Design Factors in the Museum Visitor Experience

Regan Forrest
BSc (Hons) Grad Dip Sci Comm

A thesis submitted for the degree of Doctor of Philosophy at
The University of Queensland in 2014
Business School (Tourism Cluster)
Abstract

Over the past half-century, museums have evolved from being predominantly cultural repositories to playing an important social role as venues for educational leisure experiences. Accompanying this development has been an increased emphasis on optimising the visitor experience. The physical context of the museum has long been recognised as an important facet of the visitor experience (Falk & Dierking, 2000). However, the way that visitors perceive and respond to different types of exhibition environments on a holistic level has received relatively little research attention until recently. A key limitation in advancing research in this area has been a paucity of methods for quantifying and analysing visitor perceptions of the exhibition environment beyond simple measures of satisfaction. In order to address this gap, this thesis describes the development of a model for characterising how visitors perceive different exhibition environments – Perceived Atmosphere – and relates it to different facets of the visitor experience.

As part of this study, a quantitative instrument known as the Perceived Atmosphere Instrument was piloted and refined. This allows the relationship between exhibition environment and visitor experience to be explored in greater depth. Development of Perceived Atmosphere was informed by environmental psychology, in particular environmental cognition, theories of spatial perception and the research field known as atmospherics (Kotler, 1974). Atmospherics is the study of the influence of retail environments and other service settings on customer attitudes and behaviour, and this study applied similar methods to a museum context.

Both qualitative and quantitative data were collected to explore and compare visitors’ perceptions of different exhibition environments at the South Australian Museum, a large natural and cultural history museum located in Adelaide, Australia. Qualitative data were collected through 12 pre-arranged accompanied visits to the museum, while quantitative data were collected from 602 visitors to the museum who agreed to participate in the study by completing a questionnaire that incorporated the Perceived Atmosphere Instrument. In addition, a small number of participants (n = 60) were unobtrusively tracked prior to completing the survey, allowing some preliminary analysis of the relationship between Perceived Atmosphere and visitor behaviour.

Factor analysis of the 30 semantic differentials that comprise the Perceived Atmosphere Instrument produced a four factor solution interpreted as Vibrancy, Spatiality, Order and Theatricality. There were statistically significant differences between galleries on three of these four dimensions. These differences were interpretable in light of each gallery’s physical characteristics, but also indicate
that a space’s perceived affordances are as important as its measurable physical properties. Of the Perceived Atmosphere dimensions, Vibrancy is the strongest predictor of affective, cognitive and behavioural engagement. Spatiality is a predictor of a sense of relaxation in the exhibition environment. There is a negative correlation between Order and a sense of cognitive overload. These results show that quantifying Perceived Atmosphere in an exhibition setting is technically feasible, theoretically coherent and capable of providing novel and useful insights into the environment-experience relationship.

As well as advancing our theoretical understanding of the environment-experience relationship in the museum context, these findings make practical and methodological contributions to the field. The Perceived Atmosphere Instrument is a novel, easy-to-administer research tool that can be applied to a wide range of museum settings. The ability to characterise exhibition environments by their Perceived Atmosphere properties, in particular Vibrancy, Spatiality and Order, will be useful for exhibition planners, designers and evaluators.
Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

I acknowledge that an electronic copy of my thesis must be lodged with the University Library and, subject to the General Award Rules of The University of Queensland, immediately made available for research and study in accordance with the Copyright Act 1968.

I acknowledge that copyright of all material contained in my thesis resides with the copyright holder(s) of that material. Where appropriate I have obtained copyright permission from the copyright holder to reproduce material in this thesis.
Publications during candidature

**Academic publications:**


**Peer-reviewed industry publications:**


**Conference presentations:**


**Publications included in this thesis**

No publications included.

**Contributions by others to the thesis**

No contributions by others.

**Statement of parts of the thesis submitted to qualify for the award of another degree**

None.
Acknowledgements

Being able to take time out mid-career to pursue a PhD is an immense privilege. I am grateful for the financial support of an Australian Postgraduate Award, which allowed me to focus full-time on my studies. I was also incredibly fortunate to have had such an exemplary supervisory team: heartfelt thanks go to Dr Jan Packer for her steadfast day-to-day support and attention to detail; and to Prof Roy Ballantyne for never letting me lose focus on the bigger picture. I also appreciate the welcome extended to me by the rest of the staff and fellow students in the Tourism cluster, who took my status as an external student in their stride and provided me with much assistance during my candidature. In addition, I thank the numerous fellow students and researchers across the globe who frequently offered advice and links to valuable references via #phdchat on Twitter.

Thanks to all the staff of the South Australian Museum and Artlab Australia for providing me with office space and treating me as one of their own during my candidature. It made my PhD journey feel much less like a solitary one, and having a home institution made piloting and data collection that bit easier. In particular I wish to thank Robert Morris for facilitating my coming to the Museum, Cameron Midson for producing the gallery plans used in the tracking sheets, David Kerr and Jenny Parsons for providing background information on the Museum’s galleries, the security team for their practical and moral support during the long days of data collection, and Alexis Tindall, Keith Maguire, Jo Wood and the digitisation volunteers for being friendly and supportive office mates. Thanks also to Carolyn Meehan from Museum Victoria for allowing me to do some additional piloting at Melbourne Museum, Chris Lang for sharing the Australian Museum’s visitor tracking protocols, and Angela Lush for proofreading this thesis.

I am privileged to have a supportive network of family and friends, who have encouraged me throughout my candidature and kept me grounded in the “real world” away from my research. As always, I appreciate the unwavering support of my parents. Thanks go to the extended “Caspersmith” clan, in particular John and Kate, who cheerfully provided me with a home away from home among their growing family whenever I needed to travel to Brisbane. An extra special thank you to my husband, Rick Chalwin, for his patience throughout the three and a half years of my candidature, and for taking the photographs used to illustrate this thesis.

Finally, I wish to thank the 1000+ museum visitors who contributed to this study, as well as the many clients, colleagues and collaborators who have informed and inspired my thinking over the course of my career.
Keywords
museums, museum visitors, visitor experience, atmospherics, environmental psychology, exhibition design, informal learning

Australian and New Zealand Standard Research Classifications (ANZSRC)
ANZSRC code: 150606 Tourist Behaviour and Visitor Experience, 60%
ANZSRC code: 210204 Museum Studies, 40%

Fields of Research (FoR) Classification
FoR code: 1506, Tourism, 80%
FoR code: 1799, Other Psychology and Cognitive Sciences, 20%
# Contents

Abstract ................................................................................................................................. i
Disclaimer by author ................................................................................................................ iii
Publications during candidature ............................................................................................... iv
Acknowledgements .................................................................................................................. v
List of Figures & Tables ........................................................................................................... xi
   Figures ..................................................................................................................................... xi
   Tables ....................................................................................................................................... xiii
List of Abbreviations used in the Thesis .................................................................................. xv
Glossary of Key Terms .............................................................................................................. xvi

Chapter One: Introduction ...................................................................................................... 1
1.1 A Personal Narrative on the Origins of This Study ............................................................ 1
1.2 Museums: Their Social, Cultural and Economic Role ........................................................... 3
1.3 The Research Problem ........................................................................................................ 4
1.4 Theoretical Framework ....................................................................................................... 6
1.5 Research Aims and Approach .............................................................................................. 7
1.6 Significance of the Research ............................................................................................... 8
1.7 Structure of this Thesis ....................................................................................................... 9

Chapter Two: Literature Review ............................................................................................. 10
PART ONE: Museum Exhibitions and the Visitor Experience ................................................... 10
2.1 The Importance of Experiences ......................................................................................... 10
2.2 Exhibition Design: Importance and Research Challenges .................................................. 11
2.3 Brief History of Museum Architecture and Exhibition Design ......................................... 13
2.4 New Roles for Exhibitions: From Displays to Experiences ............................................... 15
   2.4.1 Experiences as Theatre – Exhibition Design as “Scenography” .................................. 17
2.5 Theories of Exhibition Space .............................................................................................. 19
   2.5.1 Space Syntax ................................................................................................................ 19
   2.5.2 Isovist Theory – “Space Semantics” ............................................................................ 21
   2.5.3 The Exhibition as a “Text”: Semiotic and Linguistic Analysis ................................... 23
   2.5.4 Semiotics Beyond Texts: The Multimodality of the Visitor Experience ....................... 25
2.6 Summary of Part One ........................................................................................................ 29
PART TWO: Atmospherics and the Role of the Environment ................................................... 30
2.7 Introduction to Atmospherics ............................................................................................... 30
2.8 Theoretical Frameworks for Atmospherics ........................................................................ 33
   2.8.1 Modelling Consumer Response as Stimulus-Organism-Response ............................. 33
   2.8.2 Characterising Environmental Variables .................................................................... 34
   2.8.3 Affect and Emotion in Consumer Responses ............................................................. 37
2.8.4 Modelling Consumer Response through Qualitative and Narrative Approaches .......... 41
2.9 Atmospheric Variables and the Museum Visitor Experience ........................................ 43
2.10 Characterising Atmospheric Variables .......................................................................... 45
  2.10.1 Models of Environmental Perception and Preference .............................................. 46
  2.10.2 Applying Safety and Information Requirements to the Museum Space ................. 49
  2.10.3 Cognitive Appraisal in the Museum Context .......................................................... 50
2.11 Colour and Light as Atmospheric Variables ................................................................... 51
  2.11.1 Colour and Spatial Perception ................................................................................... 52
  2.11.2 Perceptions of Colour: Colour Emotion and Colour Meaning ................................ 53
  2.11.3 Lighting and Environmental Perception ................................................................. 55
2.12 A Model for Museum Atmospherics ............................................................................... 57
2.13 Summary of Literature Review Part Two ........................................................................ 59
PART THREE: Visitors in Museum Environments – an Environmental Psychology Perspective ................................................. 60
  2.14 The Emergence of Visitor Studies .................................................................................. 60
  2.15 Environmental Psychology and Spatial Design .......................................................... 62
  2.16 Environmental Psychology and Museum Visitors ....................................................... 63
    2.16.1 Observations of Visitor Behaviour: What Visitors Do in Exhibition Settings .......... 64
    2.16.2 Explorations of Visitor Experience: How Visitors Construct Meanings and Understandings from Exhibitions ............................................................................. 70
  2.17 The Visitor Experience and the Exhibition Environment ........................................... 75
    2.17.1 Fatigue and the Museum Environment ................................................................... 76
    2.17.2 Affective Responses to Museum Environments ..................................................... 78
  2.18 Summary of Literature Review Part Three ..................................................................... 80
Concluding Summary of Literature Review ......................................................................... 81
Chapter Three: Research Approach and Methodology .................................................... 83
  3.1 Introduction and Research Aims .................................................................................... 83
    3.1.2 Overview of Methodology Section .......................................................................... 83
  3.2 Research Philosophy ...................................................................................................... 84
  3.3 Research Site Selection .................................................................................................. 85
    3.3.1 South Australian Museum ....................................................................................... 86
  3.4 Research Approach ....................................................................................................... 89
  3.5 Phase 1: Qualitative Exploration of Exhibition Environments ....................................... 92
    3.5.1 Strengths and Limitations of Think-Aloud Interviews ........................................... 96
    3.5.2 Thematic Analysis of Interview Transcripts ....................................................... 97
  3.6 Phase 2: Piloting and Refining the Perceived Atmosphere Instrument ........................ 97
    3.6.1 Factor Analysis of Atmospheric Descriptors .................................................. 101
    3.6.2 Factor Analysis of Evaluative Terms ............................................................... 103
    3.6.3 Revising and Finalising the Perceived Atmosphere Instrument ......................... 105
Chapter Five: Results and Discussion – Quantitative Analysis of Perceived Atmosphere and its Relationship with Visitor Experience ................................................................. 150
  5.1 Introduction ........................................................................................................... 150
  5.2 Visitors’ Perceptions of the Exhibition Environment .................................................. 150
    5.2.1 Factor Analysis of Atmospheric Descriptors ...................................................... 150
    5.2.2 Characterising Exhibition Environments using Perceived Atmosphere ................. 160
  5.3 Relating Perceived Atmosphere to the Visitor Experience ........................................... 165
    5.3.1 Characterising Visitor Experience Through Experience Measures ....................... 165
    5.3.2 Relating Perceived Atmosphere and Experience Measures ................................. 170
    5.3.3 Characterising the Visitor Experience Through Affective and Cognitive Measures .... 171
    5.3.4 Relating Perceived Atmosphere to Affective and Cognitive Responses ................ 174
    5.3.5 Characterising Visitor Experience through Observed Behaviour ........................ 181
    5.3.6 Relating Perceived Atmosphere and Observed Behaviour .................................. 188
    5.3.7 Comparing Self-Report and Observed Measures of Engagement ......................... 190
  5.4 “Environment Focused” Visitors – a Distinct Population ............................................. 192
    5.4.1 Comparing Atmospheric Perceptions by Environment Focus .............................. 194
    5.4.2 Relationship Between Perceived Atmosphere and Affective/Cognitive Responses for EF, N and NEF Visitors ................................................................. 195
    5.4.3 Comparing Experience Measures for EF, N and NEF Visitors ............................... 197
    5.4.4. Who are the Environment Focused Visitors? ..................................................... 199
  5.5 Summary of Findings from Phase 3 ........................................................................ 201
Chapter Six: Conclusions .............................................................................................. 202
6.1 Introduction – Overview of Research Presented in this Thesis ........................................... 202
6.2 Summary of Key Findings ........................................................................................................ 204
  6.2.1 Introduction: Review of Research Aims ........................................................................... 204
  6.2.2 Key Finding 1: Visitors Use Atmospheric Cues in the Exhibition Environment as Tools for Navigation and Meaning-making ................................................................. 204
  6.2.3 Key Finding 2: Perceived Atmosphere Comprises Four Dimensions: Vibrancy, Spatiality, Order and Theatricality .............................................................. 205
  6.2.4 Key Finding 3: The Perceived Atmosphere Instrument Can Be Used to Characterise Exhibition Environments .......................................................... 206
  6.2.5 Key Finding 4: The Atmospheric Dimensions of Vibrancy, Spatiality and Order are Predictors of Affective Engagement, Cognitive Engagement and Relaxation ................. 208
  6.2.6 Key Finding 5: There is a Subset of Visitors, the Environment Focused Visitors, for Whom the Exhibition Environment is Particularly Salient ........................................... 211
6.3 Significance and Contribution of this Research ................................................................. 212
  6.3.1 Practical and Methodological Applications ..................................................................... 212
  6.3.2 Theoretical Contributions ............................................................................................... 214
6.4 Limitations and Directions for Future Research ................................................................. 216
  6.4.1 Future Research .............................................................................................................. 218
6.5 Concluding Remarks: Returning to the Personal Narrative .............................................. 220
References ...................................................................................................................................... 221
Appendix One: Phase 1 Participant Recruitment Questionnaire .................................................. 243
Appendix Two: Sample Debriefing Interview Transcript .............................................................. 246
Appendix Three: Atmosphere and Experience Questionnaire ...................................................... 249
Appendix Four: Visitor Tracking Sheets ...................................................................................... 257
Appendix Five: Participant Information and Consent Forms ....................................................... 261
List of Figures & Tables

Figures

Figure 2.1a. Illustration of Connectivity and Integration. 20
Figure 2.1b. Space syntax diagram of a traditional museum layout. 21
Figure 2.2: Isovists in convex and concave spaces. 22
Figure 2.3: Binding scale for the experience of three-dimensional space. 23
Figure 2.4. The S-O-R model. 33
Figure 2.5. Circumplex model of affective quality attributed to environments. 38
Figure 2.6. Primary emotions represented in three-dimensional space. 40
Figure 2.7. An emerging model for atmospherics. 45
Figure 2.8. Further development of the atmospherics model. 58
Figure 2.9. Consolidated Museum Atmospherics model. 82
Figure 3.1. The Aboriginal Cultures Gallery (Ground Floor). 87
Figure 3.2. The Aboriginal Cultures Gallery (First Floor). 87
Figure 3.3. The Pacific Cultures Gallery. 88
Figure 3.4. The Biodiversity Gallery. 88
Figure 3.5. Visual model of sequential mixed-methods research. 91
Figure 3.6. Melbourne Museum’s Wild! Gallery. 99
Figure 3.7. Distribution of the participant sample across method (tracked and/or surveyed) and across exhibition gallery. 107
Figure 3.8. Histogram plot of Displeasure. 120
Figure 3.9. Diagrammatic representation of the combined model of cognitive engagement used in this study. 121
Figure 4.1. Subthemes of Orientation and Navigation. 127
Figure 4.2. The pelican exhibit in the Biodiversity Gallery. 130
Figure 4.3. Subthemes of Spaciousness. 132
Figure 4.4. A representative display case in the Pacific Gallery, showing large numbers of objects with minimal labelling. 133
Figure 4.5. Subthemes of Design and Display Styles. 134
Figure 4.6. A view of the Opal Fossils Gallery showing the overhead displays. 135
Figure 4.7. Subthemes of Lighting. 139
Figure 4.8. Subthemes of Colour. 143
Figure 4.9. A view of the Fossils Gallery showing the three-dimensionality of the 144
display wall and the rich red background colour.

*Figure 4.10.* The transition between the coastal zone and marine zone of the Biodiversity Gallery.

*Figure 4.11.* Diagram showing the relationships between the environmental themes that emerged in the visitor transcripts and the hypothesised Perceived Atmosphere variables of Design Appearance, Spatiality and Information rate.

*Figure 5.1.* Relationship between hypothesised Perceived Atmosphere variables and those that emerged from the factor analysis.

*Figure 5.2.* Means plot of Vibrancy by age group.

*Figure 5.3.* Visual comparison between the Vibrancy, Spatiality, Order and Theatricality measures for each gallery.

*Figure 5.4.* Comparison of exhibition galleries by the 15 dimensions of visitor experience.

*Figure 5.5.* Comparison of experience by visit purpose.

*Figure 5.6.* Means plot of Cognitive Engagement by exhibition gallery.

*Figure 5.7.* Means plot of Cognitive Overload by exhibition gallery.

*Figure 5.8.* Diagrammatic representation of the five multiple regression analyses conducted.

*Figure 5.9a.* Hypothetical path model showing Affective Engagement mediating Cognitive Engagement.

*Figure 5.9b.* Hypothetical path model showing Cognitive Engagement mediating Affective Engagement.

*Figure 5.9c.* Vibrancy has a direct effect on both Affective and Cognitive Engagement, which in turn have a positive, reciprocal effect on one another.

*Figure 5.10a.* Frequency histogram of Dwell Time for Aboriginal-1.

*Figure 5.10b.* Frequency histogram of Dwell Time for Pacific Gallery.

*Figure 5.10c.* Frequency histogram of visitor dwell time for Biodiversity.

*Figure 5.11.* Comparison of visitor engagement profiles across galleries.

*Figure 5.12.* Floor plan of Aboriginal Gallery-1.

*Figure 5.13.* Histogram plot of Environment Focused, Neutral and Not Environment Focused visitors.

*Figure 5.14.* Visual comparison of the visitor experience dimensions of EF, N and NEF visitors.

*Figure 6.1.* Revised Museum Atmospherics model.
Figure 6.2. Diagram mapping the four exhibitions according to their Vibrancy and Spatiality scores.

Figure 6.3. Key relationships between Perceived Atmosphere (in particular Vibrancy and Spatiality) and Visitor Experience.

Tables

Table 2.1. Characterising the service environment.
Table 2.2. Relationship between factors predicting environmental preference.
Table 3.1. Summary of Phase 1 Participants.
Table 3.2. Perceived Atmosphere terms used in the pilot stage.
Table 3.3. Demographic summary of the pilot sample.
Table 3.4. Rotated factor matrix of the Perceived Atmosphere items in the pilot sample.
Table 3.5. Rotated factor matrix of evaluative terms.
Table 3.6. Summary of response and refusal rates for visitor surveys.
Table 3.7. Coding protocol for observed visitor behaviour.
Table 3.8. Participant demographics.
Table 3.9. Stated principal visit purpose of participants.
Table 3.10. Rotated factor matrix showing a three-factor solution for the nine PAD semantic differentials.
Table 3.11. Rotated factor matrix showing a four-factor solution for the 24 primary emotions terms used in the Phase 2 survey.
Table 3.12. Pattern matrix of the three-factor solution for affective response.
Table 3.13. Mean and Standard Deviation scores of the three summated scales for affective response.
Table 3.14. Pattern matrix for cognitive response measures.
Table 3.15. Summary statistics of Cognitive Engagement by Visit Purpose.
Table 5.1. Four factor solution for Perceived Atmosphere.
Table 5.2. Bivariate correlations between Perceived Atmosphere and evaluative judgements.
Table 5.3. Statistical comparison of Perceived Atmosphere by gender.
Table 5.4. Summary descriptive statistics of the Perceived Atmosphere dimensions.
Table 5.5. Statistical comparisons of Perceived Atmosphere between different
exhibition galleries.

*Table 5.6.* Bivariate correlations between Perceived Atmosphere and experience dimensions.

*Table 5.7.* Summarised results of multiple regression analyses of relevant experience measures.

*Table 5.8.* Pearson bivariate correlation coefficients of Perceived Atmosphere dimensions and affective and cognitive visitor response measures.

*Table 5.9.* Standardised regression coefficients (beta) from multiple regressions with Perceived Atmosphere dimensions as independent variables.

*Table 5.10.* SRI and %DV measures for each exhibition.

*Table 5.11.* Summary of average levels of Attentional Engagement across the three galleries.

*Table 5.12.* Statistical summary of exhibits encountered in each gallery.

*Table 5.13.* Correlations between Perceived Atmosphere and cognitive/affective measures in the subset of 60 visitors who were both tracked and surveyed.

*Table 5.14.* Correlations between Vibrancy and behavioural measures.

*Table 5.15.* Bivariate correlations between Cognitive Engagement and observed measures of Attentional Engagement.

*Table 5.16.* Bivariate correlations between Affective Engagement and observed measures of Attentional Engagement.

*Table 5.17.* Bivariate correlations between experience dimensions and observed Attentional Engagement.

*Table 5.18.* Perceived Atmosphere comparisons of EF, N and NEF visitors.

*Table 5.19* Summary of the significance and effect size of the main effects by two-way ANOVA.

*Table 5.20a.* Bivariate correlations for Cognitive Engagement, comparing EF, NEF and N visitors.

*Table 5.20b.* Bivariate correlations for Affective Engagement, comparing EF, NEF and N visitors.

*Table 5.20c.* Bivariate correlations for Relaxation, comparing EF, NEF and N visitors.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AACG</td>
<td>Australian Aboriginal Cultures Gallery</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>DV</td>
<td>Dependent Variable</td>
</tr>
<tr>
<td>%DV</td>
<td>Percentage of Diligent Visitors</td>
</tr>
<tr>
<td>EF</td>
<td>Environment Focused Visitors</td>
</tr>
<tr>
<td>EAP</td>
<td>Evaluation, Activity and Potency</td>
</tr>
<tr>
<td>ICOM</td>
<td>International Council of Museums</td>
</tr>
<tr>
<td>IV</td>
<td>Independent Variable</td>
</tr>
<tr>
<td>N</td>
<td>Neutral Visitors (with respect to Environment Focus)</td>
</tr>
<tr>
<td>N</td>
<td>Total number of cases in a survey sample</td>
</tr>
<tr>
<td>n</td>
<td>Number of cases (in a subsample)</td>
</tr>
<tr>
<td>NEF</td>
<td>Not Environment Focused Visitors</td>
</tr>
<tr>
<td>PAD</td>
<td>Pleasure, Arousal and Dominance</td>
</tr>
<tr>
<td>PAF</td>
<td>Principal Axis Factoring</td>
</tr>
<tr>
<td>PCA</td>
<td>Principal Components Analysis</td>
</tr>
<tr>
<td>PCG</td>
<td>Pacific Cultures Gallery</td>
</tr>
<tr>
<td>SABG</td>
<td>South Australian Biodiversity Gallery</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>S-O-R</td>
<td>Stimulus-Organism-Response</td>
</tr>
<tr>
<td>SRI</td>
<td>Sweep Rate Index</td>
</tr>
</tbody>
</table>
Glossary of Key Terms

Atmosphere and Experience Questionnaire – the questionnaire developed and used in the Phase 3 quantitative survey.

