design staff has limited input to that process. Typically a space is nominated and that’s where the particular exhibition will be staged. It’s a matter of looking at the strengths and weaknesses of whatever space it is. All the spaces in this building, whether it's here or over the Federation Square, have quite different strengths and weaknesses or opportunity and weakness depending on how you look at it. Some of the spaces have natural light, not many but some do. Mostly there’s a fully integrated lighting system on the ceiling that offers a lot of flexibility. Usually there’s a whole range of full grids of power and data access. We also have a very well designed mobile wall partition system that we use extensively as well. Certainly it causes us to play a role in how the design responds as well. So It’s looking at and analysing all aspects of space and considering that in a context to what the content is. If it's two dimensional works, we're looking at a lot of wall space to hang that and how that can be resolved effectively. ... It’s really looking at what the content is and trying to make the content to the space that you’re going into and fitting the audience within that.

_Do you think a blank space or blank canvas works for exhibitions_?
I can’t help it compare place like the gallery, which deals with art works, which is primarily arts to be viewed and appreciated, versus somewhere like the museum which has a much stronger agenda in terms of education. Consequently they are more complex shows in terms of educational program. Here quite often it is more about the presentation and appreciation of great art. There is an educational component of course. I would suggest that place like the museum where is often quite in depth of historical messages need to be conveyed, that can be scientific
concepts that can often be quite complex and difficult to understand, that can be research projects and all sorts of things. It's much more educational. Whereas here it's often more as I say about exhibition design in a sense of not being obvious. It's being subtle. It's about letting the arts speak. Whereas a place like the museum comes into play out there, but it's less about art, certainly about objects. ... The range of content sort of everything within the experience here is about a very specific thing, which is artistic experience in no matter what. That can be two dimensional art, video art, sound scapes, sculpture, three dimensional works. That can be very diverse as well. It's just about art. In some instances it can be a very simple designed place since it's just about creating very simple and basic spatial environment to present the art. In the other occasions it can be much complex. It really depends on the individual content.

I think so. It depends on the organisation's mission that underpins their existence. All cultural institutions, at least in the state of Victoria, have a quite strong educational role. They all have a connection to the school curriculum in the state and have school groups coming through and they have a range of program that has been specifically tailored to educate or provide a learning experience for a wide range of students, everyone from primary-aged, even pre-primary, kindergarten-aged. In the structure of the education system their programs are tailored from primary to secondary and even do with tertiary students coming in to do academic research something like that as well. They really have a strong agenda in those institutions. The state's major institutions have that as part of their programs. Speaking specifically of the National Gallery, They also vary from exhibitions to exhibitions. An exhibition like the Animals and Asian Art exhibition I mentioned before specifically targeted young audience and had a quite in-depth range of programs developed for it. Whereas a project that deals with adult-oriented contemporary art, that wouldn't have that much of school audience, at least not at the lower level. That might be much more geared to perhaps late secondary school audience. That deals with more adult concepts and themes that aren't appropriate for the young children. It really just comes down to what any particular subject matter it is.

In general, museums or galleries think education is important. It's mandated to provide an educational experience and satisfy a whole range of educational levels, from pre-school up to post-school and to adults.

If I can draw a comparison, a place like Museum Victoria is much more directly integrated into the design response, whereas the gallery, I find, is much lesser here. Just on a few recent projects I've worked on, where part of my briefs has been to work and collaborate more directly with the education program department here, involving them more directly in the design process and getting ideas from them about the range of activities and programs that I want to conduct and then being able to integrate those into the design response for that particular exhibition. For instance, the Animals and Asian Art exhibition that recently opened, a central element of that exhibition is a seating area that has quite a large communicative table where children can actually do a lot of drawing activities or origami activities things like that. The centre of the space is integrated in and there are some other peripheral activities like interactive touch screens and video. At the next level, there is a whole
range of art presented outside. That was a direct response to the educational group being involved from the early stage. Quite often in the past here they came in at the very end point of the exhibition and that was more adjunct rather than integrated into the process. I believe the model that we followed here, which is integrating educational aspect much earlier into the process, is the one that we will follow much more in the future.

*Did they bring in any educational theories or any guidelines?*
We do have specialists here. We do have professional teachers. Part of the educational program team, some of those teachers are specialists in specific areas of education. Some of them are specialists in early childhood education. Others have more secondary school basis. Those people bring their expertise to the table and would advise the designers on how to most effectively deal with certain topics. One of the areas they have put into there is particularly in relation to the presentation of information. That might be, I’m talking about textual information here, like didactic panels on the walls that actually provide written explanation and information and interpretive labels for art works or objects that are written in a language that provides insights and instruction in how they can be in the best forms for those. We’re also developing a specific template for those things at the moment. The information can be tailored for child audiences more specifically. In terms of other things like ergonomics, that’s pretty much designers’ responsibility. ...That would be much our responsibility to look at those physical designs of space. The educational professionals will still have opinions about it and input in the process.