Atmospherics – the study of the influence of the designed environment on consumer (or visitor) behaviour, as developed by Kotler (1974).

Atmospheric variables – the designed sensory cues of an environment. In this study the emphasis is on visual cues rather than other sensory stimuli.

Design Appearance – a hypothesised dimension of Perceived Atmosphere. It comprises the general feel of a space, including colour palette, lighting choices and the effect of the environment’s overall gestalt.

Exhibit – a discrete section of an exhibition, such as a display case, touch screen, video presentation, etc.

Exhibition – object displays and/or assemblages of exhibits on a given topic or theme.

Exhibition environment – the features of setting or gallery in which an exhibition is displayed, in particular spatial configuration, layout and organisation, lighting and colour palette.

Experience Measures – a 75-item adjective checklist developed by Packer et al. (2013) as an instrument for capturing the visitor experience.

Gallery – a discrete space in which an exhibition is displayed. In the case of permanent exhibitions, “exhibition” and “gallery” often become synonymous terms as the two are intimately linked.

Information Rate – in environmental psychology, information rate is a measure of a space’s novelty, coherence, complexity and mystery (the anticipated cognitive resources required to comprehend the environment). It was a hypothesised dimension of Perceived Atmosphere in this study.

Museum – except where specified otherwise, in this thesis “Museum” pertains to any informal learning environment. It encompasses traditional museums as well as science centres, zoos, visitor centres, etc.

Order – a dimension of Perceived Atmosphere as identified by exploratory factor analysis. It can be considered as comprising a subset of Information Rate.
*Perceived Atmosphere* – this term was used by Kotler (1974) to describe how a given designed environment (the intended atmosphere) was perceived by customers. In this study it was initially hypothesised to comprise of three dimensions: Design Appearance, Spatiality and Information Rate. Following the development of the Perceived Atmosphere Instrument and exploratory factor analysis, it was revised to comprise the four dimensions of Vibrancy, Spatiality, Order and Theatricality.

*Perceived Atmosphere Instrument* – a survey instrument comprising 30 seven-point semantic differentials that was developed as part of this study.

*Servicescape* – originally coined by Bitner (1992), servicescape has evolved to become a generic term for all the features present in a service environment: ambient aspects, intentionally designed sensory cues, staff, customers, etc.

*Spatiality* – a dimension of Perceived Atmosphere incorporating the extent of an environment’s enclosure or spaciousness.

*Theatricality* – a dimension of Perceived Atmosphere as identified by exploratory factor analysis.

*Vibrancy* - a dimension of Perceived Atmosphere as identified by exploratory factor analysis. It can be considered a facet of Design Appearance.

*Visitor experience* – a visitor’s subjective response to the museum setting, including cognitive, affective and behavioural aspects.
Chapter One: Introduction

1.1 A Personal Narrative on the Origins of This Study

I remember the day I saw the finished product for the first time. It was mid-2001, during the so-called “Day of 1000” at the new, soon-to-be-opened National Space Centre in Leicester, UK. As a soft-opening exercise, those of us who had worked on the project – designers, architects, fundraisers, educators, accountants, builders and so on – collectively rallied 1000 of our friends, families and extended contacts to see how the centre coped with the onslaught, and to iron out any bugs before the formal launch a few weeks later (1000 people was projected to be the number of people who would come through the door on a “typically” busy day). Of course, I had seen the exhibition spaces on a regular basis leading up to this day – starting with the morning we had drawn the exhibition plan in chalk on the fresh concrete slab to get an idea of scale. I’d seen walls go up, exhibits get installed, objects carefully lifted into place. For nearly two years I had been part of many discussions about what exhibits should go where, what the graphics should look like, the “voice” of the exhibit text, the ergonomics of interactive exhibits, and of course what we could actually afford in terms of time and money.

I had joined the National Space Centre’s exhibition development team in mid-1999. I was one of the many Australians who in their early 20s go to the UK to seek adventure and, with a bit of luck, kick-start a career. It was a small, close-knit team, and before long I was the main developer on the Solar System gallery (eventually named “The Planets”) and had a co-ordinating role for all the interactive exhibits for the centre. By the time the “Day of 1000” came by, I thought I knew the place backwards.

What I didn’t anticipate was the magical, ethereal feel the exhibitions would have when all the protective coverings were off of the floor and the house lights had been replaced by display lighting. I still remember the twinkling of the asteroid belt exhibit overhead, creating a conceptual division between the warm, vibrant exhibits of the inner solar system and the cool, quiet outer solar system. I remember feeling surprised at how spacious the whole centre felt, especially since I knew that – somewhere – there were 999 other people sharing this building with me. There was an energy

---

1 The Space Centre was one of several cultural attractions built across the UK to celebrate the turn of the millennium. http://www.spacecentre.co.uk/
to the space that transcended the specifics of a carefully chosen object or any painstakingly-honed fact on a text panel.

Naturally, my impressions were coloured by the sense of relief and achievement I had that we’d finally made it after years of hard work. But nonetheless I wondered how general visitors, having no sense of the back story that culminated in what they saw on the exhibition floor, would make of it all. Would our curatorial and design decisions make sense? Would visitors get the interpretive messages that informed our colour and stylistic choices? Would the environment evoke the feelings we intended?

Unfortunately, these were not questions I was able to explore. My employment contract with the Space Centre was only until the exhibition’s completion, so it was time for me to move on. I made the transition from client to consultant, joining the interpretation department of the exhibition design firm who had worked on the Space Centre. Over the following years I worked on a wide variety of projects, ranging from whole new museums to small temporary exhibitions. However, a common thread through all these projects, despite the best of intentions of all concerned, was a lack of opportunity to revisit completed exhibitions and see whether visitors were receiving them and interpreting them in the way we had intended. Once an exhibition was open, teams disbanded, funds ran out, and staff were already immersed in the next project. Our job was finished: But the life of the exhibition was only just beginning! And we never had the chance to go back and ask: Were the carefully planned narrative cues noticed? Did the environments stimulate the senses as we had intended? What kinds of experiences were visitors having?

Although as a design team our collective knowledge and experiences were able to inform these questions in a general way, I always had a niggling sense that there should be a way to study these issues more systematically, a way of seeing whether designers’ intentions matched visitors’ experiences. I thought that if we found a way of doing so, that was quick and easy to implement, it would have a fighting chance of actually being used – and thus inform and improve exhibition design. This thesis is the culmination of that niggling sense I had had for over a decade.

---

1.2 Museums: Their Social, Cultural and Economic Role

Museums are a well-established cultural form, although the word “museum” is now used to describe a wide variety of different intuitions, both profitmaking and non-profit. Historically, museums have revolved around a collection of some description. More recently, museums with less emphasis on material collections and more emphasis on cultural ideas or scientific phenomena have emerged. In a formal sense, museums are defined by the International Council of Museums (ICOM) as:

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 (ICOM, 2007).

In terms of visitor experience design, researchers and practitioners tend to take a broad definition of museum that encompasses both traditional collection-based museums as well as science centres, interpretive centres, zoos and aquariums. Such sites have been described by Packer (2004) as “educational leisure settings”. Museums can be considered important facilitators of lifelong learning (Lord, 2007), and satisfy a need of those who seek intellectual enrichment in their leisure time:

[Consumers] are no longer satisfied with just pleasant scenery, or a fun outing. Consumers want hedonic encounters to be incredible from a purely hedonic standpoint, yes, but now, these consumers also want to learn, to be exposed to new cultures, new information, broaden their horizons and gain new insight from their experience. (Joseph-Mathews, Bonn, & Snepenger, 2009, p. 197, emphasis added)

According to the Australian Bureau of Statistics (ABS), during the study year of 2009–2010 some 25.9% of the Australian population aged over 15 visited an art gallery, 25.5% visited a museum, and 36.8% visited zoological parks and aquariums (ABS, 2011). While this indicates that the direct use of museums is considerable, the social value of museums is much broader in the way that museums are valued by their communities as important civic institutions and focal points for economic investment (Scott, 2009).

Museums, particularly larger museums in major cities, are important as tourism destinations. They help to create a sense of place, contribute to the overall self-image of a destination, and are contributors to the tourism economy (Carey, Davidson, & Sahli, 2013; Kirshenblatt-Gimblett, 1998; Stylianou-Lambert, 2011). Furthermore, many tourists visit museums in order to orient themselves to a destination’s cultural identity (Stylianou-Lambert, 2011). Consistent with this assertion, an
estimated 29% of all international tourists to Australia in 2009 visited at least one museum or gallery during their stay (Tourism Research Australia, 2010). In the same year, nearly 4 million domestic overnight tourists and 3.4 million domestic day tourists visited a museum or gallery (Tourism Research Australia, 2010).

Within museums, the primary conduit for the visitor experience is the exhibition (Lord, 2001). This is a unique communication medium characterised by being a three-dimensional, interpreted space that creates a narrative through movement in time and in space (Wineman & Peponis, 2010). This three-dimensionality of exhibitions, along with the ability to interact with real objects, is particularly significant in a world that is becoming increasingly screen-based (i.e., two-dimensional) in the way that people interact with the world and gain new information and skills (Lord, 2007). While the display of collections has been a feature of the public museum since its inception, the role of exhibition design in orchestrating the content and narrative of an exhibition into a holistic experience has received greater recognition since the 1980s (Belcher, 1991; Dernie, 2006; MacLeod, Hanks, & Hale, 2012; Miles, Alt, Gosling, Lewis, & Tout, 1988; Psarra, 2005). There has been greater attention paid to creating experiences, not just displays. As a consequence, the role of the exhibition environment – including its scale, layout, organisation, lighting, and colour palette – has become increasingly recognised as being more than just a passive backdrop or decoration for exhibition content. Indeed, the capacity for such factors to shape how exhibition content is perceived may have been underestimated (Roppola, 2012).

1.3 The Research Problem

Considerable resources are expended in the planning, design, and construction of museum exhibitions, with a “typical” 6000 square foot exhibition costing in the order of US$200 per square foot to design and build (and up to three times this amount depending on the level of complexity and technology in the design; Museum Planning, 2011). Such installations can be in place for at least 5-10 years, and thus exhibitions have a lasting impact on the character of the visitor experience long after they are completed. Despite this high level of investment, however, there has been relatively little research into how these carefully planned and orchestrated spaces are experienced from a visitor-centred perspective, at least in a way that can meaningfully inform exhibition design (Macdonald, 2007).

One challenge to addressing this question and furthering our understanding of the exhibition-visitor relationship is a lack of shared knowledge, concepts and vocabulary among exhibition designers, museologists and visitor researchers (Macdonald, 2007; Stenglin, 2009). Museum exhibition design
has historically lacked a body of theoretical knowledge to draw upon, with the discipline being mostly practice-led and based on tacit understandings and informal communities of practice (Roberts, 2013; Roppola, 2012). As a consequence, exhibition design has struggled to gain scholarly recognition (Boycher, 2010). This is exacerbated by the time-limited and often business-oriented context in which exhibition design takes place.

Exhibitions are the product of interdisciplinary teams, bringing together a range of specialists, each having distinct (and sometimes conflicting) theoretical traditions and conventions of practice (Lee, 2007). Analysis of the exhibition environment from a design perspective has generally taken the form of peer critique. However, this may not necessarily reflect the typical visitor experience: designers have been accused of conferring awards of excellence to exhibits that have performed poorly in evaluations (Shettel, 2008). On the other hand, it has been claimed that designers are often kept at arm’s length from the exhibit evaluation process, with visitor research tending to neglect areas that could most usefully inform exhibition design (Macdonald, 2007). In practice, design decisions frequently rest on intuition and assumptions made about visitor needs, rather than being grounded in research (Roberts, 2013). Similarly, museology has tended to focus on sociocultural critiques of the museum as an institution, considering the visitor in abstract terms rather than studying visitor experiences directly (Kirchberg & Tröndle, 2012; Witcomb, 2013). Consequently, in much of the extant literature as well as in practice, visitor responses to the exhibition environment and its sensory cues have been inferred rather than tested empirically. From both an economic and academic perspective, therefore, further research into how visitors perceive and respond to different exhibition environments is warranted.

Although design, museology and visitor research represent distinct communities of practice that have sometimes struggled to speak to one another on mutually intelligible terms, the common feature that all share is a desire to connect with the visitor. Thus, development of theory that has its roots in empirical visitor research has the potential to bridge these diverse perspectives and encompass the exhibition experience more holistically (Macdonald, 2007; Roppola, 2012; Stenglin, 2009). With this goal in mind, this thesis describes the development of a model for characterising how visitors perceive different exhibition environments – Perceived Atmosphere – and relates it to different facets of the visitor experience.
1.4 Theoretical Framework

This research draws upon existing theory regarding how people perceive and respond to environments and applies it to the museum context. In particular, it is based on a theoretical concept known as *atmospherics*, which was first defined in the context of retail environments (Kotler, 1974). Atmospherics is the study of how design characteristics of a service setting influence customers’ perceptions and subsequent behaviour, such as spending time, making purchases, and recommending to others. According to Kotler’s original definition, a store’s “atmosphere” comprises its sensory elements which together communicate with shoppers through *attention* (standing out from the crowd), *message* (regarding the type of establishment and store image) and *affect* (colours, textures and sensory cues that subtly influence consumers) (Kotler, 1974).

As a complement to Kotler’s model for atmospherics, Baker developed a typology of the service environment that characterised atmospheric cues as either *ambient* (temperatures, sounds, odours), *design* (layout, colour, interior design), or *social* (presence of other customers and store employees) (Baker, 1987). It is the design elements of the exhibition atmosphere that are of interest to this study.

Both atmospherics and existing research into the museum visitor experience have been strongly influenced by the theories and techniques associated with environmental psychology (Bitgood, 2002, 2011; Ng, 2003). Environmental psychology is the study of the interplay between people and their environment, where the environment is understood to comprise both physical and sociocultural elements (Holahan, 1982; McAndrew, 1993). In environmental psychology theory, the person and environment are both considered as holistic, integrated wholes (Holahan, 1982). The environment simultaneously comprises multiple contexts across different scales (i.e., immediate surroundings, geographic regions, social and cultural contexts). Psychological responses to this environment (e.g., perceptual, cognitive, affective) mutually interact and affect behaviour. These responses in turn influence the environment, creating a reciprocal person-environment relationship. In this transactional model of environmental psychology, the person-environment interaction is the main subject of study and one cannot be fully understood in the absence of the other (Bitgood, 2002; Holahan, 1982). Applying these principles of environmental psychology to the museum environment, the visitor-exhibition dynamic can be considered to unfold in space and time as the visitor perceives, processes, responds to and interacts with cues in the exhibition environment (Bitgood, 2011; Falk & Dierking, 2000; Holahan, 1982).
As in environmental psychology more broadly, this research does not rest on the presumption that visitors are passive recipients of environmental stimuli – rather, it conceives museum visitors as active participants in meaning-making who come to museums to satisfy a range of personal and social needs (Falk & Dierking, 2000). Through their design, exhibition spaces may help or hinder this process and thus visitors preferentially seek out environments that best fit their physical, psychological and physiological requirements (Ng, 2003; Rounds, 2004). Thus, by providing a better understanding of how the exhibition environment is perceived, this research aims to provide further insight into how exhibition design can enhance the visitor experience.

1.5 Research Aims and Approach

This research set out to explore how visitors perceive different types of exhibition environment and determine how such perceptions may influence the overall visitor experience. Specific research aims were identified as follows:

- to explore visitors’ perceptions of different exhibition environments;
- to develop an instrument to measure perceptions of the exhibition environment and determine its underlying dimensions, as a way of characterising different exhibition environments from a visitor-centred perspective;
- to characterise relationships between this Perceived Atmosphere and visitor experience, as measured through visitors’ self-report responses and observable behaviour.

The research aims were addressed through a sequential mixed methods study combining both qualitative and quantitative methods. Qualitative methods were used to explore visitors’ perceptions in depth and to gain a visitor-centred perspective on the key factors that create an exhibition atmosphere. Results from the qualitative research were used to inform a larger-scale quantitative study that sought to relate Perceived Atmosphere to different facets of the visitor experience. Qualitative results were also used to assist in the interpretation of findings from the quantitative stage.

The research was conducted in three main phases:

- **Phase 1: Qualitative exploration of exhibition environments.**
  A combination of accompanied visits and semi-structured interviews with 13 participants was used to explore visitors’ perceptions and responses to a selection of exhibition environments.
• **Phase 2: Development of a quantitative instrument to measure Perceived Atmosphere in an exhibition setting.**

Using findings from Phase 1, and informed by the environmental appraisal literature, an instrument for measuring Perceived Atmosphere was developed and piloted with 172 visitors to three different exhibition galleries. Following piloting, the instrument was refined and incorporated into the main quantitative study in Phase 3.

• **Phase 3: Study of the relationship between Perceived Atmosphere and visitor experience.**

A total of 602 visitors to four different exhibition galleries completed an Atmosphere and Experience Questionnaire. Results from this, supplemented by discreet observation of an additional sample of visitors in the same galleries, allowed the relationship between Perceived Atmosphere and visitors’ cognitive, affective and behavioural responses to be studied.

Most data were collected at the South Australian Museum, a natural history and anthropology museum located in the city of Adelaide.

**1.6 Significance of the Research**

This research adds to the increasing body of evidence that atmospheric features of the exhibition environment are important for visitors’ navigation, sense-making and affective engagement. Central to gaining these insights was the development of an approach to quantify visitor perceptions of the exhibition environment – the Perceived Atmosphere Instrument. Using this instrument, four dimensions of Perceived Atmosphere were identified: Vibrancy, Spatiality, Order and Theatricality. These four factors were able to meaningfully characterise how visitors perceive different exhibition environments and in so doing provide a deeper insight into how different exhibition settings are viewed from the visitor perspective. Furthermore, three of the dimensions, Vibrancy, Spatiality and Order, were found to have significant relationships with different facets of the visitor experience in a way that is consistent across different exhibition galleries.

From a practical perspective, the Perceived Atmosphere Instrument provides exhibition designers and visitor researchers with a new approach for characterising exhibition environments in a way that can inform future exhibition development. It comprises measurable constructs that contribute to a shared language among exhibition designers, educators and evaluators. From a theoretical perspective, linking Perceived Atmosphere to broader psychological theory increases understanding of how and why visitors perceive and respond to different kinds of exhibition spaces in certain
ways. Together these findings can help inform future exhibition design and creation of museum exhibition environments that are more likely to encourage intended visitor outcomes.

1.7 Structure of this Thesis

Chapter 2 of this thesis includes a comprehensive review of the relevant literature in three parts:

1. A historical review of museum architecture and exhibition design, focusing on the emergence of experience as an important aspect of museums’ sociocultural role. This will include theoretical models for describing museum space that have emerged from architecture and linguistics theory.

2. A review of the field of atmospherics as the design of space so as to encourage specific affective, cognitive and behavioural outcomes. This will be complemented by literature about environmental perception, appraisal and preference more generally.

3. A review of the museum visitor studies literature, with an emphasis on the studies of visitors in exhibition spaces. This research is situated within a broader framework of environmental psychology.

A description of the research approach and methodology is provided in Chapter 3, describing the three-phase, sequential mixed-method study presented in this thesis. Results from the qualitative phase of research are presented and discussed in Chapter 4, while the quantitative results that form the bulk of this study are presented and discussed in Chapter 5. Overall conclusions drawn from this study, including limitations and possible future research directions, are summarised in Chapter 6. Research instruments used in this study are supplied as appendices.
Chapter Two: Literature Review

PART ONE: Museum Exhibitions and the Visitor Experience

This part of the literature review positions the museum visitor experience within a broader social and economic context and describes the role exhibition design plays in crafting visitor experiences. To illustrate how this has changed over time, a brief history of museum architecture and exhibition design is presented, tracking key developments in practice. This history is complemented by an overview of theories of exhibition space as drawn from architecture, theatre, linguistics and semiotics.

2.1 The Importance of Experiences

The 20th century witnessed a major change in industrialised societies whereby their economies moved away from being predominantly goods-based (the manufacture and trade of commodities and products) to being increasingly service-based (the development and trade of knowledge and skills). This shift brought the social aspects of economic activity into the foreground. The performative nature of everyday social interactions was chronicled by Goffman (1959), who noted the particular significance of impression management in service settings. This dramaturgical metaphor of staging and performance influenced the way the service economy, including tourism, was subsequently theorised (Grove & Fisk, 1992; MacCannell, 1973). By the turn of the 21st century, the need to move beyond “features and benefits” to the more experiential dimensions of consumption was being recognised (Schmitt, 1999). Pine and Gilmore described this as the rise of the “experience economy”, and predicted it would be just as transformative as the shift from goods to services had been (Pine & Gilmore, 1999). They asserted that commodities are fungible3, goods are tangible, and services are intangible; whereas experiences are memorable. With this greater emphasis on personal engagement, experiences command a premium in terms of both money and time people are willing to spend on them (Pine & Gilmore, 1999). One manifestation of the experience economy has been in the tourism industry, which has seen a shift in focus from tourism “products” to tourism “experiences” (Ritchie, Tung, & Ritchie, 2011). This is more than a change in semantics, it represents a conceptual shift away from product performance to an emphasis on user experience (Pine & Gilmore, 1999).

3 Fully interchangeable with another commodity of the same type and grade. Currency is considered fungible as banknotes of the same face value are completely interchangeable.
Consistent with these trends in the wider tourism and leisure industry, museums increasingly view their role in terms of the visitor experience they offer (Falk & Sheppard, 2006; Kirchberg & Tröndle, 2012). In this sense, museums are becoming active *producers* of culture, not merely passive collectors of it (Smith, 2011). Museums have become monumental representations of a destination’s sense of place and cultural identity and thus significant tourist destinations (Kirshenblatt-Gimblett, 1998).

While there has been much interest in experiences in the museum, tourism and broader consumption literature, the term itself has been used interchangeably to describe a number of different concepts (McCarthy & Ciolfi, 2008; Packer, Ballantyne, & Bond, 2013). “Experience” can be a noun or a verb: a product that is marketed and consumed; or a process that unfolds spatially and temporally. In a museum, experience can be seen as a process of mutual interaction or “dialogue” between a visitor and their setting (McCarthy & Ciolfi, 2008). The conception of visitor experience used in this study aligns with the definition as “an individual’s immediate subjective and personal response to an activity, setting or event outside their usual environment” (Packer et al., 2013). By this definition, visitor experiences are subjective and personal, making understanding the visitor experience a relatively challenging research undertaking (Packer et al., 2013). This difficulty has been reflected in the tourism literature more generally with a relative lack of theoretically and conceptually-led research in the area of tourism experiences (Ritchie et al., 2011). Nonetheless, understanding visitor experiences, and the factors that influence them, is clearly important and calls for further research and conceptual development.

### 2.2 Exhibition Design: Importance and Research Challenges

Exhibitions are an integral part of a museum’s public image and the principal means by which museums communicate with their audiences. They are the most visible aspect of museum operations; for many members of the public, exhibitions are synonymous with the museum as a whole. As museums are increasingly required to demonstrate their public value, exhibitions have become ever more important. Thus the design of exhibitions and the resulting visitor experience has become an integral component of realising museum policies of public engagement more generally (Belcher, 1991; Burton, Louviere, & Young, 2009; Falk & Sheppard, 2006; Lord, 2001).

The term “exhibition” has multiple meanings and interpretations. Exhibitions can be considered as tools to communicate and persuade; an embodiment of an institution or a representation of brand. From a historiographical perspective, exhibitions can also be seen as products of their time and the assumptions of their creators (Moser, 2010). Over time, exhibitions have evolved to encompass a
broader range of media, overlapping with art, advertising, architecture and graphic design. It is thus an orchestration of space, media, content and narrative (Dernie, 2006; Lorenc, Skolnick, & Berger, 2010; Velarde, 2001).

The term “design” is also one which is difficult to define uncontroversially. This is partly because the delineation between art and design is contested (Palmer, 1996); partly because there are tensions between design as an academic discipline and design as a professional practice (Bayazit, 2004; Jonas, 2007; Lang, 1991); and partly because design encompasses a range of intangible processes that are not unique to the discipline (Zeisel, 2006). Rather than aligning with any particular definition from the literature, this study considers design as “the specification and creation of an object or an environment in order to fulfil a given purpose or need”. It is an iterative process of creation, review and refinement.

The focus of this review will be on the design of interpretive exhibitions (i.e., those with educational, social or aesthetic intent such as those found in museums or other educational leisure settings) as opposed to commercial or trade exhibitions. However, it is noted that this distinction is a blurred one, with trade expositions, museums and retail environments all sharing common features and mutual influence (Dernie, 2006; Velarde, 2001). In interpretive exhibitions, form and content are increasingly integrated such that the design is as much a mediator of the intended message as the content: “each choice makes a meaning that is just as important to the overall meaning(s) of an exhibition as the objects on display in the space or the text panels adjacent to them” (Stenglin, 2004, p. 12).

Exhibition design is a complex and multidisciplinary endeavour that has proven difficult to theorise or even adequately define. In the words of one group of designers, it is “a mode of communication that has meant different things at different times, continues to change and expand, and, in fact, is not even recognised universally as a discipline at all” (Lorenc, Skolnick, & Berger, 2010, p. 12). Irrespective of this disciplinary ambiguity, exhibition design is a clearly identifiable profession. The 2011 (UK) Museums Association Services directory lists 52 companies under the “Exhibition Design” category, while the Australian counterpart, an online suppliers’ register managed by Museums and Gallery Services Queensland, lists 33 individuals and companies under the same category (Museum & Gallery Services Queensland, n.d.). As well as demonstrating the scale of the industry, the number of companies listed is indicative of the fact that a significant portion of exhibition design is conducted for museums (as part of a contractual relationship) rather than by museums (by an in-house design team).
While the relative economic benefits of in-house versus contracted design is beyond the scope of this review, the situation is significant from a research perspective in that it means design decisions are often taken in the context of a commercial environment. This has the effect of inhibiting the sharing of ideas and lessons learned, due to intellectual property concerns and the reluctance to openly share learning from experimental or “failed” endeavours. The overall institutional disconnect between designers and museum professionals has hitherto limited the usefulness of visitor research to exhibition design, in that visitor research has not been timed or framed in a way that can adequately inform and influence design decisions (Macdonald, 2007; Roberts, 2013). Furthermore, visitor research can be marginalised by museum staff who see it as a threat to their own professional knowledge and expertise (Lee, 2007).

It should also be acknowledged that exhibition planning, design and construction is a complex and protracted process, making it difficult to trace the history and rationale of design decisions after the fact. This affects the study of design more generally (Zeisel, 2006). At the conclusion of a project that may have been years in the making, the team’s energies (not to mention the project budget) are spent. Thus “too often, once an exhibition is finished everybody wants to just move onto the next project and no in-depth visitor research is conducted” (Macdonald, 2007, p. 159).

2.3 Brief History of Museum Architecture and Exhibition Design

From the historic buildings to the contemporary ones, museum architecture moves from ‘showing’ to telling and from classification to narrative (Hillier & Tzortzi, 2011, p. 293).

To place the existing research of museum exhibition spaces into a broader context, this section will review key developments in the practice of exhibition design and museum architecture. Museum architecture and exhibition design are clearly interlinked, as the design of exhibitions will inevitably be influenced by their architectural envelope.

The museum emerged as a distinct architectural form early in the 19th century (Giebelhausen, 2011; Higgins, 2005). These early museum archetypes, with their commanding entrance halls, rotunda, columns and wings of enfilade rooms, took their design cues from European palaces and other monumental forms, reinforcing the museum as a place of gravitas (Dernie, 2006; Giebelhausen, 2011). The monumental scale of the buildings is also believed to have reinforced cultural power hierarchies of which museums were an implicit part (Stenglin, 2004; Witcomb, 2003).
In the early history of the public museum, little specific attention was paid to the actual layout of exhibitions within these grand halls. Architecture dictated the organisation of collections, usually into wings that delineated between different categories of knowledge (Psarra, 2005). Interior décor was generally driven by architects rather than curators, with ornately patterned ceilings and floors accompanied by walls of rich, dark tones (Giebelhausen, 2011). Within these spaces, entire gallery walls were covered with artworks and uniform, built-in display cases were filled with objects (Dernie, 2006; Miles et al., 1988). The net effect of the décor and display was one of “dark, cluttered interiors” (Dernie, 2006, p. 8). The needs of the visitor were not a consideration and interpretation was minimal. The result was exhibition spaces that “presented the lay visitor with a puzzling arrangement of objects, each carefully placed beyond his reach, with a label in a language he could barely understand” (Miles et al., 1988, p. 3).

In the early 20th century, the rise of modernism in both art and architecture had a marked influence on exhibition design, in particular Walter Gropius and the Bauhaus, a renowned art, craft and design school in Germany during the 1920s and 1930s (Miles et al., 1988). Current design education can trace its roots to the Bauhaus’ teaching (Bayazit, 2004) and Miles speculates that the Bauhaus innovations were ultimately responsible for the emergence of exhibition design as a distinct profession (Miles et al., 1988, p. 7). The Bauhaus’ design of trade exhibitions in early 1930s Germany paid attention to visitor flow, sequencing, graphic design and provision of simple interactive exhibits in a way that could be considered the forerunner of museum exhibitions as they are currently conceived.

Another forerunner in modern exhibition design and interpretive techniques was Otto Neurath, who founded Vienna’s Social and Economy Museum in 1925 (Kraeutler, 2008). His exhibitions on public health and human geography recognised the public education potential of the exhibition medium, and his infographic-based communication approach later became known as the ISOTYPE pictorial language (Kraeutler, 2008; Miles et al., 1988). Neurath also recognised the importance of considering the audience in the exhibition development process, creating a team role which he called the “transformer”. The transformer was a mediator between expert and audience, who in current parlance would be known as an interpreter or audience advocate (Kraeutler, 2008).

However, these innovations took place at the margins rather than fundamentally altering European museological practice. Furthermore, the influence of Neurath and other progressive exhibition designers in Europe was curtailed by the political persecution and rapid displacements associated with the rise of National Socialism and the Second World War (Kraeutler, n.d., 2008). The resultant
social, political and economic disruption arguably hampered further advances in European exhibition design until at least the 1960s.

Meanwhile, across the Atlantic, 20\textsuperscript{th} century consumer culture was exerting its influence on exhibition design. This was particularly apparent in New York, where both museums and department stores were seeking new ways to use design to orchestrate visitor/customer attention and to convey the value of objects/products. Comparison of museum dioramas and shop window displays from the era shows how the two influenced one another during this period; in some cases it was the same designers working on both (Foster, 2012; Henning, 2006). One of these designers was Rene D’Harnoncourt, whose 1946 exhibition \textit{Arts of the South Seas} at the Museum of Modern Art incorporated dramatic lighting and evocative colour schemes in a way that broke new ground in exhibition design as a form of interpretation and as an art in itself (Foster, 2012).

In parallel with these changes in exhibition practice, Modernism challenged the conventional boundaries of art: the exhibition became a medium through which art was experienced rather than simply a place where it was catalogued (Dernie, 2006; Lampugnani, 2011). The resulting “white cube” minimalist design aesthetic has since become the archetypal art gallery environment, with the intention that the space fades into the background leaving the art as the only focus (Dernie, 2006; Giebelhausen, 2011).

In contrast with the white cube of the art gallery, hands-on museums (i.e., science centres and to a lesser extent natural history museums) have developed within a “black box” paradigm (Toon, 2005). In this case the museum interior intentionally obscures the outside world, placing the visitor in an artificial environment created by the exhibition designer. In the black box paradigm, there has been more focus on the scenography of exhibition spaces such as experimentation with the creation of different moods and characters of space through scale, layout and lighting (Dernie, 2006; Toon, 2005).

\textbf{2.4 New Roles for Exhibitions: From Displays to Experiences}

Exhibition design as a way of intentionally organising and orchestrating the museum visitor experience began to receive greater prominence in the 1960s (Miles et al., 1988). It is probably no coincidence that this same period also saw a renewed focus on the museum visitor (as discussed in Section 2.14), since a visitor-focused approach calls for greater consideration of the role of design:
[In an] ‘interpretative paradigm’, however, *design is recognised more fully as an integral part of the visitor experience*, with potentially more far-reaching implications for structuring the very nature of that experience rather than simply providing a more or less attractive medium for presenting content (Macdonald, 2007, p. 150; emphasis added).

In a relatively early attempt to classify interpretive exhibitions, Belcher (1991) defined two main exhibition types: *emotive* and *didactic*. Emotive exhibitions were those produced for primarily aesthetic or evocative purposes such as the presentation of artistic objects, or theatrical and immersive exhibits such as the recreation of an ancient Roman village. Didactic exhibitions on the other hand, were those with a more explicit educational intent and thus greater emphasis on interpretation, creating what could be called a “three dimensional essay” (Belcher, 1991, p. 63).

In the intervening two decades, the distinction between these two categories has become more blurred. Artistic exhibitions have begun to adopt more interpretation and educational exhibitions are harnessing more narrative and theatre in their presentation. In addition, a broadening in the range of exhibition media available and an increasing sophistication in audience expectations have together driven a greater emphasis on the design of the exhibition environment as a whole (Dernie, 2006; Lord, 2001; Lorenc et al., 2010; Mayrand, 2001). This evolution can be seen in the exhibition categories defined by Dernie (2006), who categorises exhibitions primarily as

- **narrative space**: the juxtaposition of objects and displays in a way that sightlines and visitor movement reveal an unfolding narrative and layered storylines;
- **performative space**: where the emphasis is on action rather than observation on the part of the visitor, for instance interactive exhibits; and
- **simulated experience**: immersive multimedia experiences and scenic reconstructions that could be considered an evolution and extension of the traditional museum diorama).

This represents a shift in thinking about exhibitions as a collection of isolated displays to exhibitions as integrated experiences:

...experience design builds a context out of the display object or product with the aim of engaging the visitor at an emotive level and in so doing attaching a personal memory to the experience of the visit... And essential to the creation of a memory-rich experience is the character of the physical setting (Dernie, 2006, p. 13).
While it is widely acknowledged that the museum exhibition environment can enhance (or indeed inhibit) the visitor experience and curatorial intent (Dernie, 2006; Goulding, 2000; Macdonald, 2002, 2007), visitor research has historically focused more on exhibition content than the nature of the environment in which it is situated. This is due in no small part to methodological challenges: it is difficult to isolate and study individual aspects of design without fundamentally altering the nature of the experience being studied. Consequently, visitor research in the museum space has historically focused on the “minute and the measurable” (Leinhardt & Knutson, 2004, p. 124) rather than broad questions about the role of exhibition design, particularly its more theatrical or affective aspects. Redressing the balance, theories of exhibition space and its role in the visitor experience and the construction of meaning have become a more significant research focus in recent years (Peponis, Dalton, Wineman, & Dalton, 2004; Roppola, 2012; Schorch, 2013; Stenglin, 2004).

2.4.1 Experiences as Theatre – Exhibition Design as “Scenography”

With the rise of the experience economy, event planners and service providers have increasingly turned to dramaturgical and theatrical frameworks as a way of conceptualising their operations (Grove & Fisk, 1992; Nelson, 2009; Zomerdijk & Voss, 2009). In such frameworks, personnel are “actors”, customers are the “audience”, the service environment is the “setting” and the consumption event is a “performance” (Grove & Fisk, 1992). Experience-based businesses pay considerable attention to the “narrative arc” of their interactions with customers, from initial anticipation and encounter to delivery and subsequent recollection. Narrative techniques such as sequential exposition, climactic revelation and denouement are seen as a way of enhancing emotional engagement and thus memorability of an experience (Zomerdijk & Voss, 2009). These narrative structures are constructed through a sequence of “experience clues” or “touchpoints”, comprising both staff interactions and the sensory properties of the physical environment (Carbone & Haeckel, 1994; Zomerdijk & Voss, 2009). The creation of themed environments is a major component of experience design (Nelson, 2009), although the adoption of sensory design principles has to some extent been hampered by a lack of knowledge of the effects of specific design attributes on customer responses (Zomerdijk & Voss, 2009).

In the museum context, exhibitions have been likened to a play: an exhibition has an overarching theme or storyline (plot) that can be divided into acts (galleries or subdivided spaces) and scenes (display clusters). Individual elements such as text panels, images and objects can in turn be related to dialogues, soliloquies and props (Crawley, 2012; Rabinowitz, 2013). Similarly, Yellis (2010) draws parallels between the museum and the theatre in the sense that both have the capacity to
transform visitors on an emotional level. He argues that both a strong narrative as well as attention to the exhibition staging, or atmospherics, are important for enacting this transformation.

These parallels between theatrical design and exhibition creation are embodied in the term *scenography*, an approach to spatial communication in which form, content and media are inseparable components of an experiential whole (Bofinger, 2010). Scenography, as the orchestration of space and form, can be considered analogous to the term “choreography” for the orchestration of movement. European in origin, the word scenography has emerged relatively recently in theatrical design (Howard, 2010). As a discipline it transcends set design to encompass “the totality of visual creation in the stage space” (Howard, 2010, p. xxiii). Use of the term in an exhibition design context is relatively widespread in continental Europe (Bofinger, 2010; Korff, 2008), although so far it has not gained currency in this context in the broader Anglosphere.

Scenography demonstrates the potential to see the exhibition environment as a holistic visual creation. The environment both reflects and reinforces the intended narrative through the selections of colour, light and form (Howard, 2009). However, just as the exhibition environment has been subservient to content in the way that museum exhibitions are critiqued and studied, scenography has been a secondary consideration in comparison to narrative or plot in theatrical critique (Howard, 2009).

While there are similarities between theatre and exhibitions, there are also marked differences in their overall purpose. This influences the way they have been theorised and studied. Although there are audience reception studies in theatre (e.g. Boerner & Jobst, 2013), theatrical scenography is considered primarily a form of artistic expression, with surrounding discourses more focused on the underlying philosophy, history and modes of production (Collins & Nisbet, 2010). In contrast, interpretive exhibition design has a far more overt didactic or communicative purpose, with the desire for visitors to come away with an understanding of an exhibition’s “big idea” (Serrell, 1996a).

There are additional differences between theatre and exhibitions with respect to the spatial and temporal relationship between designer and audience. In theatrical productions, creators and audiences share a dialogue that lasts the duration of the performance:

> There is always a sense of tension and excitement on both sides of the performative space. . . . [when] the audience and performer connect across the dark divide, from stage to audience and vice versa, they become one, and both sides know it (Howard, 2009, p. 190).
By contrast, exhibition design traditionally takes place at both a physical and temporal distance from the intended audience. In this sense, exhibition design shares parallels with the design of retail environments, where there is a similar disconnect between the design and use of the environment (Underhill, 1999). As with exhibitions, retail design is also primarily communicative in intent (Kotler, 1974). The potential for retail design to inform exhibition creation will be discussed in the context of atmospherics in Section 2.7.

2.5 Theories of Exhibition Space

One challenge of studying design is that “good” design tends to fade into the background. Its importance is subsumed by the way it supports communication in a subconscious, almost imperceptible way. An additional difficulty with theorising exhibition design is the lack of a common language of space that can be used to facilitate communication and common understanding between designers, educators, curators and other exhibition planners (Hillier & Tzortzi, 2011; Macdonald, 2007; Stenglin, 2004). Some developments towards a shared language are described below, although a comprehensive vocabulary of exhibition environments is yet to emerge (Macdonald, 2007).

2.5.1 Space Syntax

Space syntax is a way of describing, quantifying and analysing spatial relationships that has been used in architecture and urban design, including museum buildings (Hillier & Tzortzi, 2011). Space syntax quantifies spaces in terms of their juxtapositional relationships, taking the rationale that this is a better predictor of how visitors use and make sense of space than simple size or distance (Hillier & Tzortzi, 2011).

Two key syntactic measures of space are integration (the more integrated the configuration, the fewer spaces must be traversed in order to reach all other areas), and connectivity (the number of other spaces directly accessible from a given space) (Hillier & Tzortzi, 2011). These spatial properties are exemplified in Figures 2.1a and 2.1b.

Cross visibility between spaces (which may differ from connectivity) has also been used as a syntactic measure (Choi, 1999; Rohloff, Psarra, & Wineman, 2009). While integration and connectivity describe separate spatial properties, the extent to which they positively correlate contributes to the overall intelligibility of a layout (Hillier & Tzortzi, 2011).
Most syntactic studies of museum space have focused on art museums and the extent to which architectural properties influence visitor flow and thus the potential construction of meaning (Choi, 1999; Hillier & Tzortzi, 2011; Rohloff et al., 2009; Zamani & Peponis, 2010). These studies have found that visitor traffic through a museum becomes concentrated in the most integrated routes, as these represent the most efficient means of moving from gallery to gallery. Buildings with high integration tend to feel more informal and dynamic as people more frequently pass one another (Hillier & Tzortzi, 2011).

Meanwhile, the level of connectivity is also important in defining the overall feel of spaces. Low connectivity imposes constraints on visitor movement; at its extremes it will allow a single linear route that creates a didactic exhibition narrative (as per the example in Figure 2.1a). Increasing connectivity will provide more route options and thus a greater potential for choice and exploration. However, very high connectivity can offer too much choice, creating a confusing layout that is difficult for visitors to navigate (Hillier & Tzortzi, 2011).

Figure 2.1a. Illustration of connectivity and integration.
Each circle represents a room and the lines denote routes of access. The “beads on a string” arrangement of spaces shown above left illustrates low integration (all spaces must be passed through to travel from one to the other with no short-cut routes) and moderate connectivity (all spaces are connected to two other spaces; there are no dead-end routes but nor are there highly connected nodes). The “grid” arrangement above right shows higher connectivity (more multiply connected nodes and alternative routes) and high integration (most rooms can be accessed by passing through no more than one or two others). The beads extreme is easy to navigate but constraining; the grid extreme has maximum flexibility but can be confusing to navigate.

---

4 Art museums have predominated in observational studies (at the whole museum level rather than of individual exhibits) since the work of Robinson and Melton, presumably since they are less complex and variable exhibition environments compared to other types of museums.
To date, space syntax studies in museums have been primarily focused on relating syntactic properties of spaces (such as connectivity, integration and cross visibility) to observable visitor behaviour, such as overall visitor traffic, paths of individual visitor movement, location and duration of visitor stops (Choi, 1999; Hillier & Tzortzi, 2011; Kaynar, 2000; Peponis et al., 2004; Rohloff et al., 2009; Wineman & Peponis, 2009). Such research is useful, but limited in the extent to which it can reveal how the space is experienced by visitors as it is limited to studying observable behaviour. More recent studies are addressing this gap (Lu & Peponis, 2014), however they are based on virtual exhibition settings. In addition, when considering the visitor-exhibition dynamic, space syntax puts primacy on the spatial parameters of an environment rather than how visitors’ individual characteristics may shape perception of that space. Further research is needed to explore how space syntax measures relate to visitors’ perception of actual exhibition environments.

### 2.5.2 Isovist Theory – “Space Semantics”

Also derived from the architectural realm, *isovists* can be used to characterise interior environments. An isovist, or visibility polygon, is the visible extent from a given vantage point in a space. The relationship between the isovist and the surrounding space will depend on the shape of the room (Figure 2.2). For *convex* spaces, the isovist and the room shape will be the same (or in the case of interconnecting spaces such as an enfilade, an isovist may be larger than the architecturally-described room size). For *concave* spaces, the isovist will be smaller than the room, including only

---

5 An enfilade is a linear alignment of interconnecting rooms, as frequently seen in the architecture of palaces and traditional art galleries.
those parts which are visible from the vantage point. Isovists of concave spaces will include occluded boundaries which denote the visible extent of the vantage point, as well as solid boundaries representing walls and other physical barriers (Stamps, 2007).

As a two-dimensional measure, isovists can be taken at different elevations within a room for different purposes: an eye-level isovist will measure the area that is visible from a given point; a knee-level isovist will measure the area that is physically accessible. These will be significantly different measures in open-plan exhibition settings where exhibits may form barriers to movement but not visibility (Wineman & Peponis, 2009).

![Figure 2.2: Isovists in convex and concave spaces (adapted from Stamps, 2007).](image)

Isovists show potential as a basis for quantitative descriptions of the experiential and psychological properties of space. Isovist size and concavity have been found to be the most important properties
from a psychological perspective, although it has been argued the isovist is limited by the fact that it is a two-dimensional parameter that does not take into account ceiling height, which is believed to be an important factor in overall space perception (Stamps, 2005a; Stenglin, 2004). Furthermore, the isovist describes a 360° view, only a proportion of which will be within the line of sight of a visitor at any given moment as they move through an exhibition space. What a visitor sees and how they interpret it will depend on their direction of movement and viewing angle (Lu & Peponis, 2014). Thus the isovist can be considered to be a description of visibility affordances, in that it describes the extent of views that are possible from a particular vantage point. For spaces of uniform height (as is the case in the majority of exhibition spaces) Franz and Weiner (2008) have proposed and conducted initial exploratory testing of a ‘space semantics’ theory. This relates isovist properties to properties of experienced space – spaciousness, enclosure, complexity and order – which are important spatial properties in environmental psychology. These will be discussed in more detail in Part Two of this literature review (Section 2.10.1).

2.5.3 The Exhibition as a “Text”: Semiotic and Linguistic Analysis

Exhibitions can be considered as the construction of meaning in three dimensional space; space has a language and grammar that can be analysed and theorised using concepts that have originated in linguistics and semiotics (Anyfandi, Kouladis, & Dimopoulos, 2010; Austin, 2012; Stenglin, 2004, 2009). Stenglin (2004) developed a theory of the experience of museum spaces based on the concept of binding, drawn from linguistic theory. Binding theory is based on the premise that a key factor in our affective responses to space is a sense of security. Binding is thus a measure of how a space closes in or opens up around a visitor – a “too bound” space will feel claustrophobic and restrictive; a “too unbound” space will make a visitor feel vulnerable and exposed. Between these two insecure extremes are two categories for security – bound and unbound (Figure 2.3).

Figure 2.3. Binding scale for the experience of three-dimensional space (adapted from Stenglin, 2004, 2009).
Bound and unbound spaces are associated with positive affect: comfort, security, freedom, happiness and satisfaction (Stenglin, 2004). Criteria for bound and unbound spaces are culturally shaped, with different cultural and socioeconomic norms affecting what kinds of spaces will feel optimally bound or unbound (Stenglin, 2004).

A large, open atrium with a ceiling height spanning multiple storeys, a typical feature of many museum buildings, is an example of an unbound environment. It is one that is intended to communicate a sense of arrival, gravitas and grandeur. Stenglin argues that for some visitors, the overwhelming architectural proportions represented a state that is too unbound and is thus unsettling. This is similar to the “threshold effect” of imposing facades posing a barrier, particularly to infrequent museum visitors (Heumann Gurian, 2005; Stenglin, 2004).