*For this research, the educational aspect is more focused on learning.*
There have been some studies done in relation to, for instance, interpretive labels and text within exhibitions. There’s definitely a lack of supportive text out there in the reference text you can draw on to assist your understanding. There’s definitely a room for more research to be done, for that research to provide extra guidance to meld the audience educational expectation, being able to define what their expectations are, and obviously most importantly evaluating them and coming up with a set of criteria that can assist us. There’s definitely an opportunity there.

*Absolutely. As you probably gathered from my earlier comments, I think I certainly believe that evaluative information can really assist providing a framework. That’s not to say a style book or creative expression of the design in my head in terms of coming up some interesting and novel ideas. There’re certainly some baselines can be established depending on the targeted audience and educational objective of the exhibition you’re mounting. Just a matter of putting it into a form that will be documented*
and produced so it can be used as a reference tool for people like myself and others within the industry. I think there's definitely benefit there.

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| **1** What is your role in the Museum? | I am currently Exhibition and Touring Services Manager with Museums Australia Victoria. My primary role is to advise museums and galleries on all aspects of exhibition development, both static and touring. I also run a grants program providing funds to museums and galleries to develop and tour exhibitions derived from their collections. I develop and manage a professional development program to develop skills in all aspects of exhibition development and I am often on the road visiting museums and galleries providing assistance and advice on all matters relating to exhibitions.

I have a background in Art history and am currently completing my doctorate in early colonial Australian art. I have been curator and exhibitions manager in both art museums, regional and state as well as local government and Museum Victoria. |
| **2** How much responsibility do you give exhibition designers in relation to exhibition design? | It is important for exhibition designers to be involved in the project as early as possible to maximise problem solving. I have maintained that the exhibition designer should have creative responsibility as long as the curatorial rational is not compromised. A strong exhibition brief and a responsible and informed response to the brief should produce positive outcomes. I value the exhibition designer's creativity and allow the designers to create without hindrance. I also maintain that it is important for the designer to understand that the exhibition design should aim to enhance the look and objectives of the intended message of the exhibition rather than overpower or as we refer to it over design the exhibition where the focus is the design and its elements rather than the exhibition content.

I have had the experience where the initial exhibition design for an exhibition presented to the museum indicated that the design was the focus and the content seemed lost. I had the unfortunate experience to reject the plans where a bitter argument ensued. I was the project manager (who stepped in at the middle of the project) at the time and needed to resolve the conflict. It took months before any agreement was made between the museum and exhibition designer and the outcome was less than adequate. This dispute could have avoided if the roles and responsibilities were clearly outlined and the curatorial intent/message clearly identified which in this instance it was not. Unfortunately as this was also a touring exhibition, the curator was also uncooperative. |
<p>| <strong>3</strong> How did you learn about exhibition design? | As a curator and exhibition manager I learnt about exhibition design on the job and through my own research. Working in regional galleries, all the design involved there was done by me the curator with the help from exhibition technicians. The situation has changed somewhat and these days more and more regional galleries are budgeting for the engagement |</p>
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<td><strong>What do you try to achieve with exhibition design?</strong></td>
<td>The goal is to use good exhibition design to assist the visitor to navigate an exhibition, create a particular mood, or feel and to place it within a context. Ultimately it is so that the intended message of the exhibition is realised and the visitor leaving feeling enriched.</td>
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<tr>
<td><strong>Are there any basic considerations you give to the designers for designing exhibition space?</strong></td>
<td>As with any project, I provide the designers with a design brief that outlines the exhibition concept, aims and goals, the intended message, target audience, object list and size, themes for interpretive display and the 'feel' with some suggested basic ideas of design and construction; size of space and whether it will be touring exhibition and where it will tour.</td>
</tr>
<tr>
<td><strong>How important is the educational role of the exhibitions?</strong></td>
<td>This really depends on the intended message and to a certain degree all exhibitions have an informal educative role. As visitors to exhibitions, we all want to be enriched in some way, and the informal environment in a museum can achieve this through its objects, interpretation, a strong message and a design which enhances learning.</td>
</tr>
<tr>
<td><strong>How often are you asked to respond directly to the educational aspect of exhibitions in your design?</strong></td>
<td>As a curator working with designers I would ask this question for each exhibition. A clear understanding of the goal of the exhibition is a priority with the intended message or curatorial rationale as its core from which the exhibition is built. An understanding of the target audience is crucial as this will undoubtedly affect the exhibition design. We are all learners when we visit exhibitions whether we are conscious of it or not.</td>
</tr>
<tr>
<td><strong>Do you ever think about the space of the exhibition in relationship to its educational aspect?</strong></td>
<td>As a curator yes I do. A well researched subject, a clear interpreted intended message with a clearly defined audience along with a sensitive design is the basis of a successful exhibition. A memorable introduction and conclusion to the exhibition I believe helps a visitor to remember the exhibition. Feeling lost and unsure of its content will diminish the experience. The use of multiple representations and media to communicate that intended message is important and the overall design subtle but unique to the concept and themes explored. The use of multiple levels of engagement and understanding through hierarchy of information and linking concepts along the way should encourage further engagement. However this does not mean essays on a wall. Remember a visitor will also remember a poorly designed exhibition regardless of the content. The visitor should feel that she is about to enter a journey, an exploration of ideas primarily through objects and texts. The design therefore should be able to assist in this journey, by prompting the visitor to navigate through the exhibition, fluidly.</td>
</tr>
</tbody>
</table>

**Are there any principles, techniques, or information you will suggest to help visitors remember the spaces they visit?**

A well researched subject, a clear interpreted intended message with a clearly defined audience along with a sensitive design is the basis of a successful exhibition.
visitors make sense of the whole environment?
I think I have incorporated this answer above.

Would it beneficial to have some criteria for space design for an educational perspective?
Yes. It would assist designers and also curators, education and public programs staff to understand how and why objects are placed in a certain way within the space and the educative benefits. This would entail that designers have an understanding of learning styles, interpretation methodologies and audience development in order to make informed decisions.

Ingrid Rhule

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I work as an exhibition designer within MV Studios at Museum Victoria. I am currently working on the redevelopment of the Science &amp; Life galleries which involves four new major exhibitions including Dinosaur walk due to open in April this year. My role is to develop a concept design for the mentioned exhibitions through to design development and finally to built form.</td>
</tr>
<tr>
<td>2</td>
<td>My role is to develop the concept design for the exhibition space and see this through to design development and finally to completion of built form. I am responsible for developing ideas, discussing and presenting these to curators and the museum’s directors. I have direct contact with our in house carpentry team, conservation &amp; preparators, which means that I am responsible for following through my designs to realization/built form. I am responsible for liaising with external contractors and commissioning any work to be done for the exhibition.</td>
</tr>
<tr>
<td>3</td>
<td>I have a Bachelor of Arts degree in Interior Design from RMIT which introduced me to various design practices including exhibition design. One of my peers at the time worked as an exhibition designer at the NGV and I spoke with her on various occasions about her role and developed an interest from there. I have always had a keen interest in the arts and spent much of my time visiting museums and galleries.</td>
</tr>
<tr>
<td>4</td>
<td>I aim to create a unique spatial and intellectual experience for visitors through both the physical design of the exhibition and the way in which the content is presented. I aim to design spaces that delight, surprise, play, inform, and introduce new ideas and ways of seeing the world and those that allow the imagination to take hold.</td>
</tr>
</tbody>
</table>
| 5 | I begin by reading the curatorial content of the exhibition and researching related ideas and themes that allow me to develop a broad understanding of what the subject matter/exhibition is about. This involves notes and ideas in the form of both words and sketches. As this process of research continues it slowly evolves into conceptual designs that may be further developed (or discarded) into developed designs. It is important for me to develop strong conceptual foundations for my designs to grow from. I look at ways of translating the content of the exhibition into the physical nature of the space through abstraction of some kind so that it is not
merely a representation but informs how people may encounter or move through the space.

It is also important for me to respond to the existing space and to create a design that either compliments or comments on the space it is to become a part of. This may be done through the use of materials, lighting, sense of scale etc.

Once the overall design is established the detail becomes important and I start to design the placement and display of objects using similar conceptual ideas.

6 Extremely important. This flows down from the CEO of the organization right through to the educational staff and customer service staff. The museum is an educational organization which offers schools a place to visit conducting school group tours and programs. It also offers information for tourists about Melbourne, informs locals of our history & technology and our world and so on.

7 I work closely with the lead curator (who leads a team of curatorial staff) in terms of the presentation of content and the public programs staff (who organize specific educational programs for schools & the public). I am in the process of designing a very specific space for educational purposes that sits independently to the exhibitions but allows for visual and physical connections to these spaces. This space will allow public programs to gather school groups together for presentations etc.

I begin to design this space through consultations and discussions with the public programs staff as well as keeping in mind the overall design considerations of the exhibition as a whole.

In designing this space I am also thinking about what type of audience will be using the space, what they require to make them comfortable and allow them to concentrate etc. I also need to consider what the presenter needs from this space.

8 During the design process we look at spaces within the exhibition that may lend themselves educational spaces. These may need to accommodate small groups of people gathering for a presentation or discussion lead by a public program staff member balanced with self discovery. We design moments where people can interact with the exhibition/objects, moments where visitors can observe or make discoveries and moments where one can relax. So within the exhibition there is a sense of rhythm and flow between specific educational moments. It is important to design spaces that can accommodate large groups of people through to more intimate spaces for few people or individuals.

9 When designing for the public in a public building there are a number of basic things that need to be considered and are deemed important to the organization. These are such things as access, OHS issues, types of audiences and particular types of education that the organization provides etc.