Bound spaces, by contrast, tend to be more contained in scope (i.e., absence of windows) and intimate in scale (i.e., lower ceilings, smaller rooms). Bound exhibition spaces are quieter and more contemplative in nature. Binding is also associated with more constrained environments. For instance, a highly controlled visitor flow would be indicative of a bound space. Spaces that are too confined or structured may feel too bound and thus oppressive (Stenglin, 2004).

Natural light is a significant unbinder of spaces, both through the use of windows (allowing views out as well as light in) and skylights (Stenglin, 2004, 2009). In contrast, many exhibition spaces (in particular the fully enclosed black box environments described by Toon, 2005) specifically exclude natural light and are thus bound spaces. For some visitors, this exclusion of natural light and vistas may represent a space that is too bound and thus uninviting (Stenglin, 2004).

Many spatial properties that affect the binding state are intrinsic to the architecture, for instance orientation of walls, degree of permeability between spaces, and sizes of enclosed areas. However, interior design decisions, particularly the use of light, colour, materials (including reflective materials such as water pools and mirrors) and texture, are also theorised to change the binding state of a given architectural envelope by affecting its ambience (Stenglin, 2004). Design can have a significant effect on how bound or unbound a given space will feel. Describing colour schemes from an architectural perspective, Meerwein, Rodeck and Mahnke (2007) used similar language to describe respective colour choices for floors, walls and ceilings. Floor colours in mid grey, deep green and brown are described in terms such as “secure”, “sure-footed” and “supportive”, whereas
the same colours are deemed “oppressive”, “restrictive” or “burdensome” when applied to walls or ceilings.

Applying binding theory to the design of exhibitions, Stenglin (2004) argued for incremental rather than sudden or dramatic changes in binding state from one space to the next, which can be disconcerting and distracting. However, she also maintained that some variation in binding state over the course of a museum experience is desirable, hypothesising that such variety can be stimulating and thus prevent museum fatigue. While Stenglin draws upon numerous examples in museum exhibitions and buildings, many of the hypothesised outcomes are theoretical as she did not directly study the impact of binding state on the visitor experience. This remains an area open to future research.

2.5.4 Semiotics Beyond Texts: The Multimodality of the Visitor Experience

It has been argued that linguistic models can only be applied to exhibitions in a limited sense, as the exhibition environment is far more complex and multifaceted than a text (Roppola, 2012). Roppola developed a theory of visitor experience based on multimodality, a broader semiotic concept that encompasses all the ways a culture might express meaning. Text, speech, images, gestures and sounds are all examples of semiotic modes. Fonts and colours can be considered modes in some contexts. Multimodality is thus the integration of multiple modes in the creation of meaning – in a conversation, for instance, meaning is conveyed not just in the words spoken but through tone of voice, gestures and proximity of the speakers. Roppola generated her theory inductively based on interviews with over 200 museum visitors across a number of Australian museums. It consists of four interconnecting concepts: framing, channelling, resonating and broadening. These will be reviewed in turn.

2.5.4.1 Framing

Framing is used to describe the overarching structures visitors apply to the museum in order to make sense of their experience (Roppola, 2012). In general, frames are a collection of categories, criteria and expectations people use as part of the meaning-making process in daily life. People’s museum and exhibit frames are informed by their past experiences, and inform their expectations regarding what a museum should be like and what sorts of experiences they can expect to have there. Visitors may also hold different frames for different types of museums, overlapping with frames for what constitutes “art” or “science”.
In general, people only become consciously aware of their frames when they are violated in some way, such as when a visitor encounters an exhibition that contravenes their frame for what a museum is supposed to display. However, frames are not static and they can evolve and change in light of new experiences (Roppola, 2012). This framing can be both positive and negative. For instance, modern museum buildings that are open and bathed in natural light can represent a positive reframing for people who see the traditional museum as “dark and dusty”. But on the other hand, some visitors may find discordance in the juxtaposition of old objects and modern architecture.

2.5.4.2. Resonating

Roppola (2012) uses the concept of resonance to characterise the interaction between visitors and features of the exhibition environment. In physics, “resonance” is used to describe the amplification effect observed when two bodies vibrate at the same wavelength. Similarly, visitors and exhibits can be considered as being in a resonant relationship when they are “in tune” with one another. Certain environmental features, such as “size, beauty, colour, light, a quality of realism, sensory change/movement and opportunity for action” (Roppola, 2012, p. 126) tend to attract visitors and draw them in. Spaces can also have resonant qualities: environments that feel pleasant to be in owing to characteristics such as light, spaciousness or aesthetic appeal.

However, just as environmental stimuli can enhance a resonant relationship between visitors and exhibits, they can also impede it. Things that can impede or block resonant experiences include (Roppola, 2012):

- **“You can only take so much in”**: A museum visit can saturate a visitor’s sensory and cognitive capacities. Visitors deploy strategies to allocate their time and mental budgets according to their interests. A sense of too much to take in can be overwhelming and prevent visitors from engaging with an exhibition.
- **“It’s all jumbled”**: The sense of there being too much to take in can be exacerbated by the lack of a clear order or logic with which to make sense of an exhibit. The “signal” of an interpretive message is lost in the “noise” of an overly cluttered display: different features compete and cancel each other out.
- **“The people I’m with won’t let me”**: Visitors might spend less time on an exhibit than they would like if they feel they’re being hurried along by their companions. Queues and crowding can impede resonance by getting in the way or making an environment less pleasant by their presence.
2.5.4.3 Channelling

Museum exhibitions can be considered as four-dimensional media; visitors physically move through them in both space and time. Roppola describes how visitors navigate this trajectory in terms of “channelling”. More than simply wayfinding, channelling describes how “visitors [find] their way through museums conceptually, attentionally, perceptually as well as physically” (Roppola 2012, p. 174). There are three different types of channels: spatial channels, narrative channels, and multimodal/multimedial channels.

Spatial Channels

The most literal interpretation of the channelling concept, spatial channels pertain to the way that visitors read museum environments and act accordingly (Roppola, 2012). Some spaces encourage visitors to linger, others hurry them along. Seating allows time to rest, recharge and ponder. Where seating is provided, it sends visitors a message that lingering is encouraged. Visitors are more likely to watch an entire video if there’s a place to sit. Thin galleries may be perceived as corridors and moved through quickly. Doorways and escalators can have a magnetic effect, pulling visitors towards them. But for other visitors, such thresholds may act as a barrier and they will hover at the edges rather than enter. Similar behaviour has been observed in contemporary art museums, where visitors tend to linger around the entrance to video installations rather than committing to enter them (Sager, 2008). Similarly, small enclosed spaces may be inviting to some visitors but off-putting to others. Visitors also vary in the extent to which they want spatial channels to guide them along a certain path.

Narrative Channels

While spatial channels address the physical movement through an exhibition, narrative channels pertain to the conceptual journey of the visitor. An absence of narrative is often seen as confusing and disconcerting by visitors. Without a discernible narrative, an exhibition can be seen as “all mixed up”, “all over the place”, “cluttered”, or having “no real point” (visitors quoted in Roppola, 2012, pp. 204-205). Many visitors described the importance of some kind of theme as a way of organising an exhibition.

Multimodal/Multimedial Channels

Different semiotic modes can be manifested through a range of media. For instance, the mode of text can be communicated through a wide range of media such as a magazine, a scroll of parchment,
or an exhibit label. Multimodal and multimedial channelling thus describes how visitors interact with the different modes and media embodied in museum exhibits. Roppola (2012) describes the following:

- **Restorative channelling:** A diversity of media helps break up content, enhancing interest and reducing fatigue associated with reading “panels and panels and panels of text” (visitor quoted in Roppola, 2012, p. 190).
- **Selective channelling:** A way of directing visitor attention. Less is more with selective channelling: a minimalist approach helps to provide a clear focal point to a display. Text hierarchies are also a form of selective channelling by suggesting an order in which to engage with the content.
- **Fragmented channelling:** Caused by too much complexity without sufficient coherence to enable visitors to make sense of it. Fragmented channels can also result from having too large a physical distance between related items (e.g., a label too far away from the object it describes), or having adjacent exhibits competing with each other for visitor attention.
- **Synchronous channelling:** A harmonious relationship between the multimedial elements of an exhibit. The different parts of the exhibit enhance and complement each other rather than competing for attention. Unlike in fragmented challenging, the complexity of multiple modes and media is complemented by coherence.

### 2.5.4.4 Broadening

Broadening is the term Roppola uses to describe visitors engagement with the interpretive content of museums, as they negotiate “the poetics and politics of display” (Roppola, 2012, p. 217, original emphasis). Examples of broadening that take place in museums include:

- **Experiential broadening:** seeing or doing something you would not normally have the chance to
- **Conceptual broadening:** improving understanding of a theoretical principle
- **Affective broadening:** exploration on an emotional level
- **Discursive broadening:** considering an issue from another point of view.

Framing, resonating, channelling and broadening are not a sequence of processes – all four can be seen taking place simultaneously over the course of a museum visit. It is noteworthy that three of the four concepts, framing, resonating and channelling, are all relatively “content neutral” in that they describe the relationship between visitors and exhibits in a way that transcends the specific interpretive messages that exhibits are meant to convey. This is a novel insight, particularly since
most museum visitor research historically has taken as its starting point what visitors “learn” from a given exhibition (however “learning” is defined)⁶. It also suggests that understanding the museum visitor experience could benefit from further research that looks at broader patterns in the museum-visitor relationship rather than being limited to the specifics of exhibit content.

2.6 Summary of Part One

Over the course of the past 150 years, exhibition design has shifted from unmediated display to interpretive and experience-led design. A driving factor in this shift is a greater emphasis on the museum visitor, higher audience expectations, and recognition that design has a greater role to play than the creation of a mere container, backdrop or decoration.

Despite this, research into the way museum visitors experience exhibition spaces as a whole, as opposed to individual exhibits, is relatively limited. The role of the exhibition environment (or ambience or atmosphere) in shaping the visitor experience is widely acknowledged but less well-understood. However, theoretical models such as space syntax, linguistics and multimodal semiotics are beginning to be supported by empirical evidence and may be useful for offering further insights into the way visitors perceive and respond to exhibition space.

⁶ This point is discussed in further detail in Part Three of this literature review.
PART TWO: Atmospherics and the Role of the Environment

This part draws upon literature from outside traditional museology and visitor studies to identify other theories and research approaches that may be able to offer an insight into the museum visitor experience. It introduces the concept of atmospherics as the environmental psychology of retail environments, and considers how atmospherics research may be applied to the museum context. It then positions this research within environmental psychology more broadly, in particular environmental perception, cognition and appraisal theories. Part Two concludes by proposing a possible model for understanding the atmospherics of the museum environment.

2.7 Introduction to Atmospherics

The term atmospherics was first used in describing the design of retail environments, where it has been defined as “the conscious designing of space to create certain effects in buyers” (Kotler, 1974, p. 50). The central premise of atmospherics is that the environment has the capacity to influence people’s behaviour; this influence can be manipulated in perceptible and predictable ways through design choices. Kotler described atmospherics as a “silent language”: akin to body language, temporal language or spatial language. At the time, such intangible forms of communication were beginning to receive more scholarly attention and atmospherics built upon these foundations (Kotler, 1974). Atmospherics’ influence is posited to take place via sensory and emotional mechanisms (Kotler, 1974), with behavioural outcomes often taking place on a subconscious level (Turley & Milliman, 2000).

More broadly, the emergence of atmospherics parallels the growth of a consumer-based, service-driven economy over one that was primarily dependent on commodities and manufactured goods. Accordingly, Kotler predicted atmospherics’ significance to be greatest in instances of pleasure-based (hedonic) consumption rather than purchases of necessity, and in market segments in which there is little to differentiate on the basis of price or quality alone (Kotler, 1974). Atmospherics is now widely acknowledged as an important component of experience quality in a wide range of leisure settings (Chang & Horng, 2010; Lin, 2004), and the term is frequently used by marketers as an umbrella term for the overall design and ambience of a retail, leisure, or service environment (Baker, Parasuraman, Grewal, & Voss, 2002).

Kotler drew a distinction between the intended atmosphere (the sensory qualities conferred to a space by design choices) and the perceived atmosphere, which may vary for individual customers depending on their selective attention and specific goals (Kotler, 1974). Salient features of the
physical environment inform the customer’s perceived environment, which in turn can influence purchasing behaviour through **attention** (standing out from the crowd); **message** (regarding the kind of establishment and its intended market); and **affect** (cues such as colours, sounds and textures to subtly influence the desire to purchase)(Kotler 1974).

Several variables such as layout, crowding, product location, music, colour, lighting and aroma have been tested for their impacts on retail consumers’ affective responses, perceptions of value and quality, and behavioural responses such as time spent, traffic flow and purchasing patterns (reviewed in Ng, 2003 and Turley & Milliman, 2000, with selected studies described below). Taken together, such studies support the notion that changes to the environment can lead to discernible changes in both attitudes and behaviour. However, research to date has been dominated by experimental manipulation of isolated variables rather than exploration of the experience of whole atmospheres (Ballantine, Jack, & Parsons, 2010; Lin, 2004; Ng, 2003; Turley & Milliman, 2000; Vogels, 2008b). Several researchers have called for retail atmospherics research to move beyond experimental manipulation and into more nuanced and naturalistic enquiry (Bloch, Ridgway, & Dawson, 1994; Ng, 2003; Turley & Milliman, 2000). Such studies remain relatively limited, although a body of research is beginning to accumulate (Ballantine et al., 2010; Custers, de Kort, IJsselsteijn, & de Kruiff, 2010; Gilboa & Vilnai-Yavetz, 2013; Joy, Wang, Chan, Sherry, & Cui, 2014; Underhill, 1999, 2004).

Following extensive observational studies of retail settings, Underhill (1999) documented key features of customers’ in-store behaviour and examples of how subtle changes to design and layout can markedly influence purchasing. For instance, he noted customers’ orienting behaviours upon entering a store, leading him to characterise the space immediately beyond a store’s entrance as the “transition zone.” In this transition zone, customers are focused on adjusting to their new environment and, as a consequence, are less likely to notice signage or items such as hand-held shopping baskets. Underhill observed that when the baskets were moved further into the store, more customers picked one up, enabling them to carry and ultimately purchase more merchandise (Underhill, 1999). In the museum context, design decisions such as positioning of directional signage, the presence of contextual “scene setters”, and the location of choice points have similarly been shown to affect visitor orientation and the number of exhibits that visitors will encounter and attend to (Bitgood, 2011; Goulding, 2000; Klein, 1993).

These parallels indicate that studies of the retail environment may offer useful analogies for characterising museum visitor experiences. Both retail and museum environments are entered
voluntarily, sometimes with a set agenda and sometimes just for general browsing. Furthermore, there is a history of cross-fertilisation between retail and museum design, with the same practitioners undertaking both over the course of their careers (Henning, 2006). More recently, museums and retail have both positioned themselves within the broader leisure sector, which is becoming increasingly customer (visitor) focused. In this context, experience is seen as creating a point of difference in a crowded marketplace (Bonn, Joseph-Mathews, Dai, Hayes, & Cave, 2007; Falk & Sheppard, 2006; Pine & Gilmore, 1999). Some shoppers have likened the tactile experience of trying and handling merchandise to that of being in an interactive museum. Like a museum visit, to these customers the act of shopping is an opportunity to enjoy the aesthetics of the environment, gain inspiration, and learn about new things (Gilboa & Vilnai-Yavetz, 2013). Likewise, luxury brands make use of a contemporary art gallery aesthetic to position themselves as arbiters of good taste (Joy et al., 2014). Within the museum itself, the gift shop is being increasingly considered to be part of the overall visitor experience, leading to calls to pay greater attention to the atmospheric elements of museum retail environments and to the relationship between exhibition and retail spaces (McIntyre, 2010).

Although there are clear similarities between retail and museum environments, there are also important differences, particularly with respect to purpose and definitions of success. In designing museums, the general objective is to create settings where visitors feel comfortable and in control, on the premise that this will maximise the possibility of learning (Packer, 2006; Rui Olds, 1994). On the other hand, the prime objective of a retail setting is to maximise sales (or, at least, profits) – anything that does not serve this ultimate goal, irrespective of any other customer benefits conferred, will not be considered “successful” (Uzzell, 1995). In contrast to straightforward quantifiable measures such as sales turnover or profits, the criteria for assessing the success of a museum exhibition (even if they are agreed to be some definition of learning) are far more nuanced, complex, and possibly not fully agreed upon – even by an exhibition’s creators (Shettel, 2008).

Despite these differences in intent and desired outcomes, there are sufficient overlaps to consider the application of retail atmospherics research to informal learning settings to be a viable course of enquiry. To explore this further, the following section will explore how retail atmospherics research has characterised the service environment and customer responses.
2.8 Theoretical Frameworks for Atmospherics

2.8.1 Modelling Consumer Response as Stimulus-Organism-Response

In the atmospherics literature, the most influential theoretical framework for characterising consumer responses to the environment has been the Stimulus-Organism-Response (S-O-R) model (Mehrabian & Russell, 1974b). Although it has come under criticism more recently for implying a unidirectional environment-behaviour relation and for inadequately taking consumers’ goals and motivations into account, it continues to be the most commonly used paradigm in atmospherics research (Liu & Jang, 2009; Massara, Liu, & Melara, 2010).

The S-O-R model, derived from environmental psychology, asserts that sensory inputs from the environment (the Stimulus) combines with personality factors to trigger an internal, primarily emotional reaction (the Organism); this subsequently results in behavioural outcomes (the Response). Behavioural responses are characterised as either approach or avoid behaviours (see Figure 2.4). Approach behaviours include the desire to explore, work, and cooperate with others, while avoid behaviours include retreating, aversion to others and desire to leave the situation. Approach-avoidance may be measured through actions or through verbal indications of preference (Mehrabian & Russell, 1974b).

![Figure 2.4. The S-O-R model (adapted from Mehrabian & Russell, 1974b, p. 8).](image-url)
In the S-O-R model, the relationship between an environment and the resulting behaviour is mediated by the emotional response that the environment elicits. In characterising the emotional response, Mehrabian and Russell conceptualise emotion as comprising three orthogonal dimensions: pleasure-displeasure, degree of arousal (extent of sensory stimuli) and dominance-submissiveness (extent to which a person feels in control of the environment and the situation). Together these are known as the PAD (pleasure, arousal, dominance) dimensions (Mehrabian & Russell, 1974b; Mehrabian, 1995; Russell & Mehrabian, 1977). PAD state is measured using semantic differential scales, with each scale intended to vary one of the dimensions while keeping the other two relatively constant. For instance, the 18 semantic differentials originally specified by Mehrabian and Russell included despairing-hopeful (varying pleasure); relaxed-stimulated (varying arousal) and guided-autonomous (varying dominance)(Mehrabian 1995; Mehrabian and Russell, 1974b).

The S-O-R model was first applied to the retail environment by Donovan and Rossiter (1982), who demonstrated a relation between pleasure and approach-avoid intentions in a range of retail settings, as measured through a self-report survey using the PAD dimensions. The effect of arousal was weak in isolation although it was found to interact positively with pleasure. There was no identified relationship between dominance and approach-avoid intentions (Donovan & Rossiter, 1982). Subsequent to this landmark study, the S-O-R model and PAD dimensions have been widely used in consumer and service settings research (Ezeh & Harris, 2007; Turley & Milliman, 2000). These studies have demonstrated a link between atmospheric stimuli and consumer behaviour and/or purchase or revisit intentions, and results have been consistent with the notion that affective measures of pleasure, arousal, and in some instances, dominance act as mediators in this relationship (Ezeh & Harris, 2007; Gilboa & Rafaeli, 2003; Kaltcheva & Weitz, 2006).

2.8.2 Characterising Environmental Variables

Although the S-O-R model was widely used during the 1980s, it was recognised that it did not incorporate a comprehensive framework for characterising the service environment. The two most commonly cited models developed to address this gap are those developed by Baker (Baker, Levy, & Grewal, 1992; Baker, 1987) and Bitner (1992). In Baker’s model, the service environment comprises three main dimensions: ambient, design and social. The ambient dimension includes factors such as noise, cleanliness and air quality – environmental features that we seldom consciously recognise unless they are inappropriate to the setting. Conversely, design factors are those features that are at “the forefront of our awareness” (Baker, 1987, p. 80), comprising both
aesthetic and functional elements. For the social dimension, Baker applies a dramaturgical framework to classify customers sharing a service environment as the “audience”. As with other social settings, the optimum size of the audience will be context dependent. For instance, in some circumstances the experience is enhanced by sharing it with a crowd; in others it is detrimental. Service personnel form the other part of the social dimension (Baker, 1987).

In the servicescape model (Bitner, 1992), environmental dimensions are characterised as “ambient conditions” (nonvisual sensory stimuli), “space/function” (layout and furnishings) and “signs, symbols and artefacts”. These dimensions come together to create the “perceived servicescape”, to which both staff and customers respond “cognitively, emotionally and physiologically” (Bitner, 1992, p. 59). This in turn influences their behaviour and social interactions.

The servicescape model has been applied to the study of diverse tourism, leisure and entertainment contexts including sporting events, casinos, cinemas and recreation centres (Brunner-Sperdin, Peters, & Strobl, 2012; Moon, Kim, Ko, Connaughton, & Lee, 2011; Pullman & Gross, 2004; Wakefield & Blodgett, 1996, 1999). The servicescape has been further characterised by Wakefield and Blodgett (1999) as comprising both “intangible” and “tangible” elements. Intangible elements include factors such as promptness and reliability of service, while tangible elements pertain to décor, equipment and general ambience. Intangible elements are thought to influence the cognitive assessment of service quality, whereas tangible elements act on an affective level (Wakefield & Blodgett, 1999). Intangible factors are significant predictors of service quality in all settings; however, the relative importance of tangible factors increases with time spent in the environment and the hedonic intent of the consumption event (Wakefield & Blodgett, 1999).
Table 2.1. Characterising the service environment. The parallels between the environmental variables described in Bitner’s (1992) servicescape model and the dimensions of the service environment characterised by Baker (1987).

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient</strong></td>
<td><strong>Ambient</strong></td>
</tr>
<tr>
<td>• Temperature</td>
<td>• Air Quality</td>
</tr>
<tr>
<td>• Air Quality</td>
<td>o Temperature</td>
</tr>
<tr>
<td>• Noise</td>
<td>o Humidity</td>
</tr>
<tr>
<td>• Music</td>
<td>o Circulation/Ventilation</td>
</tr>
<tr>
<td>• Odour</td>
<td>• Noise (level, pitch)</td>
</tr>
<tr>
<td></td>
<td>• Scent</td>
</tr>
<tr>
<td></td>
<td>• Cleanliness</td>
</tr>
<tr>
<td><strong>Space/Function</strong></td>
<td><strong>Design</strong></td>
</tr>
<tr>
<td>• Layout</td>
<td>• Functional</td>
</tr>
<tr>
<td>• Equipment</td>
<td>o Layout</td>
</tr>
<tr>
<td>• Furnishings</td>
<td>o Comfort</td>
</tr>
<tr>
<td></td>
<td>o Signage</td>
</tr>
<tr>
<td></td>
<td>• Aesthetic</td>
</tr>
<tr>
<td></td>
<td>o Architecture</td>
</tr>
<tr>
<td></td>
<td>o Colour</td>
</tr>
<tr>
<td></td>
<td>o Scale</td>
</tr>
<tr>
<td></td>
<td>• Materials</td>
</tr>
<tr>
<td></td>
<td>o Texture, pattern</td>
</tr>
<tr>
<td></td>
<td>o Shape</td>
</tr>
<tr>
<td></td>
<td>o Style</td>
</tr>
<tr>
<td></td>
<td>o Accessories</td>
</tr>
<tr>
<td><strong>Signs, Symbols and Artefacts</strong></td>
<td></td>
</tr>
<tr>
<td>• Signage</td>
<td>• Audience (other customers)</td>
</tr>
<tr>
<td>• Personal Artefacts</td>
<td>o Number</td>
</tr>
<tr>
<td>• Style of decor</td>
<td>o Appearance</td>
</tr>
<tr>
<td></td>
<td>o Behaviour</td>
</tr>
<tr>
<td></td>
<td>• Service Personnel</td>
</tr>
<tr>
<td></td>
<td>o Number</td>
</tr>
<tr>
<td></td>
<td>o Appearance</td>
</tr>
<tr>
<td></td>
<td>o Behaviour</td>
</tr>
</tbody>
</table>

N.B. The servicescape places staff and consumers as ‘moderators’ rather than integral to the environment or “perceived servicescape”. 
Despite slightly different conceptualisations, both Baker and Bitner characterised the physical elements of the environment in similar terms (Table 2.1). While Baker’s model is a simpler conceptualisation of the environment, Bitner’s term servicescape has gained significant currency across the customer services and experience design literature. The original servicescape has been extended and modified to create models such as the designscape and the experiencescape (Chui et al., 2010; Rosenbaum & Massiah, 2011). More recently, the servicescape concept has become so embedded in the atmospherics literature that the terms servicescape and atmospherics can be seen to be used interchangeably (Ezeh & Harris, 2007). Other authors distinguish between the two terms, albeit inconsistently (cf. Heide & Gronhaug, 2006; Turley & Bolton, 1999). For the purposes of clarity, in this thesis servicescape will be used to describe the complete service environment in a generic sense, while atmospherics will pertain to the sensory aspects of that environment. This is consistent with Kotler’s original definition of atmospherics as being primarily a sensory phenomenon (Kotler, 1974).