I think that there are aspects designers need to consider when designing an exhibition but I am hesitant to suggest that this should be criteria. I believe that design should be fluid and not necessarily follow criteria which would lead to generic repetitive exhibitions which lack a sense of
uniqueness. I believe a good designer always responds to particular limitations and requirements offered by the project.
### APPENDIX 4

**RESEARCH DATA, THE 17TH & 18TH CENTURY EUROPEAN ART GALLERY, NATIONAL GALLERY OF VICTORIA**

**Checklist of spatial context**

<table>
<thead>
<tr>
<th>Area: Dutch and Flemish Painting (1)</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| **Staging**                          |          | • low light condition, dark green walls, low key  
          |          | • Low figure-ground effect under low light condition | Limited |
| **Orientation**                     | Frames of Reference | The entrance is the only reference | Limited |
|                                     | Spatial Graphics | No route information | None |
| **Space Cuing**                      |          | No cues | None |

<table>
<thead>
<tr>
<th>Area: Dutch and Flemish Painting (2)</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| **Staging**                          |          | • Low light conditions, dark green walls, low key  
          |          | • Low figure-ground effect under low light conditions | Limited |
| **Orientation**                     | Frames of Reference | No reference | None |
|                                     | Spatial Graphics | No route information | None |
| **Space Cuing**                      |          | The painting in the middle of the display wall can be identified as a weak space cue | Limited |
### Area: Dutch and Flemish Painting (3)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Clarity</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Simple rectangular plan with two glass display cabinets close to the centre</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>No information showing connection to the next space.</td>
<td>None</td>
</tr>
<tr>
<td><strong>Spatial Staging</strong></td>
<td>Low light condition, dark green walls, low key Low figure-ground effect under low light conditions</td>
<td>Limited</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td><strong>Frames of Reference</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Although the mezzanine can be used as reference, it is hard to recognise.</td>
<td>Limited</td>
</tr>
<tr>
<td><strong>Spatial Graphics</strong></td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td>Two glass display cabinets provide moderate cues.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

### Area: the Rembrandt Cabinet

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Clarity</strong></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Simple rectangular plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A display wall not shown on the floor plan</td>
<td></td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>No information showing connection to the next space.</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td>• Low light condition, dark green walls, low key Low figure-ground effect under low light condition</td>
<td>Limited</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td><strong>Frames of Reference</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No reference</td>
<td>None</td>
</tr>
<tr>
<td><strong>Spatial Graphics</strong></td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td>The Rembrandt portrait can be identified as a limited cue.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
### Area: European Painting (1)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>The only connection to the next exhibition space is the sign of the name.</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staging</td>
<td>• Medium light condition, dark green walls, low key, high ceiling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medium figure-ground effect</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Frames of Reference</td>
<td>No reference</td>
</tr>
<tr>
<td></td>
<td>Spatial Graphics</td>
<td>No information</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td>Hard to identify an appropriate one</td>
</tr>
</tbody>
</table>

### Area: European Painting (2)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No connection to the next space</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staging</td>
<td>• Medium light condition, dark green walls, low key, high ceiling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medium figure-ground effect</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Frames of Reference</td>
<td>No reference</td>
</tr>
<tr>
<td></td>
<td>Spatial Graphics</td>
<td>No information</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td>A contemporary sculpture surrounded by classic paintings provides a strong cue.</td>
</tr>
</tbody>
</table>
### Area: European Painting (3)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Simple rectangular plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Ample space providing flexibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>No connection to the next space</td>
<td></td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, dark green walls, low key, high ceiling</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Medium figure-ground effect</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>No reference</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The video shown in the space forms a special focal point and provides a strong cue.</td>
<td>Strong</td>
</tr>
</tbody>
</table>

### Area: Decorative Art and Painting (1-1)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Simple rectangular plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Ample space providing flexibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>No connection to the next space</td>
<td></td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light grey walls, low key</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Grey walls provide moderate figure-ground effect under medium light condition.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td>Although the mezzanine can be used as reference, it is hard to recognise.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spatial Graphics</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>No information</td>
<td></td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The three statues can be identified as limited cues.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
### Area: Decorative Art and Painting (1-2)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td>Connection</td>
<td>No connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>medium light condition, light grey walls, low key</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Grey walls provide moderate figure-ground effect under medium light condition.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frames of Reference</td>
<td>Although the mezzanine can be used as reference, it is hard to recognise.</td>
<td>Limited</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some furniture can be identified as cues.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

### Area: Decorative Art and Painting (1-3)

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Ample space providing flexibility</td>
<td>Strong</td>
</tr>
<tr>
<td>Connection</td>
<td>No connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Medium light condition, light grey walls, low key</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Grey walls provide moderate figure-ground effect under medium light condition.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frames of Reference</td>
<td>No reference</td>
<td>None</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some 3D objects displayed on the floor can be identified as cues.</td>
<td>Limited</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
<td>Evaluation</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Organization</td>
<td>Rectangular plan with two curve walls in the centre</td>
<td>Moderate</td>
</tr>
<tr>
<td>Flexibility</td>
<td>With several objects placed in the space, the flexibility is less than the other spaces.</td>
<td>Moderate</td>
</tr>
<tr>
<td>Connection</td>
<td>No connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light grey walls, low key</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Grey walls provide moderate figure-ground effect under medium light condition.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Although the mezzanine can be used as reference, it is hard to recognise.</td>
<td>Limited</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>Curve walls and space provide a strong cue</td>
<td>Strong</td>
</tr>
</tbody>
</table>
Annotated panorama

(Pages 265-269)
Dutch and Flemish Painting (1)

- No spatial connection
- No clear space cue
- No graphic information
- The entrance provides limited reference.

Dutch and Flemish Painting (2)

- No spatial connection
- No graphic information
- No clear space cue
- No frame of reference

Dutch and Flemish Painting (3)

- No graphic information
- Two glass display cabinets provide moderate space cues.
- No spatial connection
- Limited frame of reference
The Rembrandt Cabinet

- No frame of reference
- No spatial connection
- No graphic information

- Limited space cue

The space behind the display wall

- No spatial connection
Decorative Art and Painting (1-1)

- No spatial connection
- Limited space cue
- Limited frame of reference

Decorative Art and Painting (1-2)

- Moderate space cue
- Limited frame of reference
- No spatial connection

Decorative Art and Painting (1-3)

- Limited space cue
- No frame of reference
- No spatial connection
Decorative Art and Painting (2)

- No graphic information

- Curve walls provide a strong cue.

- No spatial connection

- Limited frame of reference
APPENDIX 5
RESEARCH DATA, THE CITY MUSEUM, MELBOURNE

Checklist of spatial context-ground floor

<table>
<thead>
<tr>
<th>Area: (G1) Gateway to the Gold Field</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Small space with a cabinet in the middle</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging                             |          | • Medium light condition, light green walls  
|                                     |          | • Full of text, images, and objects, creating the atmosphere with moderate figure-ground effect | Moderate  |
| Orientation                         | Frames of Reference | The hallway provides a strong reference. | Strong    |
|                                     | Spatial Graphics | no route information | None      |
| Space Cuing                         |          | The woman’s clothes can be used as a cue. | Limited   |

<table>
<thead>
<tr>
<th>Area: (G2) The Perfect Place</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Small space providing enough flexibility</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging                     |          | • Medium light condition, light green walls  
|                             |          | • Full of text, images, and objects, creating the atmosphere with moderate figure-ground effect | Moderate  |
| Orientation                 | Frames of Reference | The hallway provides a strong reference. | Strong    |
|                             | Spatial Graphics | no route information | None      |
| Space Cuing                 |          | The big piece of gold can be used as a cue. | Limited   |
### Area: (G3) Boom Town-1

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity: Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility: Small space providing enough flexibility</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Connection: No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>

**Staging**

|                   | • Medium light condition, light blue walls            | Moderate   |
|                   | • Full of text, images, and objects, creating the atmosphere with moderate figure-ground effect |            |

**Orientation**

| Frames of Reference | The hallway provides a strong reference. | Strong     |

**Spatial Graphics**

| No route information | None                                           |

**Space Cuing**

| The woman’s clothes can be used as a cue. | Limited |

### Area: (G4) Boom Town-2

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity: Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility: Small space providing enough flexibility</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Connection: No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>

**Staging**

|                   | • Medium light condition, light blue walls            | Moderate   |
|                   | • Full of text, images, and objects, creating the atmosphere with moderate figure-ground effect |            |

**Orientation**

| Frames of Reference | The hallway provides a strong reference. | Strong     |

**Spatial Graphics**

| No route information | None                                           |

**Space Cuing**

| No special objects can be identified as cues. | None       |
## Area: (G5) A City at Play

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space with several cabinets, providing limited flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light red walls</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Full of text, images, and objects, creating the atmosphere with moderate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>figure-ground effect</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>The hallway provides a strong reference.</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The clothes can be identified as cues.</td>
<td>Limited</td>
</tr>
</tbody>
</table>

## Area: (G6) A City at Work

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Small space providing limited flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light red walls</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Full of text, images, and objects, creating the atmosphere with moderate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>figure-ground effect</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>The hallway provides a strong reference.</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The clothes can be identified as cues.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
### Area: (G7) Deakin Room

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>The space is filled with furniture, providing limited flexibility.</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>Middle light condition, light yellow green walls</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>The original setting provides the space a strong stage</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference The hallway provides a strong reference</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No special objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>

### Area: (G8) Seasonal Exhibition-1

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space, yet providing enough flexibility</td>
<td>Moderate</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light green walls</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• Full of life images, providing an atmosphere of the sports life in Melbourne</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference The hallway provides a strong reference.</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No special objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>
### Area: (G9) Seasonal Exhibition-2

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>A simple rectangular plan with a display wall close to the front entrance</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A very small space divided by the display wall</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, blue and light green walls</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td>• The space creates limited atmosphere with many small photos.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>The entrance to the lobby provides the only reference.</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No special objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>

### Checklist of Spatial context-basement

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area: Growing in the Old Treasury-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space, providing enough flexibility</td>
<td>Moderate</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>• Medium light condition, light green walls</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• The original furnishing provides the sense of the life in the basement.</td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>The entrance lead to the stairs can provide a reference.</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No special objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>
## Area: Growing in the Old Treasury-2