The atmospheric dimensions of particular interest to this study are those which can be apprehended visually (broadly synonymous with the design elements in Baker’s model of the service environment, see Table 2.1) rather than the (nonvisual) ambient elements of the environment, which are beyond the scope of this research. Thus, hereafter in this thesis, “atmospheric variables” will principally refer to the visual dimensions of the environment – “those at the forefront of our awareness” (Baker, 1987, p. 80) – rather than nonvisual ambient dimensions. While Baker has previously placed lighting within the ambient rather than design category (Baker et al., 1992), since lighting is an important aspect of the visual perception of a space it will be incorporated within the atmospheric variables of interest to this study (see Section 2.11).

2.8.3 Affect and Emotion in Consumer Responses

The S-O-R model presumes that consumer responses are primarily triggered by an emotional response to the environment. Mehrabian and Russell (1974b) used the term “emotion” to describe the PAD dimensions, although pleasure and arousal have since been characterised as “affective” dimensions (Russell, Ward, & Pratt, 1981). In general, the use of the terms emotion and affect is inconsistent. The terms are frequently used interchangeably in the literature (Hosany & Gilbert, 2009). Emotion has been described as “one of the fuzziest concepts in all of the sciences” (Sander

---

7 It has been claimed that this primacy of the visual over other senses is a feature of Western cultures and not a universality (Erskine-Loftus, 2013). Given the Western context of this study, this does not negate its emphasis on visual dimensions. However, it may limit the applicability of the findings to non-Western contexts.

8 Lighting was not specifically included in Baker’s initial characterisation of the service environment (Baker 1987 and Table 2.1).
and a consistent definition has proven elusive. Generally, affect is described as an umbrella term that encompasses emotions, moods and attitudes (Bagozzi, Gopinath, & Nyer, 1999; Hosany & Gilbert, 2009; Sander & Scherer, 2009). Moods are sometimes distinguished from emotions in terms of being less intense and not being elicited by a specific stimulus or event – in contrast to moods, emotions have an identifiable cause (Hosany & Gilbert, 2009). Precise definitions and delineation of emotion, moods and affect is beyond the scope of this review; it is affect in the more general sense that is of principal interest to this study.

2.8.3.1 Circumplex Model of Affect

The circumplex model of affect is a derivative of the PAD dimensions that omits dominance. Among the PAD dimensions, dominance has proved to be a problematic measure (Desmet, 2010; Gilboa & Rafaeli, 2003). It is possibly the dimension that is the most culturally and context-dependent. Dominance has been proposed as being primarily cognitive rather than affective in nature (Russell et al., 1981), leaving pleasure and arousal as the principal affective components of environmental appraisal (Russell et al., 1981; Russell, 1988). This results in a two-dimensional circumplex model as shown Figure 2.5.

![Circumplex model of affective quality attributed to environments](image)

*Figure 2.5. Circumplex model of affective quality attributed to environments (adapted from Russell et al., 1981).*
Some researchers consider both arousal and dominance to be cognitive rather than affective dimensions, with pleasure being dependent on the extent to which perceived arousal and dominance match prior expectations (Massara et al., 2010). This premise is broadly supported by studies that show the relationship between pleasure and arousal is dependent upon whether a low-arousal or high-arousal experience is anticipated (Kaltcheva & Weitz, 2006; Massara et al., 2010; Wirtz, Mattila, & Tan, 2000). However, other researchers warn against reducing emotional response to simply positive versus negative affect, arguing that the separate effects of conceptually distinct emotions can be lost (Machleit & Eroglu, 2000).

2.8.3.2 Primary Emotions Theories

Both the PAD dimensions and circumplex model are dimensional models – that is, affective states are conceptualised as being a product of varying levels of underlying orthogonal dimensions. An alternative model is that based on a number of primary emotions, which can be combined in different ways to produce the gamut of affective response (Izard, 1977; Plutchik, 1980). By way of example, Izard (1977) identified ten basic emotions: Joy, Sadness, Interest, Anger, Guilt, Shame, Disgust, Contempt, Surprise and Fear; whereas Plutchik’s (1980) model has eight: Anger, Joy, Sadness, Acceptance, Disgust, Anticipation, Surprise and Fear. Both models have been successfully used to study emotional responses to a shopping experience (Machleit & Eroglu, 2000) although the bias towards negative emotions in the Izard model suggests that the Plutchik model may be more relevant in the museum context.

Primary emotions are based on psychoevolutionary theory. Plutchik argues that the primary emotions emerged as adaptations for survival and reproduction, and can be found in some manifestation in all animals (Plutchik, 1980). In an analogy to colour mixing, primary emotions can be combined to form new, secondary emotions – for instance Joy and Anticipation combine to form Optimism (Plutchik, 1980). Taking this analogy further, Plutchik’s model is frequently represented as a wheel of emotions that resembles a colour wheel. Furthermore, within each emotion “colour” there is a spectrum of intensity – for instance the spectrum of Anger ranges from mild annoyance to intense fury (Plutchik, 1980). These different intensities can be represented by expanding the colour wheel into three-dimensional space (Figure 2.6.)
Figure 2.6. Primary emotions represented in three-dimensional space. The conical shape reflects the notion that as emotions become less intense, they are less distinct from one another (adapted from Plutchik, 1980, p. 157).

2.8.3.3 Limitations of the S-O-R Model

A major limitation of much of the existing servicescape research is that it does not investigate the nature of atmospheric perceptions in depth. Several studies have concluded that environments associated with pleasant affective states are more likely to result in approach behaviours (Kaltcheva & Weitz, 2006). Such findings confirm the intuitive notion that people will preferentially gravitate to settings they find pleasant. However, these studies have left the question as to why a certain environment is perceived to be pleasant largely unexplored.

A further limitation of the S-O-R model is that it does not lend itself to the study of multisensory experiences where there are extensive interactions between variables (Ballantine et al., 2010). The predominance of the S-O-R model may be a contributing factor to retail research being primarily constrained to the quantitative study of isolated variables rather than the more holistic study of perceived atmospheres: “There is a need for a more ‘macro’ level theory that would explain how consumers process the entire atmosphere, which can often send competing or deviant signals, and form some evaluation of it” (Turley & Milliman, 2000, p. 208).
2.8.3.4 Cognitive Appraisal Theory

In contrast to the direct relationship between environmental stimulus and emotional response implied by the S-O-R model, cognitive appraisal theory suggests that affective responses are mediated by cognitive evaluations of stimuli (Roseman & Smith, 2001). Cognitive appraisal theory is being increasingly applied to consumer settings as it is considered to provide a more robust framework for understanding the causes and consequences of particular emotional states (Bagozzi et al., 1999; Watson & Spence, 2007).

According to cognitive appraisal theory, the emotion elicited by a stimulus depends upon a subjective interpretation of the situation according to a number of appraisal dimensions (Sander & Scherer, 2009). Although the precise nomenclature, nature, and range of these dimensions varies among theorists (Bagozzi et al., 1999; Sander & Scherer, 2009; Smith & Ellsworth, 1985; Watson & Spence, 2007), it is agreed that the most significant dimension is appraisal of a situation in light of the extent to which it is congruent with a person’s needs, interests, priorities and goals. Congruent stimuli will lead to positive emotions, whereas incongruent stimuli trigger negative emotions. Besides outcome desirability, situations will be further appraised in light of factors such as control or agency (the level of perceived control over the situation and the extent to which circumstances are perceived to be self-caused, caused by others, or caused by circumstance), and certainty (whether the situation is primarily related to known past or present events or to future possibilities)(Smith & Ellsworth, 1985; Watson & Spence, 2007). For instance, anger differs from guilt based on agency, with anger being other-caused and guilt as self-caused. Similarly, anticipation differs from satisfaction on the basis of certainty (Watson & Spence, 2007).

2.8.4 Modelling Consumer Response through Qualitative and Narrative Approaches

Research of the retail environment has been criticised for being overly behaviourist in its approach (Uzzell, 1995), with a consequent lack of emphasis on consumers’ cognitive, physical and social needs (Ng, 2003). A considerable proportion of servicescape research has been conducted from a marketing perspective. The prime interest of such studies has been to determine how the environment influences perceptions of products and stores and – ultimately – how this can be manipulated to maximise sales. However, taking a consumer perspective, making purchases is only one aspect of the overall shopping experience, which has other social and sensory elements such as the opportunity to congregate in comfort and safety (Bloch et al., 1994; Gilboa & Vlai-nai-Yavetz, 2013; Ng, 2003).
Taking a qualitative and consumer-centred approach, Ballantine et al. (2010) conducted a within-subjects case study of two electronics stores: one being utilitarian in nature, the other offering a more hedonic experience. Shoppers verbalised their actions and experiences in each store (an approach called protocol interviews), followed up by in-depth semi-structured interviews about the experience in each store environment. Using this approach, the researchers identified two overarching environmental variables: attractive stimuli (factors that attracted attention and encouraged approach) and facilitating stimuli (factors necessary to facilitate engagement with the product). Attractive stimuli included lighting, sounds, space, colour, product display and design. Among the facilitating stimuli were comfort factors, (lack of) crowding, product display and the presence of store staff. Reactions to facilitating stimuli moderated the reactions to attractive stimuli. That is, negative reactions to facilitating stimuli could diminish the effectiveness of attracting stimuli whereas positive reactions to facilitating stimuli enhanced reactions to attractive stimuli (Ballantine et al., 2010).

While these findings are based on a single study, they are intriguing in that the atmospheric variables emerged mostly unprompted by the research participants in a naturalistic setting, rather than participants responding to changes to researcher-defined variables in an experimental situation. The emergence of attracting and facilitating stimuli suggests that shoppers interact with atmospheric stimuli on different levels and for different purposes. This is consistent with a more transactional view of the person-environment dynamic, with the relationship between the shopper and the retail setting being one of seeking the best “fit” – consumers seek out environments that maximally support their needs or goals (Ng, 2003). A similar phenomenon has been described in relation to strategies deployed by the museum visitor (Rounds, 2004), as will be described in Section 2.16.1.4.

In another study of over 100 narratives of mall experiences (Gilboa & Vilnai-Yavetz, 2013), four distinct ways emerged that customers conceptualised the mall and described their experiences:

1. **Seductive experience**: Characterised by impulse buying. Purchasing behaviours are frequently attributed to mall and store atmospherics that “seduce” customers to buy.
2. **Interactive museum**: Primarily exploratory in nature. Customers are more focused on browsing than buying, and their prime motivation is to enjoy the aesthetics of the mall and environment and learn about “what’s new”. It is also characterised by sensory interaction with merchandise – touching, smelling and tasting merchandise. Some participants describe the mall as a place to come to relax – which could be considered analogous to restorative museum experiences (Packer & Bond, 2010; Packer, 2014).
3. **Social arena:** The mall is seen primarily as a place to socialise and be in proximity to others. These customers pay relatively little attention to the mall environment or atmospherics; the mall is simply a convenient public place to go for social interaction.

4. **Functional place:** These are goal-oriented customers who come to the mall to make planned purchases. They tend to avoid undirected browsing or impulse purchases. These customers are only focused on the mall environment to the extent it helps them meet their well-defined goals. In contrast to the other experience types that are associated with pleasant emotions, customers who see the mall as a ‘functional place’ may view their visit as a ‘necessary evil’.

It is noteworthy that one of the conceptualisations of the mall is museum-like, thus underscoring the parallels between museum and retail environments. Customers who come to the mall for interactive museum-like or seductive experiences appear analogous to the hedonic shoppers in Ballantine et al.’s (2010) study. They seem to be particularly sensitive to the attracting stimuli of the environment, whereas utilitarian “functional place” shoppers appear to ignore attracting stimuli and only pay attention to facilitating stimuli if they are relevant to achieving their planned purchase goals. The social arena experience is also classified as hedonic, although the mall environment did not particularly feature in social experience narratives (Gilboa & Vilnai-Yavetz, 2013). However, a likely unspoken assumption is that malls offer a safe, comfortable and predictable environment in which to socialise. In this context, such comfort and safety factors could possibly be classed as facilitating stimuli, but arguably were considered too self-evident to be explicitly mentioned.

### 2.9 Atmospheric Variables and the Museum Visitor Experience

As in the consumer environment, the perceived atmosphere constitutes an important part of the exhibition experience, as this quotation from a recent exhibition review attests: “... the gallery has been beautifully designed and lit, creating a soothing blue subaqueous environment in which visitors swim in and out of pools of light like languid fish. Above their heads, the atmosphere twinkles and flows” (McAdam, 2011, p. 42). Conversely, an exhibition perceived to lack these elements may be disappointing: “I expected to see the colour of blood, the brightness of fire, the vast azure expanse of the sea, but I mostly saw the same dull grey” (Handley, 2014, p. 47). These examples illustrate how atmospherics can be considered as a form of interpretation and an additional communication medium within the exhibition space; an evocation of Kotler’s “silent language” (Kotler, 1974).

Market research in the cultural sector has demonstrated the importance of the environment to visitors’ overall perceptions of museums and other cultural attractions. In a survey of 500 visitors to
four Florida attractions (a museum, an aquarium, a performing arts centre and a zoo), ambience factors (including colour scheme, lighting and signage) had a marked impact on visitors’ intention to revisit and willingness to recommend an attraction (Bonn et al., 2007).

Applying a modified S-O-R framework to the museum environment, Kottasz (2006) found that atmospheric variables had an impact on the affective state of visitors and self-reported behavioural intentions (as determined by post-visit survey). In this study, all three dimensions of pleasure, arousal and dominance impacted on visitors’ approach intentions. This is in contrast to other studies from the retail sector that have failed to show a significant role for dominance (Turley & Milliman, 2000). It is possible that dominance (which can be interpreted as feeling in control of the environment) is significant in the museum context, as has been proposed by Rui Olds (1994). Alternatively, there could be specific elements of this study that made dominance appear more salient. Structural Equation Modelling supported a relationship between atmosphere, affect and approach intentions in line with the S-O-R model, however, this was with a relatively small sample size of 140 visitors across a number of different UK museums (Kottasz, 2006).

The findings of Bonn et al. (2007) and Kottasz (2006) indicate that atmospheric factors such as lighting, colour schemes, layout and signage play an important role in creating an overall perception of an exhibition environment. However, both of these studies were primarily focused on characterising the visitor experience from a marketing perspective. Thus the dependent variables were visitors’ intention to recommend and re-visit an attraction, rather than aspects of the experience itself. These studies do not provide an in-depth understanding of role of atmospherics in the visitor experience, although both suggest this would be a fruitful area of future research (Bonn et al., 2007; Kottasz, 2006).

The importance of atmospherics is also supported by additional qualitative evidence. In a series of semi-structured interviews with museum visitors exploring perspectives on the value of the visit, comments regarding the general atmosphere or ambience emerged in 43 percent of interviews (Packer, 2008). In another exploratory study using open-ended interviews with museum visitors, atmospheric factors were a recurring theme in the way people described their visit and what attracted their attention (Roppola, 2012). Furthermore, a longitudinal qualitative study demonstrated that exhibition layout and spaciousness were capable of evoking a “spatial feeling” among visitors, which remained as a lasting impression of the museum experience (Schorch, 2013). These findings support the assertion that the atmospheric dimension of a museum experience is important to a significant proportion of visitors.
However, despite its importance in shaping experience, exhibition atmospherics (as opposed to more specific and tangible dimensions such as content) has received relatively little research attention: “Research to date has rarely investigated the impact of atmospheric cues on visitor responses and behaviour in museums and little is known about this important topic” (Kottasz, 2006, p. 97).

2.10 Characterising Atmospheric Variables

As described above, the atmospheric variables of interest to this study are those that can be apprehended through visual appraisal of a scene. A prospective relationship between the environment and visitor experience, based on Kotler’s conceptualisation of atmospherics, is presented in Figure 2.7. This model represents a synthesis of the atmospherics and servicescape literature as outlined above, and is presented here as a proposed alternative to the S-O-R model that has dominated existing servicescape research. Extending from Kotler’s (1974) original atmospherics model, visitor (consumer) needs influence the perceived atmosphere and this perceived atmosphere influences responses through attention, message and affect. Visitors use environmental cues to seek out environments that offer the best fit with their interests and needs (Ng, 2003).

![Figure 2.7. An emerging model for atmospherics.](image.png)
To further inform the relationship between perceptions of the museum environment and visitor experience, the following sections of this review will turn to existing research and theoretical frameworks for understanding how environments are perceived more generally. The major visual cues of environments, particularly indoor environments, have been described as space and function, lighting and colour (Lin, 2004). In order to understand the role of space and function in environmental appraisal, relevant theories arising from the field of environmental perception and appraisal are reviewed in Section 2.10.1. This section will be followed by a review of light and colour as environmental stimuli (Section 2.10.2).

### 2.10.1 Models of Environmental Perception and Preference

#### 2.10.1.1 Gestalt Psychology and Spatial Perception

Gestalt psychology is the study of the perceptual relationships between parts and wholes, where the whole has emergent properties that transcend those of their component parts⁹. In other words, it is not just individual components of a scene, but their grouping and juxtaposition that will influence what is perceived. Gestalt psychology posits that perception is an intrinsically holistic phenomenon (Wagemans, Elder, et al., 2012; Wagemans, Feldman, et al., 2012). While the methods and conceptual inferences of the early gestalt psychologists were discounted by the mid-20th century, gestalt principles regarding perceptual groupings and hierarchies continue to influence the study of environmental appraisal and visual processing more broadly (Krampen, 1991; Wagemans, Elder, et al., 2012). Some gestalt rules appear to be innate, while others develop in infancy or are otherwise refined through past experience (Wagemans, Elder, et al., 2012).

Gestalt principles describe the organisational rules that are spontaneously and subconsciously applied to a scene. For instance, objects that are similar (e.g., in size, colour, shape), symmetrical, behaving synchronously, or enclosed by a common boundary, will be perceived as forming a group. Similarly, there are organisational rules that inform the capacity to extrapolate three-dimensional properties from two-dimensional visual arrays, or otherwise mentally “fill in” images based on incomplete visual information (Wagemans, Elder, et al., 2012). While a detailed overview of these rules and principles is beyond the scope of this review, the underlying principle of Gestalt psychology is that context is paramount. Such a focus on the holistic is an important facet of experience-based marketing (Schmitt, 1999) and the crafting of “destination image” in tourism.

---

⁹ This should not be interpreted as the oft-quoted phrase “the whole is greater than the sum of parts”. Rather, it is more accurate to say that the whole is different from the sum of parts (Wagemans, Feldman, et al., 2012).
(Echtner & Ritchie, 2003). Gestalt psychology offers further support for studying environments as holistic entities, since “to dissect is to distort” (Goulding, 2000, p. 274).

### 2.10.1.2 Evolutionary Theories for Environmental Preference

Since human evolution has been shaped by interactions with the environment, it is reasonable to surmise that many aspects of environmental appraisal will have an evolutionary basis. Evolution can help explain many human preferences and behaviours, including a propensity to travel, an attraction to novelty and beauty, and a drive to make sense of our surroundings (Crouch, 2013).

Environmental aesthetics (or environmental preference) studies have been used to study responses to a range of environmental stimuli representing both the built and natural environment. Such preference judgements are made rapidly, consistently and subconsciously as the result of both affective (pleasure and interest) and cognitive (recognition, prediction, and evaluation) processes (Kaplan, 1987, 1988b): "Environmental preference is the outcome of what must be an incredibly rapid set of cognitive processes that integrate such considerations as safety, access, and the opportunity to learn in a single affective judgement" (Kaplan, 1988a, p. 63).

From a synthesis of multiple preference studies, Kaplan (Kaplan, 1987, 1988a) identified four main predictive factors in environmental appraisal: coherence, legibility, complexity and mystery. All of these factors relate to information: either that which is immediately apparent, or that which can be inferred through moving further into the scene. These four factors can in turn be divided into two categories: understanding (ability to make sense of the scene) and exploration (the promise of additional information) (Kaplan, 1987). Thus the four factors can be related (Table 2.2).

Kaplan argues that the relationship between information and environmental preference is neither coincidental nor trivial. Rather, evolutionary history has conditioned humans to rapidly evaluate and explore environments for their information value. Consequently environmental preference is an essential aspect of understanding the environment-behaviour dynamic (Kaplan, 1972, 1987, 1988b).
Table 2.2. Relationship between factors predicting environmental preference (adapted from Kaplan, 1987, 1988b).

<table>
<thead>
<tr>
<th>Understanding</th>
<th>Exploration</th>
</tr>
</thead>
</table>
| Immediately apparent; relates to the two-dimensional visual array | **Coherence**
(\textit{the extent to which the scene seems to “hang together”}) | **Complexity**
(\textit{information richness of the scene}) |
| Can be inferred or predicted; appraisal of the three-dimensional landscape | **Legibility**
(\textit{the predicted navigability of the scene upon further exploration}) | **Mystery**
(\textit{the promise of the scene offering additional information upon further exploration}) |

There is a nonlinear relationship between preference and complexity/mystery. Preference varies in an inverse U-shape with the most preferred environments having a moderate level of complexity or mystery. Such a finding is consistent with a preference for environments that offer sufficient visual interest without exceeding the finite amount of information that the brain can process simultaneously (Kaplan, 1988b; Mehrabian & Russell, 1974). It is also consistent with evolutionary preferences:

\ldots people should be enticed by new information, by the prospect of updating and extending their cognitive maps. \ldots however, they cannot stray too far from the familiar, lest they be caught in a situation in which they are helpless \ldots (Kaplan, 1987, p. 15).

Thus the ability for a scene to offer information and interest as well as safety is a prime consideration in preference. Safety in particular is taken to be the most fundamental element of environmental preference for all animals (Stamps, 2007). It appears these preferences have profoundly shaped human development, including the way people respond to environmental stimuli on a neurological level (Stamps, 2005a, 2005b).

Expanding upon the evolutionary concept of safety is the “prospect and refuge” theory (Appleton, 1988). Prospect describes the range of vision from a given vantage point, whereas refuge is the extent to which the environment affords protection. According to this theory, preferred environments are those that allow full perception of a scene (e.g., allowing sight of prey) but are not so exposed as to be vulnerable to attack (from enemies or predators). Extending prospect and refuge theory to take into account more specific environmental attributes is “permeability theory” – the
“concept that the environment influences safety by limiting either perception or motion” (Stamps, 2007, p. 166). The basis of permeability theory is the finding that humans are highly sensitive to perceptions of spaciousness or enclosure, of which permeability is a measure (Stamps, 2005a, 2005b). Permeability can be either visual (the perceptual extent of the scene) or locomotive (the physically accessible extent of the scene). For example, a window affords visual permeability but not locomotive; a bend in the distance has locomotive permeability but not visual. Visual permeability is a strong predictor of perceptions of spaciousness, while locomotive permeability influences perceptions of safety (Stamps, 2005b).