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Simple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rectangular plan</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space, providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging      | Medium light condition, duotone, white and green walls  
|              | The original furnishing provides the sense of the life in the basement. | Moderate   |
| Orientation  | Frames of Reference                              | No frames of reference | None     |
| Spatial Graphics | No route information                           | None |
| Space Cuing  | No special objects can be identified as cues.    | None      |

## Area: Growing in the Old Treasury-3

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Simple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rectangular plan</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space, providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging      | • Medium light condition, light grey walls  
|              | • The original furnishing provides the sense of the life in the basement. | Moderate   |
| Orientation  | Frames of Reference                              | No frames of reference | None     |
| Spatial Graphics | No route information                           | None |
| Space Cuing  | No special objects can be identified as cues.    | None      |
### Area: (B1) Gold Field Gold Deal

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Clarity</strong> Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td><strong>Flexibility</strong> A small space with several chairs providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td><strong>Connection</strong> No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td>• Video shown on a big screen in a very dark room</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>• Creating a strong figure and ground effect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Creating a frightening atmosphere</td>
<td></td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td><strong>Frames of Reference</strong> The hallway provides a strong reference.</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Spatial Graphics</strong></td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td>The big screen can provide a strong cue.</td>
<td>Strong</td>
</tr>
</tbody>
</table>

### Area: (B2) Gold Escort

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Clarity</strong> Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td><strong>Flexibility</strong> A small space with several chairs, providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td><strong>Connection</strong> No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td>A long piece of glass with some text placed in the middle of the room</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td><strong>Frames of Reference</strong> The hallway provides a strong reference.</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Spatial Graphics</strong></td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td>The big piece of glass can be identified as a cue.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
### Area: (B3) Shipping and Trade

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space with a TV and several chairs, providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• A TV placed in a very dark room</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>• Creating a strong figure and ground effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td></td>
</tr>
<tr>
<td>• The hallway provides a strong reference.</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The TV can be identified as a cue.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

### Area: (B4) Gold Rush Melbourne

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A small space with a big TV providing little flexibility</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• A big TV showing animated images placed in a very dark room</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>• Creating a strong figure and ground effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td></td>
</tr>
<tr>
<td>• The hallway provides a strong reference.</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The big TV can be identified as a cue.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
### Area: (B5) Melbourne’s Building Boom

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>A circular light box around the room</td>
<td>Moderate</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging          | • A circular light box showing the panorama of Melbourne’s important buildings  
                   | • The light box makes the centre of the room very bright.                    | Moderate   |
| Orientation      | Frames of Reference                                                          | Strong     |
| Spatial Graphics | No route information                                                         | None       |
| Space Cuing      | The circular light box provides a strong cue.                                | Strong     |

### Area: (B6) Cultural Change

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>Simple rectangular plan</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>An empty room</td>
<td>Strong</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>An empty room with changing lighting</td>
<td>Moderate</td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>
### Area: (B7) Colonial Bureaucracy

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Limited</td>
</tr>
<tr>
<td>Flexibility</td>
<td>The space cannot be accessed.</td>
<td>None</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td>The space works like a display cabinet containing some old shelves.</td>
<td>Limited</td>
</tr>
<tr>
<td>Orientation</td>
<td>Frames of Reference</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No route information</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>No objects can be identified as cues.</td>
<td>None</td>
</tr>
</tbody>
</table>

### Area: (B8) Gold Market

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Clarity</td>
<td>Strong</td>
</tr>
<tr>
<td>Flexibility</td>
<td>With some installation in the room, the space provides limited flexibility.</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing connection to the next space</td>
<td>None</td>
</tr>
</tbody>
</table>
| Staging       | • The space equipped with a LED screen showing animated text and some installation simulating gold blocks.  
                • The installation is situated in a dark room, creating a strong figure and ground effect. | Moderate   |
| Orientation   | Frames of Reference                                                          | Strong     |
| Spatial Graphics | No route information                                                        | None       |
| Space Cuing   | The gold block installation can be identified as a cue.                       | Moderate   |
Annotated panorama

(Pages 281-293)
(G1) Gateway to the Gold Field

- No spatial connection
- No graphic information
- Limited space cue

(G2) The Perfect Place

- No spatial connection
- Limited space cue
- No graphic information
(G3) Boom Town-1

- No spatial connection.
- No graphic information
- Limited space cue

(G4) Boom Town-2

- No space cue
- No spatial connection
- No graphic information
(G5) A City at Play

• Limited space cue

• No graphic information

• No spatial connection

(G6) A City at Work

• Limited space cue

• No spatial connection

• No graphic information
(G7) Deakin Room

- No graphic information
- No spatial connection
- No space cue

(G8) Seasonal Exhibition-1

- No spatial connection
- No graphic information
- No space cue
(G8) Seasonal Exhibition-2

- No graphic information
- No space cue
- No spatial connection
Growing in the Old reasury-1

- No graphic information
- No spatial connection
- No space cue
Growing in the Old reasury-3
(B1) Gold Field Gold Deal