Thus, at their core, environmental preference theories contend that people’s needs for information as well as safety are paramount. Concepts arising from this premise offer an explanatory framework for understanding behavioural responses in given environmental contexts. These theories have been greeted with particular enthusiasm by landscape architects (Appleton, 1988) as a way of explaining behaviour in the urban environment. For instance, people tend to move reasonably quickly through open spaces, stopping only when near a wall or other structure that can be seen as a form of refuge (Rui Olds, 1994).

There are considerable parallels between permeability theory described above, and the binding theory of museum space as developed by Stenglin (2004) and described in Section 2.5. Despite arising from different theoretical traditions, both models assume the centrality of perceptions of safety (or control over the environment), as well as the importance of a sense of spaciousness or enclosure (where spaciousness and enclosure can be taken as analogous to unbound and bound states respectively in binding theory). This suggests that environmental appraisal models may be able to offer an empirical complement to the theoretical concept of binding.

2.10.2 Applying Safety and Information Requirements to the Museum Space

Judgements about safety are primarily of concern when making appraisals of unfamiliar environments. However, safety can be considered as being necessary but not sufficient for creating a sense of positive affect within an environment. In keeping with Kaplan’s information-based environmental preference theory described above, environments need to also promise a level of interest; a moderate stimulation of the senses (Ng, 2003; Rui Olds, 1994). Providing adequate signage and presenting exhibitions in a logical and thematically coherent way (i.e., scene setting) is another way of meeting visitors’ information needs (Goulding, 2000).
In the context of a museum visit, safety needs may be considered in terms of the need to feel comfortable or belonging in the environment, although they could be considered analogous in the sense that a feeling of “not belonging” may trigger similar negative affect to feeling “not safe”. In the absence of welcoming design cues, visitors can enter exhibition spaces somewhat tentatively (Goulding, 2000). For some visitors, the large scale of museum interiors and exhibits can feel intimidating (Heumann Gurian, 2005).

Applying general safety and information needs to the museum setting, Rui Olds (1994) proposed four main characteristics of ideal museum environments:

1. **Movement**: The freedom to explore the environment in a self-directed manner.
2. **Comfort**: A varied ambience and moderate stimulation of all the senses; variety in scale, finish, lighting, texture and mood.
3. **Competence**: A sense of belonging and well-ordered and signposted spaces that allow visitors to find their way around with confidence.
4. **Control**: To not feel exposed; the ability to protect ourselves from unexpected approach (a sense of safety in the environment).

Interestingly, these characteristics share strong parallels with those that emerged when visitors described conditions for “Learning for Fun” experiences in museums, that is, a sense of discovery or fascination; appealing to multiple senses; an appearance of effortlessness; and availability of choice (Packer, 2006). This suggests that environmental appraisal models are capable of describing environments in terms that are meaningful to museum visitors. Learning for Fun will be discussed in the context of museum visitor experiences in Section 2.16.2.3.

### 2.10.3 Cognitive Appraisal in the Museum Context

The cognitive appraisal dimensions of outcome desirability, agency and certainty are likely to be relevant to studies of museum visitors. Visitors will be attracted to those exhibits and environments that offer the greatest fit with their needs and goals (Pekarik & Schreiber, 2012; Rui Olds, 1994) and respond negatively to environments that confound and frustrate them. This positive or negative appraisal in the context of outcome desirability will then be further shaped through appraisals of other dimensions. For instance, low level of certainty may be welcome in circumstances of positive affect (anticipation, surprise), but pose a barrier if the principal response is negative (trepidation, confusion). Agency appraisals are considered particularly important in cases eliciting negative affect (Watson & Spence, 2007). In the case of confusing navigation or poorly designed exhibits,
different emotional and behavioural responses can be envisaged based on different appraisals of agency. Those who consider the museum responsible are likely to respond with anger and be given to complain. In contrast, visitors who interpret such instances as a failure on their own part may feel ashamed and inclined to withdraw. For these visitors, confusion may rapidly progress to loss of confidence.

2.11 Colour and Light as Atmospheric Variables

Together light and colour are major determinants in defining the overall character of a space. Colour alone constitutes the major basis of our visual assessments and subconscious responses (Meerwein et al., 2007; Singh, 2006; Yüksel, 2009). Moreover, beyond light’s role in enabling the perception of colour, its role in and of itself may be underestimated since light is usually registered subconsciously in the context of a broader visual assessment (Boyce, 2004; Custers et al., 2010; Meerwein et al., 2007).

The numerous studies that have investigated light and colour as atmospheric elements have yielded complex and sometimes conflicting results (Babin, Chebat, & Michon, 2004; Barli, Aktan, Bilgili, & Dane, 2012; Brengman & Geuens, 2004; Crowley, 1993; Gohar, 2008; Knez, 1995, 2001; Park & Farr, 2007; Singh, 2006; Turley & Milliman, 2000). Some studies have revealed cultural and gender differences in responses to light and colour, particularly on subjective dimensions such as preference (Knez, 2001; Ou, Luo, Woodcock, & Wright, 2004b, 2004c; Park & Farr, 2007; Singh, 2006; Valdez & Mehrabian, 1994). However, others have found sufficient consistency across genders and cultures to support the notion that at least some physiological and psychological responses are universal (Hutchings, Ou, & Ronnier Luo, 2012; Mahnke & Mahnke, 1987; Meerwein et al., 2007; Ou, Ronnier Luo, & Cui, 2008).

Colour in particular has been found to affect the perception of flavour, time, crowding, temperature and size (Gohar, 2008; Mahnke & Mahnke, 1987; Yuksel, 2009). The colour of a retail environment can alter attitudes towards products and likelihood of purchase, although the way the environment is lit can also influence these judgements (Babin, Hardesty, & Suter, 2003; Bellizzi & Hite, 1992). This indicates that light and colour have a mutual influence that may not be apparent if each is studied in isolation.

Red is believed to stimulate the appetite and encourage fast turnaround, hence its prevalence in fast food restaurants. By contrast, blues can suppress appetite and have been identified as a suitable
choice for all-you-can-eat buffets (Singh, 2006). Rooms painted in warm colours (reds and yellows) are perceived to be several degrees warmer than blue or green rooms set to the same ambient temperature (Mahnke & Mahnke, 1987; Nassau, 1983). A noisy environment will seem noisier if it is painted predominantly in yellows and reds (Mahnke & Mahnke, 1997). Red is generally considered the most arousing colour, capable of producing the strongest emotional, physiological and perceptual responses (Mahnke & Mahnke, 1987; Meerwein et al., 2007; Spenwyn, Barrett, & Griffiths, 2009). Red is the main colour used in casino décor and lighting as it is thought to create an exciting environment and increase gambling activity as well as contract patrons’ perceptions of time (Singh, 2006). However, empirical support of this notion is equivocal. In one study, betting speed was found to be more influenced by music tempo than lighting colour, while risk-taking was not significantly affected by either light or music, albeit in a simulated setting (Spenwyn et al., 2009). Nonetheless, the same study showed that red lighting enhanced the effect of fast-tempo music. Such findings reinforce the need to research atmospheres holistically and in context: atmospheric factors may operate in concert with one another and this is difficult to elucidate in studies that manipulate individual atmospheric variables.

Overall these findings suggest that light and colour will be significant elements in the determination of overall perceptions of an exhibition environment, the general ‘feel’ of spaces and the subsequent visitor experience. This likely significance has been acknowledged by other researchers (Bonn et al., 2007; Kottasz, 2006; Peponis et al., 2004; Roppola, 2012; Stenglin, 2004), although few studies have directly addressed perceptions of light and/or colour in a museum setting.

2.11.1 Colour and Spatial Perception

From an architectural perspective, colour influences the overall perception of a space’s size and ambience. A colour’s lightness is one of the most significant factors in space perception (Mahnke & Mahnke, 1987). In general, brighter (i.e., lighter) colours appear lighter in weight than darker colours, for instance a ceiling in a dark colour will appear lower than one in a lighter shade (Meerwein et al., 2007). Dark and saturated colours advance and reduce the perceived size of a room (Mahnke & Mahnke, 1987). The position and juxtaposition of colours in a room (walls, ceilings and floors) will affect their perception. For instance, dark ceilings can seem oppressive but the same shade on the floor feels secure and supportive (Meerwein et al., 2007).
While lightness influences perceived size and the sense of openness, saturation\(^{10}\) mostly influences the sense of “activity”. Highly saturated colours are associated with an increased sense of excitement and complexity, while less saturated shades are more calming, regardless of hue (Mahnke & Mahnke, 1987).

The other important determinant in an architectural context is whether a colour is “warm” or “cool”. At constant lightness and saturation, warmer hues appear heavier than cooler ones, while saturated bright colours in warmer tones (e.g., reds, ochres, oranges) appear closer and heavier than pale, cooler shades (e.g., light blue, lime green). Warm shades have been described as having a “centrifugal” action, focusing attention towards the environment, whereas cool tones are “centripetal” and thought to enhance concentration and task focus (Mahnke & Mahnke, 1987).

These descriptions on the role of colour are consistent with those in Stenglin’s (2004) binding theory (Section 2.5.3). The findings from “colour-emotion” research can provide further theoretical basis for the role of colour in environmental perception, as will be shown in the following section.

### 2.11.2 Perceptions of Colour: Colour Emotion and Colour Meaning

Different disciplines approach the field of colour meaning from different perspectives. For psychologists, there is a universal dimension to colour meaning in that responses are theorised to be instinctive or physiological in basis, creating colour-meaning combinations that are fixed concepts. From a semiotic perspective, however, colour meanings are taken to be culturally constructed, and are thus open to change (Van Leeuwen, 2011). While there is not necessarily an inherent contradiction in these two views (indeed, it is logical to surmise that a colour will come to represent concepts that are consistent with the psychological responses it elicits), such multiple layers of associations may help to explain the sometimes contradictory characteristics of colour meaning: “On the one hand the connection of meaning and colour seems obvious, natural nearly; on the other hand it seems idiosyncratic, unpredictable and anarchic” (Van Leeuwen, 2011, p. 343).

Taking a social semiotic perspective, colour can be considered to have multiple meaning potentials – only a subset of which will be realised in any specific context (Kress & Van Leeuwen, 2002; Van Leeuwen, 2011). Kandinsky, the art theorist and Bauhaus teacher (Caivano, 2006), defined two main categories of colour meaning: “direct value” – the ability of colours to “move toward” or

\(^{10}\) Saturation is a measure of the purity or strength of a colour (Meerwein et al., 2007).
“away from” us; and “associative value” – symbolic association with colours such as the association with flame or blood (Kandinsky, 1977; cited in Kress & Van Leeuwen, 2002).

**2.11.2.1 Findings from Colour Emotion Research**

Colour emotion research is primarily based on studies where participants assign different colours a rating along a range of semantic differential scales (e.g., vivid vs. sombre; soft vs. hard). The semantic differential technique is credited to Osgood (Osgood, Suci, & Tannenbaum, 1957), who identified three underlying factors thought to be the core of affective response: *evaluation, activity* and *potency* (EAP) (Osgood, 1969). Osgood’s EAP factors are analogous to Mehrabian and Russell’s PAD framework, with PAD dimensions being originally derived from the EAP factors (Mehrabian & Russell, 1974b). Thus evaluation corresponds to pleasure, activity to arousal, and potency to dominance (Mehrabian & Russell, 1974b; Valdez & Mehrabian, 1994).

Following a factor analysis of colour appraisals using the semantic differential technique, Sato et al. (Sato, Kajiwara, Hoshino, & Nakamura, 2000) identified two factors that explained the majority of variance; these were interpreted as the two EAP factors of activity and potency. This finding was supported by subsequent studies that identified comparable factors (Gao & Xin, 2006; Kuo, 2007; Ou, Luo, Woodcock, & Wright, 2004a). Sato et al. (2000) identified an additional factor, temperature, which also emerged in Ou et al.’s studies of single colours and colour pairs (Ou et al., 2004a, 2004b). However, in another study the warm-cool semantic pair loaded on the activity factor (Gao & Xin, 2006) and yet another study excluded warm-cool as its descriptive power was limited to certain hue ranges (Kuo, 2007).

In general, saturated colours are perceived to be more active, and darker colours have a greater potency (Gao & Xin, 2006; Sato et al., 2000). The evaluation dimension, being based on more subjective assessments of colour (e.g., like/dislike and elegant/vulgar), was found to be more affected by context, gender, culture and individual preferences (Gao & Xin, 2006; Ou et al., 2004a, 2004b; Sato et al., 2000; Taft, 1997). Thus it is difficult to predict colour preference solely on the basis of colour emotion (Ou et al., 2004c). Taking an analogous approach, Valdez and Mehrabian (1994) studied the influence of colours on participants’ PAD responses. Consistent with the EAP studies, they found that saturated colours were more arousing (reflecting the relationship between saturation and activity), and darker colours more eliciting of dominance (analogous to the relationship between potency and darkness).
These empirically determined relationships between saturation and activity and lightness and potency (which includes weight) provide additional theoretical basis for the architectural maxims described in Section 2.11.1, namely that saturated colours make an environment more exciting and complex (more active and arousing), and that darker colours have a greater perceived weight (potency and dominance) and thus make a room appear smaller or more bound (Meerwein et al., 2007; Stenglin, 2004).

2.11.3 Lighting and Environmental Perception

Most lighting research has focused on utilitarian requirements such as task visibility and avoidance of visual discomfort and fatigue. By contrast, the psychological and particularly affective impact of artificial lighting has been a relatively unexplored field (Boyce, 2004). While lighting has been found to play a role in influencing perceptions of interior spaces such as retail environments (Custers et al., 2010; Turley & Milliman, 2000), the contribution of lighting to the creation of an overall atmospheric mood is less well understood. A complicating factor is distinguishing between lighting’s atmospheric role and its purpose on a more utilitarian level (Areni & Kim, 1994).

Despite these complexities, it is generally accepted that bright light is more arousing than soft light, whereas “cool” white light is more arousing than “warm” white light (Mahnke & Mahnke, 1987; Park & Farr, 2007). Similarly, cool white light is judged as brighter than a warm source at constant illuminance (Park & Farr, 2007). Furthermore, different kinds of lighting can influence perceptions in different ways. For instance, peripheral, indirect lighting helps to create a sense of spaciousness; non-uniform lighting can increase complexity and create focal points of interest (Custers et al., 2010; Flynn, 1988).

From an atmospheric perspective, lighting is considered a “micro” environmental characteristic that comes together with other micro characteristics to give an emergent or “molar” sense of atmosphere (Quartier, Christiaans, & van Cleempoel, 2008). Lighting comprises multiple variables, such as overall light intensity (lux levels), colour temperature, colour rendering properties and light distribution. The subtle interplay between these variables and the wider atmospheric context makes research into lighting atmospherics problematic, especially as lighting is most likely to play a

---

11 A description based on the physics of light sources. The higher the colour temperature, the greater the prevalence of higher-energy blue wavelengths. Counterintuitively, cool white light has a higher colour temperature than warm white light.

12 Colour rendering is a measure of how closely a light source replicates the appearance of colours as seen in natural light.
contributing role rather than a principal determinant in the creation of an overall mood of a space (Boyce, 2004; Custers et al., 2010; Vogels, 2008b).

In an attempt to quantify the role of lighting in the creation of a perceived atmosphere, one study initially identified two underlying dimensions, cosiness and liveliness\(^{13}\), in the perception of retail atmospheres (Vogels, 2008b). These dimensions emerged from factor analysis of responses to an atmosphere survey (Likert-scale responses to 38 atmosphere descriptor terms) piloted across 11 different retail environments. Cosiness and liveliness ratings were capable of distinguishing between the actual retail environments used in the initial study as well as between simulated retail environments in a subsequent study where the only change was illumination settings (Vogels, 2008b). Consolidating these data with further ratings of different lighting conditions in a laboratory setting revealed two additional factors: tenseness (e.g., threatening, oppressive) and detachment (e.g., formal, chilly) (Vogels, 2008a). These four dimensions were used by Custers et al. (2010) to relate different lighting conditions to perceived atmospheres across 57 different retail environments. In another study, using Vogels’ measures to compare lighting attributes of a simulated supermarket, cosiness, liveliness and tenseness were all found to correlate with measures for pleasure and arousal (Quartier, Vanrie, & Van Cleempoel, 2014).

While the emphasis of Vogels’ study was on lighting conditions, it is likely that other design attributes of the retail environments used in the pilot study were contributing towards atmospheric perceptions. Supporting this notion is the fact that the differences between the liveliness/cosiness ratings of actual retail environments were far greater than those across the simulated environments in which only lighting had been changed (Vogels, 2008b). Furthermore, there is an apparent similarity between the terms liveliness/cosiness and the underlying factors identified in colour emotion research of activity, potency and temperature (Section 2.11.2.1 above). Thus it is possible that these dimensions are semantic variations of one another, and similar underlying dimensions may be identified in other settings such as exhibition environments. However, their relative importance will likely vary, and there may also be additional site-specific, hitherto unidentified factors. Nonetheless, taken together these research findings indicate potentially fruitful directions for future research into perceptions of the exhibition environment.

\(^{13}\) Translations from the original Dutch used in the questionnaire and subsequent factor analysis. Replicating Vogels’ approach in the Chinese language also produced a two factor solution, which was similarly interpreted as liveliness and cosiness (Liu, Luo, & Li, 2014).
2.12 A Model for Museum Atmospherics

Extending from the conception of the service environment comprising ambient, design and social elements (Baker, 1987), theories from environmental aesthetics and light/colour appraisal, provide an alternative way of characterising the visual cues of a space based on perceptual properties. Environmental appraisal theories have highlighted the role of information, coherence and perceptions of safety in the environment, articulated as novelty, mystery, complexity, coherence, spaciousness and enclosure (Kaplan, 1987; Stamps, 2005b, 2007). Light and colour are also important contributors to the visual appraisal of a scene, particularly in an indoor context (such as within an exhibition) (Boyce, 2004; Meerwein et al., 2007; Singh, 2006; Vogels, 2008b; Yüksel, 2009). Consolidating these variables creates a potential taxonomy of atmospheric variables for exhibition environments:

- **Design Appearance**: Encompassing the visual elements that cannot be articulated in tangible spatial descriptions such as size or layout: for instance colour, lighting, and overall mood conveyed by an environment.
- **Spatiality**: Space and layout variables that can be expressed in terms of architectural properties of a space, for instance the level of enclosure and overall coherence of a space (incorporating coherence, spaciousness and enclosure).
- **Information Rate**: Environmental properties that give an indication of the overall complexity of the environment and the likely cognitive resources that will be required to navigate such an environment (incorporating novelty, mystery and complexity).

These variables are shown in the museum atmospherics model in Figure 2.8 (a development of that found in Figure 2.7).

---

14 NB. “Information” in this sense pertains to the level of complexity rather than specific information on signage or exhibits. However, the overall density of signage and exhibits would likely contribute to the perceived complexity of the environment, hence influencing the Information Rate.
Figure 2.8. Further development of the atmospherics model.
Characterising visitor responses will be explored in Part Three of the literature review.
2.13 Summary of Literature Review Part Two

Originally developed for the retail and marketing sector, atmospherics offers a framework for characterising the influence that designed visual cues can have on visitor behaviour. Visitors use these cues (both consciously and subconsciously) as they seek out environments that best fit their needs, interests and goals. Previous research in the museum environment suggests an important role for atmospheric variables in framing the overall visitor experience, however, this has yet to be studied in depth.

Environmental appraisal literature emphasises the central importance of information and safety in predicting overall environmental preference. In the museum context, this translates to a need for moderate stimulation of the senses (without being overwhelming) and a sense of autonomy and control over the experience. Furthermore, light and colour are major factors in the creation of the overall mood of an indoor environment. Based on this literature, the atmospheric dimensions of Design Appearance, Spatiality and Information Rate have been proposed. Further research is needed to test the usefulness of these variables in the museum context, and determine how they are related to the visitor experience more generally:

- How do visitors perceive the atmospheric dimensions of an exhibition environment, and how does this relate to Design Appearance, Spatiality and Information Rate?
- In what ways do atmospheric cues influence other aspects of the visitor experience? What are the implications of this for exhibition design?
PART THREE: Visitors in Museum Environments – an Environmental Psychology Perspective

This final part of the literature review will present relevant aspects of visitor studies literature: in particular, those studies that relate to the exhibition environment and how it is perceived and used by visitors. Accordingly, it can be considered to be an overview of the environmental psychology of the exhibition setting, and thus relates visitor studies to the environmental psychology research presented in Part Two. It concludes with a summary that brings together all three strands of the literature review to culminate in the research questions that this study set out to address.

2.14 The Emergence of Visitor Studies

While the educational role of the museum has been widely recognised since the origins of (our current conception of) the public museum in the early 19th century (Hein, 1998), the educational value of museums was not a subject of research prior to the 20th century. Indeed, 19th century commentary could be considered more as being polemics on the failure of certain social classes to recognise the formality of the museum environment and moderate their behaviour accordingly (Leahy, 2012; Witcomb, 2003).

The earliest systematic studies of visitor behaviour can be traced to the first half of the 20th century, in particular those of Edward Robinson and his students Arthur Melton and Mildred Porter in the 1920s and 1930s (as reviewed in Bitgood, 2013). However, there was very little published research in the area prior to the late 1960s (Bitgood, 2013; Hein, 1998; Yalowitz & Bronnenkant, 2009). It was at this point that researchers began to address the question of how exhibits and their effectiveness might be evaluated. In one of these early studies, Shettel and colleagues (Shettel, Butcher, Cotton, Northrup, & Clapp Slough, 1968) proposed three categories of variables for studying the didactic effectiveness of exhibits: viewer variables (including prior knowledge, motivations and demographic profile), design variables (primarily focused on the amount and presentation of text but also including sequencing and the inclusion of dynamic vs. static displays) and exhibit effectiveness variables (essentially observable visitor behaviours and measurable changes in knowledge and/or attitudes). As well as arguing for clearly identified criteria for evaluating exhibit effectiveness, the study identified the challenges of the museum setting in comparison to more formal educational settings, noting that casual exhibit viewers are “easily distracted and not easily instructed . . . [They are] fickle, jumping about from display to display,
looking for something that interests [them]” (Shettel et al., 1968 p. 148). The study suggested the key challenge of exhibit design was one of capturing this ‘fickle’ visitor attention.

By the 1970s, terminology from education research and evaluation had become more clearly established in the museloggical lexicon (Screven, 1976), suggesting the emergence of more clearly defined audiences, objectives, and measurable outcomes for exhibitions. In the 1980s and 1990s, developments in the perceived social and educative role of the museum had brought a greater impetus to the study of museum visitors (Hein, 1998), with models and research agendas for characterising the interplay between visitors, exhibits, and learning outcomes beginning to emerge (Falk & Dierking, 1992; Koran, Koran, & Foster, 1988; Koran & Koran, 1986; Screven, 1986). The number of researchers increased dramatically and it was around this time that the term visitor studies gained currency as the accepted term for the study of museums from a visitor’s perspective (Bitgood & Loomis, 1993).

Over this period, the study of the museum-visitor relationship has been informed by three main paradigms that parallel conceptions of cultural audiences more generally (Stylianou-Lambert, 2010). The first, the behaviour paradigm, positions the museum as a mass communicator and the visitor as the recipient of a preferred message. The second, the incorporation/resistance paradigm, is a critical paradigm in which the museum is seen to represent a hegemonic cultural order: museum messages are “encoded” in such a way that they are intelligible only to certain privileged classes. The third, the spectacle/performance paradigm, positions visitors as more active cultural consumers who use the museum space for their own meaning making and identity construction (Stylianou-Lambert, 2010). These paradigms have informed visitor research in different ways, but the overall arc of progression has been towards seeing the visitor as an active participant in the museum experience, not just a passive recipient of it. With this shift in perspective, the relationship and implicit power balance between the museum and its visitors became increasingly prominent in museological discourses. While in part a philosophical development, economic imperatives also helped drive this change as museums were increasingly expected to perform according to market-based indicators (Goulding, 2000; Hein, 1998; Hooper-Greenhill, 1992, 1994).

The influence of market-derived terminology is evident in Doering’s (1999) definitions of three main ways in which museums could view their visitors: “strangers”, “guests” or “clients”. When the museum sees visitors as strangers, visitors come on the museum’s terms and are sometimes only grudgingly accepted. The institutional focus is directed primarily towards the collection. In contrast, when visitors are seen as guests, museums take greater responsibility for welcoming and educating
them. This focus on hosting leads to increased emphasis on providing visitor amenities and services. Taking this power balance a step further, when museums see their visitors as clients, they are accountable to their visitors. Museum visitation is recognised as another leisure-going activity in a competitive marketplace and the institutional focus is on service to the public as well as care for collections (Doering, 1999).

While the movement from strangers to guests to clients does not necessarily represent a historical trajectory – Doering (1999) claimed that examples of all coexist and the same museum may view their audiences differently in different operational contexts – there has been a tendency over time for visitors to be increasingly framed in either the guest or client role. Irrespective of whether the key driver of this is philosophical repositioning or market imperatives, understanding visitors’ needs and meeting them is now an essential aspect of museums achieving their strategic objectives.

2.15 Environmental Psychology and Spatial Design

Environmental psychology has been a multidisciplinary field from its inception, drawing upon research in architecture, interior design, urban planning, geography and social science (Giuliani & Scopelliti, 2009; Holahan, 1982; McAndrew, 1993). Having such broad underpinnings, not all researchers working in environment-behaviour studies self-identify as environmental psychologists; indeed some researchers resist the term entirely (Graumann, 2002). While this makes a clear, uncontested definition of the field difficult, it is generally agreed that environmental psychology is concerned with studying the relationship between people and their environment.

Environmental psychology emerged as a discipline when psychological researchers started to shift away from laboratory-based research that had previously dominated psychology towards the study of human behaviour in real-life settings (Levy-Leboyer, 1982; McAndrew, 1993). Thus from the outset, environmental psychology has had a focus on real-world observation rather than controlled experiments in artificial settings (Bonnes & Bonaiuto, 2002). Some of the earliest environmental psychology research, conducted in the 1960s and 1970s, involved observation of entire communities, particularly children’s behaviour, over periods spanning several years (McAndrew, 1993).

The emphasis of environmental psychology research has generally been to address specific social issues, resulting in a practical and pragmatic methodological approach (Holahan, 1982). Such research has proved beneficial in building an evidence base for explaining the underlying
environmental causes of social problems, and to inform design decisions intended to address them. Such design interventions have improved the operations of prisons, schools, hospitals, workplaces, downtown precincts and other public environments, to the greater benefit of society. These changes are often quite simple but nonetheless can have a marked impact on the way spaces are used (Gifford, 2002; Holahan, 1982).

The design of formal learning environments has also been enhanced through interventions informed by environmental psychology. Researchers have found that the “softening” of classrooms (softer furnishings, softer lighting, decorative touches) increased student participation in class, improved test scores and had a positive impact on student affect (Gifford, 2002). These findings are consistent with educational philosophies in which the environment is considered an important part of the learning experience, and as such should be well-designed, well-ordered and aesthetically pleasing (Mooney, 2000).

As a place type, free-choice learning environments such as museums are an opportune environment for environmental psychology research, since they comprise a complexity of physical, social and cultural elements. Within exhibition spaces visitors interact with exhibits, environments and each other to produce affective, cognitive and behavioural outcomes. The next section will provide an overview of the field of visitor studies, with a particular emphasis on studies of the environment-behaviour dynamic in museum exhibition spaces.

2.16 Environmental Psychology and Museum Visitors

Although visitor studies practitioners are drawn from a variety of fields, notably museum education, many of the research methods have their basis in environmental psychology (Bitgood, 2002). Bitgood has described the study of “the fit between the museum visitor and the environment of the exhibition center” as “social design” (Bitgood, 2011, p. 11), itself a branch of environmental psychology. Visitor studies shares environmental psychology’s emphasis on studying behaviour in naturalistic settings, along with a flexible, applied methodological approach that is less rigidly tied to theoretical frameworks than other disciplines (McAndrew, 1993). In keeping with the applied nature of the majority of environmental psychology, the bulk of visitor studies research has been designed to answer specific, practical questions about the relationship between people and a particular environmental setting (Bitgood, 2002). The disadvantage of this practical emphasis, however, has been a relative lack of attention to broader theoretical development until more recently (Phipps, 2010).
Visitor studies is consistent with transactional models of environmental psychology that contend it is the interplay between the person and the environment that is essential for understanding the exhibition experience; one cannot be fully understood without an appreciation of the other (Bitgood, 2002, 2006a). Accordingly, this review will focus on studies that take the exhibition-visitor dynamic as their main area of interest, since these are most relevant to the understanding of the role of exhibition design in the visitor experience.

Within the realm of person-in-environment visitor studies, there have been two main areas of research: one that has observed what visitors do in the exhibition space (drawing upon visitor observation); and one that has explored what visitors learn and experience in the exhibition environment (drawing upon visitors’ own responses, either through quantitative or qualitative approaches). Each of these areas will be reviewed in turn.

2.16.1 Observations of Visitor Behaviour: What Visitors Do in Exhibition Settings

Historically, a key premise of visitor research has been that the museum is primarily an educational or learning space; the original rationale for studying visitor behaviour was as an indicator of learning. For instance, spending time at exhibits was assumed to be a prerequisite for learning to occur (Serrell, 1998). Observation of visitors is only an indirect measure of learning; it is assumed that certain behaviours are necessary, but possibly not sufficient, for learning to take place. Moreover, the presumed centrality of didactic learning to the judgement of an exhibition’s overall success has since been questioned (Rounds, 2004). Nonetheless, this research represents the first attempts to understand the factors that may influence the museum visitor experience.

2.16.1.1 Tracking and Timing Studies

The approach of studying visitor behaviour through tracking and timing visitor movement in exhibition spaces was pioneered by the work of Robinson and Melton in several US museums in the 1920s and 1930s (Melton, 1935; Robinson, 1928). These studies have proved influential, studying phenomena such as attracting power (the extent to which a display causes a visitor to stop and look at it) and holding power (the duration a display holds a visitor’s attention). These behavioural patterns continue to be studied (Bitgood, 2009b). Tracking and timing studies have been used extensively in visitor research and are now seen as an essential component for understanding and evaluating the success of an exhibition (Yalowitz & Bronnenkant, 2009).
Until the 1990s, tracking and timing studies were for the most part confined to studying exhibitions in isolation. A lack of commonly defined definitions, methods and research tools prevented further comparison or generalisation (Serrell, 1996b). To address this, Serrell coordinated a study across multiple exhibitions, with a view to refining a common method for visitor observation and creating metrics that could serve as benchmarks for evaluating exhibition success (Serrell, 1998). This meta-analysis, based on observations in 110 exhibitions across museums, science centres, zoos and aquaria in the US, represented a landmark in describing and comparing general patterns of visitor behaviour in exhibition settings.

From these studies, Serrell determined that the average dwell time (the total time spent in an exhibition) in the vast majority of exhibitions was less than 20 minutes, regardless of exhibition size (Serrell, 1998). Typically, visitors were found to stop at around one third of available exhibit elements (where a “stop” was defined as having feet planted and attention directed at an exhibit element for at least 2-3 seconds; Serrell, 1998, p. 12).

The distribution curve of dwell time was strongly right-skewed for most of the exhibitions studied, indicating that the number of visitors remaining within the exhibition decreased markedly with time (Serrell, 1998). This is in contrast to other studies that have shown a bimodal pattern of visitor dwell time, albeit in a more limited number of exhibitions (Falk, 1997). The right-skewed dwell time curve is a characteristic of uncued visitors (i.e., visitors who are unaware they are being observed); cued visitors to the same exhibitions demonstrated a more bell-shaped dwell time curve (Serrell, 1998, p. 36). Thus tracking studies should be considered subject to cuing bias and studies using cued visitors should be interpreted with caution.

The Serrell study also defined two additional quantitative measures of visitor time and attention: the Sweep Rate Index or SRI (the median time spent in an exhibition as a function of area); and the percentage of diligent visitors or %DV (the percentage of visitors who attend to at least half of all exhibit elements). Across the exhibitions studied, the SRI was usually between 200 and 400 square feet per minute, with %DV around 25% (i.e., a quarter of visitors stopped near at least half of the exhibit elements). There was no correlation between SRI and %DV so they are considered independent measures (Serrell, 1998).

This study is instructive in that it demonstrated how visitors move through exhibition spaces and use exhibit elements across a range of exhibition types. It also helped establish a common language and methodology for timing and tracking studies (Yalowitz & Bronnenkant, 2009). However, there
are also acknowledged potential weaknesses, such as not taking into account possible variations in audiences across different exhibitions, as well as the potential effects of content and/or design attributes (Serrell, 1998).

Moreover, the use of SRI and %DV as measures of success presumes that in a perfect exhibition, all visitors will systematically and thoroughly explore the majority of exhibit elements: “a goal of 100% diligent visitors is ambitious but achievable” (Serrell, 1998, p. 39). However, others have argued that this is not a realistic or reasonable expectation, in that it fails to take into account visitors’ own strategies for using exhibitions. Visitors’ needs may be met more effectively by not visiting “diligently” (Rounds, 2004). SRI and %DV should therefore be considered as more descriptive than evaluative, and ‘time spent’ just one consideration in the overall effectiveness of an exhibition.

2.16.1.2 Experimental Studies in Museum Settings

Practical constraints have limited experimental studies to relatively small and simple exhibition spaces (Bitgood & Patterson, 1993; Bourdeau & Chebat, 2001, 2003; Klein, 1993). Nonetheless these studies have yielded some useful indicators regarding potential impacts of design and spatial factors on visitor movement and attention.

In one extended, multi-phase experimental study, Bitgood and Patterson (1993) found that labels had the potential to have both “attention directing” and “attention competing” effects with respect to the object displays. The physical and conceptual relationships between labels and objects were significant; labels served an attention directing purpose when they were positioned such that they were able to be viewed concurrently with the relevant object. Other interpretive tools besides labels (in this instance, the introduction of a bronze reconstruction intended to provide further context to a mummy display) were also able to affect visitor attention. In another experimental study in a comparably-sized space, it was demonstrated that visitor dwell time and routes through the space could be influenced by the addition of further contextual interpretive elements (Klein, 1993).

Experimental studies have focused primarily on changes to exhibit labels and gallery configuration. In contrast, the design appearance of the exhibition environment has been studied only rarely, and those experiments that have been conducted are of limited scope. During the formative evaluation of a cave exhibit, Bitgood and colleagues (Bitgood, Pierce, Nichols, & Patterson, 1987) compared lighting levels in a simulated cave environment. They found that medium levels of lighting were
more appealing and dramatic than lower or higher. However all three of the experimental lighting levels were low in the context of normal ambient interior lighting, plus a cave environment is one that is expected to be dark. Similarly, low lighting was hypothesised to be a factor in the high sense of immersion found in a narrow and low-lit minerals hall, evocative of a mine environment (Harvey, Loomis, Bell, & Marino, 1998). The general applicability of these findings is not clear, beyond acknowledging that light levels can affect the perception of a space. In another experimental study within an art gallery, wall colour was changed from light beige to dark brown. In the dark brown condition, uncued visitors to the gallery took more footsteps, moved more quickly and covered more area, but nonetheless spent less time overall in the space (Srivastava & Peel, 1968). It is difficult to interpret these results with only a single colour change, as the change from a light to dark colour would have affected the visual properties of the room in multiple ways.

2.16.1.3 Impacts of Design and Layout on Visitor Behaviour

Design cues can be important in helping visitors navigate complex exhibit environments, particularly in larger and more complex exhibition areas where the overall layout is not apparent from the outset, or where there are decision points in the layout (Klein, 1993). Understanding relationships between design and behaviour is not trivial; it is recognised that:

- patterns of accessibility through the space of the exhibition, connections or separations among spaces or exhibition elements, sequencing and grouping of elements, forms our perceptions and shapes our understanding (Wineman & Peponis, 2010, p. 86).

While some general patterns in visitor traffic have been observed, strategic positioning of iconic or attention-catching displays can be significant in determining the route visitors take (Bitgood, 2006a; Melton, 1935). In the absence of such attention-catching displays, visitors tend to take direct routes through exhibition spaces and seldom backtrack (Bitgood, 2006a; Bourdeau & Chebat, 2001; Klein, 1993), although in a wide corridor they may take a zig-zag path to see displays on both walls (Klein, 1993).

Thus design decisions can have a significant impact on the path visitors take: what they see, what they might miss and therefore the overall clarity of the exhibition’s narrative, thematic organisation or interpretive message. In some cases multiple decision points can be the result of a deliberate design decision to encourage “serendipity or chance encounters” (Witcomb, 2003, p. 147-148). This can nonetheless cause navigational and conceptual difficulties for some visitors who feel they have
missed something by not being able to take a more systematic route (Bitgood, 2003; Goulding, 2000; Witcomb, 2003).

Space syntax (described in Section 2.5.2) has mostly been applied to patterns of movement throughout entire museum buildings but can also be used to study visitor behaviour within open plan environments and individual exhibition spaces (Kaynar, 2000; Peponis et al., 2004; Wineman & Peponis, 2009). Such studies have shown that even in the absence of overt architectural constraints, visitor flow is affected by juxtaposition, cross-visibility and thematic linking of exhibits. This has been described as “spatially guided movement”, as opposed to movement that is “spatially dictated” or “spatially random” (Wineman & Peponis, 2009). In a study of open-plan hands-on science exhibitions in different combinations of temporary exhibition spaces, Peponis et al. (2004) found that the effect of spatially guided movement can be increased through more explicit labelling of exhibits, both through textual labels and the use of colour to delineate different thematic areas within an open-plan exhibition setting. This is broadly consistent with the findings of Falk (1997), who determined that more explicit thematic labelling of exhibits can increase both dwell time and the ability of visitors to articulate the intended key themes in post-visit interviews, regardless of the order in which exhibits are used. Moreover, while the sample size was small (incorporating only three temporary exhibition galleries) the tracking data collected by Peponis et al. (2004) suggested the possibility that the size and shape of an exhibition area can also impact visitor flow and dwell time.

Together these findings hint at the potential for design, including individual exhibit design, exhibit juxtaposition and the shape of exhibition areas, to form an important part of the exhibition’s communication medium. So far, however, the precise design factors that influence spatially guided movement, and the extent to which these affect the way visitors construct meanings, are yet to be thoroughly explored. As the researchers acknowledged:

   Our discussion of the manner in which themes are spatially defined is an elementary step in the direction of developing richer descriptions of exhibition arrangements. Further work is needed in order to model with precision the impact of other factors ranging from lighting to color (Peponis et al., 2004, p. 472).

2.16.1.4 Theories of Visitor Behaviour in Exhibitions

Findings from observational studies have led researchers to theorise strategies that visitors deploy when navigating exhibitions, although these strategies are likely to be subconscious rather than
explicit (Bitgood, 2006; Rounds, 2006). Visitors who come to a museum primarily to satisfy their curiosity will adopt strategies that will best serve to satisfy that curiosity. Rounds (2004) characterises the museum space as an “interest landscape”, in which visitors engage in “foraging” behaviours to seek out experiences that meet their curiosity-driven needs. This results in visitors seeking out “wide but shallow” learning experiences by browsing through many different subject areas. He argued that a visit spanning several exhibitions fleetingly can be a more effective visit strategy than viewing a single exhibition thoroughly; thus it is inappropriate to consider visitors’ use of around 20-40% of exhibition elements as a “failure” – on the part of either the exhibition or the visitor. Rather, such a finding challenges museums to re-evaluate the museum-visitor relationship, and broaden the definition of learning in the museum: future research should “[extend] the inquiry to areas inclusive of a broader affective and social spectrum of museum visitor behaviors, not limited to the traditional measure of cognitive outcomes” (Spock, 2006, p. 170).

Extending the concept of an interest landscape, the attention value model (Bitgood, 2006a, 2011, 2013) states that visitor behaviour is the consequence of a continuous and often subconscious cost-benefit analysis on the part of visitor, where benefits or “utility” (such as satisfying curiosity or enjoyment) are weighed up in relation to costs (time, effort, and so on). In this model, the principal currency is visitor attention: visitors choose where and in what ways they “spend” this attention over the course of a museum visit. Bitgood draws a distinction between attention and interest, in that interest is taken to be a relatively stable characteristic of individual visitors whereas attention is transient and more readily influenced by environmental and situational factors (Bitgood, 2011, p. 232). The model recognises three main levels of attention: capture (stopping, moving towards or looking at something), focus (short viewings of 5-10 seconds) and engage (in-depth reading and processing). Three main modes of attention have also been identified at a neurological and functional level: alerting, orienting, and executive control (Wang, Liu, & Fan, 2011). Design attributes of the exhibition environment can influence where attention is directed, in particular at the capture and focus levels (Bitgood, 2011).

The nature and extent to which visitors will choose to give an exhibit their attention will depend on the ratio of perceived utility divided by perceived cost (Bitgood, 2011, 2013). Perceived utility is primarily a function of visitor characteristics, for instance prior interest in the subject matter, predisposition towards certain types of exhibits or the purpose of visiting. Perceived cost can vary from visitor to visitor, but will also be affected by the way an exhibition is designed. For example, the perceived cost of reading a text panel will be affected not only by its length and layout but also the visitor’s reading proficiency. Because it is a ratio relationship, any increase in the perceived cost
can have a dramatic effect on whether a visitor chooses to stop at an exhibit, which manifests itself in a strong correlation between preferred exhibit characteristics and attracting power: “. . . visitors carry out a preliminary appraisal of exhibits to decide whether to invest any of their time in stopping. They do this very critically and yet very rapidly” (Alt & Shaw, 1984, p. 34).

In terms of visitor behaviour, Bitgood suggests that the attention value model explains the observation that visitors take the most direct and economical route through exhibitions, only diverting on their path when the perceived benefits of doing so (e.g., to look closer at an intriguing display) outweigh the attention “costs”. Over the course of a visit, the perceived relative size of these costs and benefits change, accounting for some of the behaviours that have been ascribed to “museum fatigue” (Bitgood, 2009a, 2009b).

2.16.1.5 Limitations of Observational Studies

While observational research is a powerful descriptive approach, its explanatory power is limited by the fact that studies can only characterise what visitors do, not why (Yalowitz & Bronnenkant, 2009). Some studies have combined observational research with interviews or surveys, but historically the emphasis has been on the visitor’s ability to absorb and recall curatorially-defined messages rather than a more general, exploratory perspective on the visitor experience (for instance Falk, 1993; 1997). In contrast to behaviour, experience is a highly subjective dimension that cannot be studied through observation alone: understanding the visitor experience requires the input and reflections of visitors themselves. Such studies will be reviewed in the next section.

2.16.2 Explorations of Visitor Experience: How Visitors Construct Meanings and Understandings from Exhibitions

Understanding the full extent of the visitor experience requires a shift of focus away from educational goals and other institutionally-defined criteria for what constitutes a successful museum visit. Rather, researchers need to consider the visit from the point of view of the visitor – their needs, motivations and interests: “Visitors make use of museums for their own purposes, and from varying perspectives. The museum can influence these outcomes but cannot control them” (Doering, 1999, p. 80).

This visitor-centred research tradition has drawn upon the theories and methodologies of educational research. In particular, research has been informed by educational theories in which the learner is conceptualised as an active participant in the learning process, rather than a passive
recipient of externally-defined and incrementally-delivered knowledge (Hein, 1998). This has been accompanied by the increasing acceptance of the use of qualitative, exploratory research conducted in real-world settings (Hein, 1998).

2.16.2.1 The Contextual Model of Learning

The contextual model of learning, developed by Falk and Dierking (2000), has underpinned a large proportion of museum visitor studies since its publication (Phipps, 2010). It is a descriptive framework for characterising the learning experience in free-choice settings that portrays the visitor experience as product of the interactions of a visitor’s personal, sociocultural and physical contexts over time. It can be considered analogous to other contextual models in environmental psychology, in which there are six principal contexts: the physical, psychological (personal) and sociocultural contexts of the person; and the physical, sociocultural and interpersonal contexts of the environment (Wapner & Demick, 2002).

Each of the personal, social and physical contexts can be further divided into 3-4 key subfactors that influence the visitor experience. Together these provide a framework for understanding the various factors that can influence the visitor experience, although their relative importance varies from site to site and visitor to visitor. However, the contextual model remains a descriptive model rather than an explanatory one (Falk & Storksdieck, 2005).

2.16.2.2 Characterising Satisfying Visitor Experiences

Research into the visitor experience has incorporated varying combinations of interviews, surveys and ethnographic studies in order to develop and extend our understanding of what visitors expect, experience and value while in the museum. These research perspectives view the museum visitor experience as complex and multidimensional, incorporating the physical, intellectual, social, emotional and even the spiritual aspects of visitors (Pekarik, Doering, & Karns, 1999; Sheng & Chen, 2012). The challenge for researchers is thus to develop theoretical frameworks that have the capacity to incorporate the full spectrum of the visitor experience, ranging from the public and social aspects to the deeply personal.

In an early study seeking to find characteristics of the “ideal” museum exhibit, eight broad categories emerged from in situ interviews with visitors: attractiveness/noticeability, overall evaluation, clarity and ease of comprehension, evaluation of subject matter, required visitor response, emotional reactions, visual effect, and appeal to different age groups (Alt & Shaw, 1984).
A second set of visitors then rated two museum exhibits as well as their hypothetical “ideal” exhibit against a list of attributes representing these eight characteristics. Attributes that strongly applied to the ideal exhibit included “it makes the subject come to life” and “you can understand the point/s it is making quickly”. Attributes with a strong negative relationship with the ideal included “it doesn’t give enough information” and “your attention is distracted from it by other displays”. Taken together these suggest an ideal exhibit is one that has a short, easy-to-understand message that is presented in an engaging way. Interestingly, the attribute “it involves you” was unrelated to the hypothetical ideal, suggesting that the participatory nature of an exhibit was not valued in and of itself but rather was dependent on whether the payoff was sufficient reward for the added investment of time and effort that participation necessitates (Alt & Shaw, 1984).

Broadening the unit of analysis from individual exhibits to the museum experience more generally, Pekarik et al. (1999) conducted interviews with visitors regarding what they found ‘satisfying’ about their visit. They thus identified four main categories of experience: object experiences; cognitive experiences; introspective experiences; and social experiences. The main type of experience on offer changes from museum to museum, as well as between exhibitions within the same museum. Visitors may come to the museum seeking more than one of these experience types, however one modality may predominate for any given visit context. Pekarik et al. (Pekarik, Schreiber, Hanemann, Richmond, & Mogel, 2014) have since identified that different visitors are predisposed to different kinds of experiences, and that these dispositions are capable of predicting visitor behaviour. Visitors’ interests can be broadly classified as being one or two of the following: ideas – interest in concepts and facts; people – attraction to human stories and emotional connection; objects – attraction to objects and aesthetics; physical – a propensity towards multisensory engagement and interactivity. They are known collectively as IPOP (Pekarik et al., 2014). When related to observed visitor behaviour by combining surveys and visitor tracking, IPOP categories have been shown to have predictive and explanatory power in terms of which exhibits visitors stop at as well as those that they avoid.