- No spatial connection.
- No graphic information

- Limited flexibility

(B2) Gold Escort

- No spatial connection.
- No graphic information

- Limited flexibility
(B3) Shipping and Trade

- No spatial connection.
- No graphic information

- Limited flexibility

(B4) Gold Rush Melbourne

- No spatial connection.
- No graphic information

- Limited flexibility
(B5) Melbourne's Building Boom

- No spatial connection.
- No graphic information
(B8) Gold Market

- No spatial connection.
- No graphic information

- Limited flexibility
# APPENDIX 6
RESEARCH DATA, THE HUMAN BODY EXHIBITION, MELBOURNE MUSEUM

Checklist of spatial context

<table>
<thead>
<tr>
<th>Area: Space 1</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>The space is mainly formed by the two display walls. The perimeter is not clearly defined.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Providing enough space for visitors to move around</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td>• The display walls provide many detailed information about human body, and try to raise visitors’ interest. • Since the space is not well defined, the atmosphere is polluted by the information from the other spaces.</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Frames of Reference</td>
<td>The entrance area can provide a reference.</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Spatial Graphics</td>
<td>No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td>The curved mirrors provide an interesting figure in the space.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area: Space 2</th>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Clarity</td>
<td>The space is enclosed at one end of the whole gallery. Although the shape is non-geometric, the open plan offers good visibility to the space.</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Providing enough space for visitors to move around</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td>The nude figure images provide a strong atmosphere to the space.</td>
<td>Strong</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Frames of Reference</td>
<td>No reference can be found in the space.</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Spatial Graphics</td>
<td>No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td>The nude adult images can be identified as cues.</td>
<td>Strong</td>
</tr>
</tbody>
</table>
### Area: Space 3

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Clarity      | • The space is defined by three display walls with one end open to the other spaces.  
• The floor plan is close to rectangular and makes the space easy to identify. | Moderate   |
| Flexibility  | The small space provides enough flexibility.                                  | Moderate   |
| Connection   | A small board showing information about the next space                       | Limited    |
| **Staging**  |                                                                             |            |
| Frames of Reference | The yellow background colour unifies the atmosphere of the space.               | Moderate   |
| **Orientation** |                                                                             |            |
| Frames of Reference | The entrance area and centre space of the gallery can provide references.         | Strong     |
| Spatial Graphics | No graphic information showing the detail of the space                         | None       |
| **Space Cuing** |                                                                             |            |
|               | No clear cues can be identified.                                             | Strong     |

### Area: Space 4

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Clarity      | • A small space with a floor plan close to a quadrant.  
• Hard to quickly identify the shape of space.  
• The display in the space is simple. | Moderate   |
| Flexibility  | A very small space with bench along one wall provides very limited flexibility. | Limited    |
| Connection   | No information showing the next space                                         | None       |
| **Staging**  |                                                                             |            |
| Frames of Reference | The body organs and dark purple lighting create a special environment in comparison to the other spaces. | Strong     |
| **Orientation** |                                                                             |            |
| Frames of Reference | The entrance area and centre space of the gallery still can be seen from the space. That provides a strong direction.         | Strong     |
| Spatial Graphics | No graphic information showing the detail of the space                         | None       |
| **Space Cuing** |                                                                             |            |
|               | The model of body organs can be identified as a cue.                         | Limited    |
### Area: Space 5

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td><strong>Clarity</strong> • A very small space mainly defined by the display on two sides. • More like a passage than a space • The separation to the next space is not very clear.</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td><strong>Flexibility</strong> Also functioning as a passage, the space suggests a connection to the next space than a space for viewing content.</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td><strong>Connection</strong> No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td><strong>Frames of Reference</strong> The entrance area and centre space of the gallery still can be seen from the space. That provides a strong direction.</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td><strong>Spatial Graphics</strong> No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The x-ray image of a body provides an interesting cue.</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

### Area: Space 6

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td><strong>Clarity</strong> • The space is well defined by the walls. • The floor plan is close to a square.</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td><strong>Flexibility</strong> Enough room for four people to move around.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td><strong>Connection</strong> No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td>Staging</td>
<td><strong>Frames of Reference</strong> Very limited visual connection to the main entrance area or the centre space.</td>
<td>Strong</td>
</tr>
<tr>
<td></td>
<td><strong>Spatial Graphics</strong> No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td>Space Cuing</td>
<td>The identification of a strong cue is hard from the models despite the interesting installation.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
### Area: Space 7

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>• The space is defined by one display case and two walls.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• The floor plan is close to a triangle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• With three entry points, the boundary of the space is not very clear.</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Enough room for four people to move around.</td>
<td>Moderate</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
</tbody>
</table>

**Staging**

- The medical images create the theme for the space.
- The atmosphere is polluted by the information from other spaces.

**Orientation**

- The main entrance area and centre space can be easily referenced from the space.

**Spatial Graphics**

- No graphic information showing the detail of the space

**Space Cuing**

- The image showing the body temperature can be a cue.

---

### Area: Space 8

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>• The space is defined by two display walls with one wide open end to other spaces.</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td>• The boundary of the space is hard to spot.</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>With the wide open end, the space provides great flexibility.</td>
<td>Strong</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
</tbody>
</table>

**Staging**

- The space is unified by the red background colour.
- The setting lacks a clear theme.

**Orientation**

- The main entrance area and centre space can be easily referenced from the space.

**Spatial Graphics**

- No graphic information showing the detail of the space

**Space Cuing**

- The operatable microscope can be a cue.

---
### Area: Space 9

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>• The space is formed by a display cabinet, one short display wall, and one hands-on activity board.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• The small area well provides the boundary of the space.</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>It is hard to contain more than three people and maintain good flexibility in the area.</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The space is mainly staged by the images and model of human musculoskeletal system. The atmosphere is diluted by the information pollution from other areas.</td>
<td>Limited</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frames of Reference</td>
<td>The main entrance area and centre space can be easily referenced from the space.</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The skeleton can be a cue.</td>
<td>Limited</td>
</tr>
</tbody>
</table>

### Area: Space 10

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity</td>
<td>• The space is consisted of two small spaces. Each space is formed by a display cabinet, a short display wall, and an activity board.</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>• The area of each space is small but clear.</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>It is hard to contain more than three people and maintain good flexibility in each small space.</td>
<td>Limited</td>
</tr>
<tr>
<td>Connection</td>
<td>No information showing the next space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Staging</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The atmosphere is created from the models and images of human circulation and hormonal systems. However, the staging is weakened by the information pollution from other areas.</td>
<td>Limited</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frames of Reference</td>
<td>The main entrance area and centre space can be easily referenced from the space.</td>
<td>Strong</td>
</tr>
<tr>
<td>Spatial Graphics</td>
<td>No graphic information showing the detail of the space</td>
<td>None</td>
</tr>
<tr>
<td><strong>Space Cuing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The circulation and hormonal models can be the cues.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
### Area: Space 11

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Organization  | **Clarity**  | • The space is consisted of two small spaces. Each space is formed by a display cabinet, a short display wall, and an activity board.  
• The area of each space is small but clear. | Moderate   |
|           | **Flexibility** | It is hard to contain more than three people and maintain good flexibility in each small space. | Limited    |
|           | **Connection** | No information showing the next space | None       |
| Staging  | **Frames of Reference** | The atmosphere is created from the models and images of human immune and nervous systems. The staging is weakened by the information pollution from other areas. | Limited    |
| Orientation  | **Frames of Reference** | The main entrance area and centre space can be easily referenced from the space. | Strong     |
|           | **Spatial Graphics** | No graphic information showing the detail of the space | None       |
| Space Cuing     | **Space Cuing** | The immune and nervous system models can be the cues. | Limited    |

### Area: Space 12

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
</table>
| Organization  | **Clarity**  | • The space is consisted of two small spaces. One space is formed by a display cabinet, a short display wall, and an activity board. The other is formed by one long and short display wall.  
• The area of each space is small but clear. | Moderate   |
<p>|           | <strong>Flexibility</strong> | It is hard to contain more than three people and maintain good flexibility in each small space. | Limited    |
|           | <strong>Connection</strong> | No information showing the next space | None       |
| Staging  | <strong>Frames of Reference</strong> | The atmosphere is created from the models and images of digestive system and other body parts. The staging is greatly affected by the information pollution from other areas. | Limited    |
| Orientation  | <strong>Frames of Reference</strong> | The main entrance area and centre space can be easily referenced from the space. | Strong     |</p>
<table>
<thead>
<tr>
<th>Spatial Graphics</th>
<th>No graphic information showing the detail of the space</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Cuing</td>
<td>The digestive system model can be a cue.</td>
<td>Limited</td>
</tr>
</tbody>
</table>
Annotated panorama

(Pages 302-308)
Space 4

- Limited space cue
- No spatial graphic information inside or outside the entrance
- No information about next rooms to enable spatial connection

Space 5

- No spatial graphic information inside or outside the entrance
- No information about next rooms to enable spatial connection
- The space is not well defined, providing limited clarity.
- Very small space provides limited flexibility
Space 8

- The microscope provides a limited cue.
- No spatial graphic information inside or outside the entrance.
- The space is not well defined, providing limited clarity.
- No information about next rooms to enable spatial connection.

Space 9

- No appropriate place for placing spatial graphics.
- The skeleton provides a limited cue.
- The small area provides limited flexibility.
- No information about next rooms to enable spatial connection.
Space 10

- No appropriate place for placing spatial graphics.
- The small area provides limited flexibility.
- The models provide limited cues.
- No information about next rooms to enable spatial connection.

Space 11

- No appropriate place for placing spatial graphics.
- The small area provides limited flexibility.
- The models provide limited cues.
- No information about next rooms to enable spatial connection.
Space 12

- No appropriate place for placing spatial graphics.
- The small area provides limited flexibility.
- The models provide limited cues.
- The space lacks characters because it is separated by two smaller spaces, which carry two different themes.
- No information about next rooms to enable spatial connection.
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