Inevitably, exhibitions will vary in the extent to which they offer experiences that cater to all four IPOP categories. Different museums (or exhibitions within museums) tend to offer a different range of experiences, thus conferring a distinctive “personality” to each site. Research building upon on Pekarik et al.’s (1999) “satisfying experience” framework has demonstrated this, identifying 15 distinct dimensions of visitor experience as reported by visitors through the completion of an adjective checklist (Packer et al., 2013). This Experience Measures checklist has been applied to museums, zoos, aquariums and festivals and identified distinct experience profiles for each.
As well as the nature of experience offered, prior motivations and expectations of visitors will influence what visitors choose to engage with and thus the resulting experience – these initial visitor agendas are sometimes referred to as “entrance narratives” (Doering, 1999). Visitor expectations tend to frame the resulting experience, with there being a strong agreement between expectations and eventual experience among visitors to various Smithsonian exhibitions (Pekarik & Schreiber, 2012). This suggests that visitors are attuned to finding those exhibition elements that will meet their expectations. It is also possible that visitors can easily self-select into exhibitions that they anticipate are most likely to satisfy their expectations in museums with a wide range of exhibitions on offer, such as the Smithsonian.

Motivational factors for museum-going have been variously categorised as place, education, life cycle, social event, entertainment and practical issues (Falk, Moussouri, & Coulson, 1998); and as learning and discovery, passive enjoyment, restoration, social interaction and self-fulfilment (Packer & Ballantyne, 2002). While these models overlap, Packer and Ballantyne’s model is based on individual needs and goals, whereas Falk et al. studied motivation in a more social and situational context. There were also differences in the respective studies’ participants. Packer and Ballantyne studied independent adult visitors, whereas Falk et al. focused on families, and it is likely that motivations of a family group will be different from those of independent adults. Families may describe a learning motivation in terms of “education” in the context of providing instructive experiences for their children. For independent adults, learning may be less easily delineated from entertainment (Packer & Ballantyne, 2002; Packer, 2006). Irrespective of these different conceptualisations, it appears that motivational factors do have a significant impact on visitor behaviour and learning, both during the visit as well as when visitors subsequently reflect on their experience (Falk, 2009).

Motivational factors also underpin Falk’s identity model for characterising visitors (Falk, 2006, 2009), where identity is taken to be a situational construct rather than a fixed attribute of visitors (Falk, 2011). In this model, identity can be understood as the role that a visitor adopts in the context of a given visit, rather than an inherent characteristic of the person. Based on visitor motivations and purposes for visiting, Falk has identified five of these archetypal visitor identities: explorers (curiosity-driven visitors for whom museum-going is a means of satisfying their general interest); facilitators (visitors primarily focused on the needs of another, such as a parent accompanying a child); experience seekers (experience “collectors” who are influenced by an exhibition’s reputation and the recommendations of others); professional/hobbyists (visitors with a specific motivation and
interest in the museum’s subject matter); and *rechargers* (visitors seeking time out from day-to-day life and a space to reflect [initially described as spiritual pilgrims]). Additional identities may be applicable to particular museum contexts, such as *respectful pilgrims* for war memorials and *community seekers* for ethnic heritage museums (Bond & Falk, 2013). A similar typology was identified by Stylianou-Lambert in a study of art museum visitors (Stylianou-Lambert, 2009, 2011); she described these as the “perceptual filters” that frame the visitor experience. Both Falk’s identity model and Stylianou-Lambert’s perceptual filters model suggest that visitors’ motivations and expectations will affect the way they apprehend and respond to a given exhibition environment. However, while Falk has claimed that the identity model has sufficient predictive value to enable it to inform museum operations, including exhibition design (Falk, 2009), this remains the subject of ongoing debate (Dawson & Jensen, 2011; Falk, 2011; Jensen, Dawson, & Falk, 2011).

### 2.16.2.3 Museum Learning and Enjoyment

Visitors’ motivations and agendas are not fixed; these evolve on an ongoing basis as the visitor interacts with the museum environment (Bitgood, 2011, p. 320). In many cases, visitors come to museums without specific prior agendas but rather allow themselves to be drawn into learning experiences. For these visitors, following curiosity and learning for learning’s sake is what makes museum visits enjoyable. Packer (2006) described this phenomenon as “Learning for Fun”. The factors that support Learning for Fun experiences were found to include: a sense of discovery or fascination; appeal to multiple senses; appearance of effortlessness; and the availability of choice (Packer, 2006). These conditions are all largely independent of specific exhibition content and thus they provide a useful context for further research into understanding, in general terms, how exhibition design may either help or hinder learning processes:

> There is a need for further research on both the process and outcomes of learning for fun . . . What features of the learning environment facilitate deeper approaches to learning? . . . [If there are] visitors who have no particular learning agenda but who can be drawn into a learning experience that is both enjoyable and in many cases productive, then it is important that the conditions that facilitate such an experience be understood and provided (Packer, 2006, p. 341).

Rather than being fleeting and superficial, the “fun” of a visitor experience can lead to deeper reflection and consequently lasting learning outcomes. In a longitudinal study of visitors to a number of different wildlife tourism sites, Experiential Engagement (including enjoyment and the excitement of seeing live animals) was one of the predictors of Reflective Engagement (processing of the experience on both cognitive and affective levels), as determined by Structural Equation
Modelling. In turn, Reflective Engagement was the strongest predictor of short-term learning as measured immediately post-visit, which itself was a weak predictor of longer-term learning and behaviour change (Ballantyne, Packer, & Falk, 2011). Thus, in contrast to what was once a widely-held assumption – that “entertainment” and “education” are in constant tension with one another – the two are seen as fundamentally linked from the perspective of a visitor (Falk et al., 1998; Moreno Gil & Ritchie, 2009; Packer & Ballantyne, 2004; Packer, 2006; Rounds, 2004). Learning for its own sake, or satisfying curiosity, is something that many visitors find inherently enjoyable, even if visitors do not articulate overt learning goals when directly questioned (Packer, 2006).

2.17 The Visitor Experience and the Exhibition Environment

The studies described in this review can be taken to reflect an evolution of the understanding of the visitor experience. Early studies took a somewhat mechanistic view of the museum-visitor relationship, being focused primarily on observation (Melton, 1935; Robinson, 1928). These studies placed the visitor in a passive role; their perspective unheard. Later studies placed visitors in a more active role, but the experience was still primarily framed in terms of curatorially-defined goals such as using exhibitions thoroughly and absorbing pre-defined exhibit messages (Falk, 1993, 1997; Serrell, 1998). Subsequent studies, informed by a more constructivist view of learning (Hein, 1998), as well as an acknowledgement that outcomes besides learning are important (Packer, 2008), took a broader view of the visitor experience, recognising that successful visitor outcomes may not necessarily coincide with curatorially-defined goals (Falk, 2006; Packer, 2008; Rounds, 2004; Spock, 2006). In parallel, museums have broadened their definition of learning to encompass a wider range of experiences than purely factual transmission (Falk & Storksdieck, 2005; MLA, 2008; Phipps, 2010):

When using the term ‘learning’, we should never fall into the trap of thinking that it refers only to the internalization of facts and concepts. This is true of learning in general, and learning from museums in particular . . . most human learning is self-motivated, emotionally satisfying, and personally rewarding . . . humans are highly motivated to learn when they are in supporting environments . . . (Falk, 2006, p. 152).

Taking a visitor-centred view does not negate the role of design. Indeed, the role of design of the physical environment may have been underestimated by an emphasis in visitor studies that has left the physical environment “unexamined” (Roppola, 2012). The studies outlined in this section have demonstrated that design decisions can and do have an impact on the visitor experience. Design can influence visitor flow (Klein, 1993; Peponis et al., 2004); the level and quality of social interactions
(Choi, 1999; Hillier & Tzortzi, 2011); visitor attention (Bitgood & Patterson, 1993); and affective responses (Packer, 2006, 2008). Moreover, design is important for creating orientational, narrative and interpretive signposts whose absence can be disconcerting:

regardless of the quality of display, there is one further factor which can either enhance the experience, or detract from it at a very early stage resulting in frustration and anxiety, and that is the nature of the physical environment (Goulding, 2000, p. 270).

Bitgood (2003) observed that casinos deliberately incorporated confusing layouts and poor orientation, presumably as a strategy for increasing dwell time and gaming revenue. He noted that similar orientation difficulties in some museums were an unintended consequence of design, in this case causing visitors to deplete cognitive resources on orientation rather than engagement with exhibits.

An appreciation of how spatial cues influence the way visitors construct meaning is important for avoiding curatorial miscommunication (Macdonald, 2002, Spock, 2006). Such miscommunication-through-design is not just limited to tangible exhibition elements: lighting too can affect the way an entire exhibition space is read. As this recent review of an exhibition in London’s Science Museum describes:

. . . the term 'immersive' is now apparently synonymous with 'dimly lit' . . . Perhaps because of the gloom, I failed to notice the signage identifying the five zones until I was leaving, having mistaken the circular labels for amusingly quirky outgrowths of the display system. I was therefore uncertain how to navigate the space (McAdam, 2011, p. 45, emphasis added).

2.17.1 Fatigue and the Museum Environment

The concept of “museum fatigue” has long been recognised, being first described in 1916 by Gilman (cited in Bitgood, 2013). However, while the phenomenon is widely accepted and cited in the literature (for instance Bourdeau & Chebat, 2001; Falk, 1993; Macdonald, 2007; Melton, 1935; Robinson, 1928), there is a lack of clarity about precisely what constitutes museum fatigue and what causes it (Bitgood, 2009a). In Gilman’s early studies (cited in Bitgood, 2013), fatigue was the presumed cause of a consistently observed phenomenon that visitors progressively dedicate less time and attention to exhibits. This is observed in individual exhibitions as well as over the course of an entire museum visit (Bitgood, 2009a, 2009b). However, fatigue may be a misleading term, as
physical and mental exhaustion are only two of the concepts that can possibly explain the observed behaviour. In a recent review, Bitgood (2009b, p. 25) put forward alternative explanatory concepts:

- **Satiation**: A decrease in attention after repeated exposure to similar objects (this would explain the observation that visitor time and attention “resets” somewhat each time the visitor enters a different exhibition space).
- **Stress**: Unwanted distractions or frustrations.
- **Information overload**: Too many sensory inputs at one time or over a short period.
- **Object competition**: Mutual distraction caused by many objects being displayed together.
- **Limited attention capacity**: Cognitive resources as a finite supply that needs periodic “recharging”.
- **Decision making processes**: Visitors becoming more selective with their time and attention as the visit wears on.

Bitgood (2011) has also suggested strategies that may exacerbate fatigue:

- **Provide attention focusing aids**: guides and pamphlets can help visitors decide where to focus their attention and what to see next.
- **Minimise physical and mental exertion**: pace an exhibit so that there are spaces for both physical and mental rest.
- **Facilitate wayfinding**: provide easy-to-follow signage and manage decision points so that visitors are not overwhelmed by excessive choice.
- **Minimise the cognitive workload**: ensure exhibit content is in short, clear, manageable chunks and ensure there is a clear relationship between objects and labels.
- **Provoke questions in the visitor**: this can raise visitor curiosity and provide prompts for what to look out for in an exhibit.
- **Encourage breaks**: integrating cafes or rest stops within the museum experience can encourage visitors to rest before attempting to tackle another gallery.

These principles suggest that organising exhibition spaces such that visitors can make informed decisions regarding what to attend to, and combining this with prompts that can encourage deeper engagement with exhibits, may facilitate the visitor experience and thereby reduce fatigue.
2.17.2 Affective Responses to Museum Environments

Whereas historically the sciences (including psychology) have regarded affect as inferior to more rational processes such as cognition, affect is now understood to be an essential part of learning, decision making and social functioning (Barrett, Mesquita, Ochsner, & Gross, 2007; Immordino-Yang & Damasio, 2007; Norman, 2004). Affect has been recognised as playing a powerful role in memory, and in the application of learning to novel contexts (Immordino-Yang & Damasio, 2007). Positive affect aids imagination and creativity, while attractive objects (which presumably produce positive affect in the user) are perceived to be easier to use (Norman, 2004). This latter point suggests that design can influence positive affect and thus help foster a mind-set that is conducive to discovery, exploration and learning. This emotional dimension will inevitably shape the visitor experience: “Emotions colour our memories and experiences and thus our selective attention to information” (Uzzell & Ballantyne, 1998, p. 152).

For most of visitor studies’ history, there has been an emphasis on either cognitive or behavioural responses to the museum experience (i.e., observational studies or interviews designed to elicit cognitive dimensions of learning, such as recall of factual content). However, affect is recognised as an important facet of the visitor experience (Falk & Gillespie, 2009; Packer, 2008; Roppola, 2012; Soren, 2009). Affect was found to be important in the creation of an overall mental picture (or “image”) of the museum (Moreno Gil & Ritchie, 2009). Furthermore, this affective dimension was strongly linked to a motivation of seeking “richness of experience” (comprising both entertainment and educational motivations) from a museum visit (Moreno Gil & Ritchie, 2009). This suggests a possible link between affective responses and Learning for Fun experiences as described by Packer (2006). Indeed, affective responses to museum experiences appear to constitute a major component of the appeal of visiting:

... the learning that was most valued was expressed in the affective language of the intrinsic dimension, using words such as enrichment, discovery, enlightenment, inspiration, perspective, awareness, insight refreshment, affirmation, joy, pleasure and excitement (Scott, 2009, p. 199, emphasis added).

In an empirical study of the role of affect in an exhibition context, Falk and Gillespie (2009) trialled an adapted “affect grid” (Russell, Weiss, & Mendelsohn, 1989) as a measure of visitors’ affective state. This instrument is based on the circumplex model of affect comprising two underlying dimensions of pleasure and arousal (Russell, 1988), and consists of a 9 x 9 grid in which respondents’ pleasure and arousal states can be rapidly collected as a single item scale. In this study,
the affect grid was shown to be a suitable instrument for measuring affect in an exhibition setting, and was capable of discriminating between responses to different exhibition types (Falk & Gillespie, 2009). Furthermore, visitors who had experienced an exhibition with high emotional content were able to recall, several months later, more details of the exhibition environment than control visitors.

In the context of heritage sites, attention to the emotional content of a visitor experience has been described as “hot interpretation”, to distinguish it from the more cool, detached, and primarily cognitive approach that heritage interpretation has often emphasised (Uzzell & Ballantyne, 1998). In hot interpretation, emotional engagement is seen as a way of challenging visitors to reconsider their values, preconceptions and beliefs. This is particularly pertinent to the interpretation of sites and stories that are inherently emotionally laden, such as sites of war and dispossession, although Uzzell and Ballantyne argue that no heritage interpretation can truly be value-free or emotionally neutral. Providing adequate space and opportunities for reflection is an important facet of designing exhibitions on emotionally complex, contested subjects (Ballantyne, Packer, & Bond, 2012).

Technological developments are allowing physiological indicators of affective response, such as changes in heart rate and skin conductance, to be studied in real time and integrated with other data such as visitor tracking and self-report measures (Tröndle, Greenwood, Kirchberg, & Tschacher, 2012). Such physiological responses have been shown to correlate with self-reported aesthetic and emotional judgements of art works in a gallery setting (Tröndle & Tschacher, 2012; Tschacher et al., 2012). An increased heart rate variance is generally associated with positive affect and the personality trait “openness to experience”; in this study it was shown to correlate with positive judgements of Aesthetic Quality, Humour/Surprise (evoked an artwork) and to a lesser extent evaluation of Curatorial Quality. Similarly skin conductivity, an indicator of overall arousal level, correlated with judgements of dominance (judgement of a work to be strong or stimulating). In addition to responses to individual works, the same study showed that changes to gallery configuration, intended to create atmospheres that were respectively “ordered”, “dramatic” or “contemplative”, led to differences in both visitor movement and physiological responses (Tröndle & Tschacher, 2012).

Affect plays an important role in responses to environmental stimuli more generally, as has been shown by environmental appraisal studies (Section 2.10.1). Together these findings indicate that affect will be an important element of visitors’ responses to museum environments. Therefore,
frameworks for studying the visitor experience should encompass affective elements as well as cognitive and behavioural responses.

2.18 Summary of Literature Review Part Three

As the general study of the person-environment dynamic, environmental psychology is a useful framework for understanding the interaction between visitors and the museum environment. While much visitor research has not self-identified with environmental psychology, it has used similar approaches and techniques.

Previous research in exhibition environments has focused primarily on either visitor behaviour (observational studies) or on visitor learning and experience (surveys and various qualitative methods). Whereas much early visitor research was focused primarily on the ability of museums to meet pre-defined educational objectives, the museum visitor experience has more recently been conceptualised in much broader terms. This has led to a greater recognition of the affective dimensions of the museum experience, and the way that visitors appropriate the museum space to satisfy their own learning and curiosity goals. The visitor experience is now understood to encompass behavioural, cognitive and affective elements. However, while there has been considerable research into the reasons why people choose to visit museums, and the types of experiences that visitors find enjoyable or satisfying, the role of the exhibition environment in either enhancing or inhibiting such experiences has not been studied in any detail. Addressing this research gap will be important for informing future exhibition design.
Concluding Summary of Literature Review

This literature review has positioned museums as cultural tourism destinations, which, in response to both philosophical shifts and market drivers, have increasingly emphasised the importance of the visitor experience in their overall operations. This has had a profound impact on the way that museums conceptualise and design their exhibition spaces. Museum space can be seen as having its own language, as has been articulated in theories such as space syntax and binding. However, the relationship between these theoretical constructs and the subjective experience of museum visiting has not been thoroughly investigated.

In order to develop theories that may integrate a design-centred conception of space with a visitor-centred one, the atmospherics model, drawn from the retail literature, was introduced. As with space syntax and binding theory, the central premise of atmospherics is that the design of an environment can confer meaning; this meaning in turn influences behaviour as people use atmospheric cues to seek out environments that offer the best fit with their motivations and goals.

When considering the visual dimensions of an exhibition atmosphere (these are the main aspects that an exhibition designer may orchestrate and control), environmental appraisal literature has highlighted the importance of both information and safety in determining overall perceptions of a given environment. For interior spaces, lighting and colour use are also important determinants of environmental perception and the overall sensed character of an environment. This has led to the proposal of three main dimensions of Perceived Atmosphere: Design Appearance, Spatiality and Information Rate.

The final section of this review demonstrated that the focus of museum visitor studies has evolved in parallel with the changing social and cultural role of the museum, along with broader philosophical developments in both psychology and pedagogy. Thus early studies focused almost exclusively on behaviour, where as an increased emphasis on the educational role of the museum led to research intended to determine the extent to which visitors assimilated institutionally-defined cognitive messages. More recently, the view of the visitor experience has broadened, recognising the wide range of visitor motivations and thus resulting experiences that the museum offers. It is now acknowledged that the museum visitor experience must be understood holistically, encompassing behavioural, cognitive and affective aspects.
Nonetheless, while existing research suggests that the exhibition environment plays an important role in this holistically-defined experience, this relationship has not been explored in detail. In order to address this gap, the proposed research will explore the relationship between perceived atmosphere (primarily the visual dimensions) and visitor responses, taking into account cognitive, affective and behavioural aspects. This research will be guided by the theoretical framework presented in Figure 2.9.

Figure 2.9. Consolidated Museum Atmospherics Model.
This model is a further evolution of that shown in Figures 2.7 and 2.8. Visitor motivations and goals influence the Perceived Atmosphere, which comprises the principal dimensions of Design Appearance, Spatiality and Information Rate. The Perceived Atmosphere, through attention, message and affect (Kotler, 1974) in turn influences visitors’ cognitive, affective and behavioural responses to the exhibition environment, thus shaping the visitor experience.
Chapter Three: Research Approach and Methodology

3.1 Introduction and Research Aims

Although the literature has indicated that the exhibition environment plays an important role in the visitor experience, few studies have addressed this aspect directly. Previous research into museum atmospherics has focused more on its role in brand identity and marketing than the nature of the visitor experience itself (Bonn et al., 2007; Kottasz, 2006). Furthermore, in-depth and visitor-centred investigations of the exhibition environment are limited, with theory in this area at a relatively early stage of development (Roppola, 2012). Thus there is a need for further research to improve our understanding of the person-environment dynamic, in particular the role of museum atmospherics and its implications for exhibition design.

In broad terms, the purpose of this research is to contribute to our understanding of the role of the exhibition environment in the museum visitor experience. More specifically, this study has focused on the relationship between Perceived Atmosphere and visitor experience as shown in the Consolidated Atmospherics model in Figure 2.9. Accordingly, it has been guided by three main aims:

- exploration of visitors’ perceptions of exhibition environments
- development of an instrument to measure Perceived Atmosphere
- characterisation of the relationships between Perceived Atmosphere and visitor experience, as measured through visitors’ self-report responses and observable behaviour.

3.1.2 Overview of Methodology Section

This chapter describes the underlying philosophy and overall approach of the research undertaken, including results from piloting and instrument development that informed the main body of data collection. Specifically it encompasses:

- research philosophy and methodological implications
- description of the selected research sites
- description of each phase of the study, including descriptive statistics of the study samples
- description of the summated scales developed to measure visitors’ affective and cognitive responses.
3.2 Research Philosophy

This research is situated within a *post-positivist* research paradigm, in particular post-positivism with a critical realist ontology (Guba & Lincoln, 1994). Post-positivism emerged in the 20th century as a reaction to positivism, the research tradition which had predominated since the Enlightenment. According to positivism, there is an objective reality that exists independently of any observer; this reality is knowable through the methodical application of empirical research. The positivist researcher is thus cast as an independent observer and documenter of natural laws (Crotty, 1998). It was maintained that both the natural and human sciences were subject to such discernible natural laws and thus amenable to similar research methodologies (Guba & Lincoln, 1994).

Developments in scientific and philosophical thought in the early 20th century exposed flaws in the positivist paradigm, resulting in the rise of what is now broadly understood as a post-positivist research paradigm (Crotty, 1998). However, definitions of post-positivism and its relationship to positivism vary somewhat between theorists (Alvesson & Skoldberg, 2010; Bhaskar, 1998; Cruickshank, 2011). For the purposes of this study, post-positivism is considered not an outright rejection of positivism, but rather a modification and qualification of positivism’s claims (Guba, 1990). It is a paradigm that continues to undergo development and refinement (Guba & Lincoln, 1994) although there are some unifying commonalities of post-positivist research.

Post-positivism, like positivism, recognises the existence of an objective reality although post-positivism accepts that this reality may only ever be imperfectly understood. This can be compared to *constructivism* (the main competing paradigm to post-positivism), in which the existence of an objective reality is considered dubious (Crotty, 1998; Guba & Lincoln, 1994). Consequently, constructivist epistemology views knowledge as *created* rather than *revealed* (i.e., the observer and the observed are intrinsically linked in meaning-making), and thus objectivity is neither achievable nor desirable in research.

In contrast, post-positivist epistemology does value objectivity, while accepting that objectivity is a goal that can never be truly attained. The observer can never be completely independent of the observed; prevailing theory and context will inevitably influence research observations. Thus scientific theories and concepts are not a neutral reflection of objective reality, they are human constructs that are historically and socially grounded and thus subject to revision and change (Bhaskar, 1998; Crotty, 1998; Guba, 1990):
If the objects of our knowledge exist and act independently of the knowledge of which they are objects, it is equally the case that such knowledge as we actually possess always consists in historically specific social forms . . . changing knowledge of unchanging objects is possible (Bhaskar, 1998, p. 11).

The ontological and epistemological position of a research paradigm will have methodological implications (Guba & Lincoln, 1994). Epistemologically, post-positivist research aims to reach a balance between discovery and verification: Studies remain open-minded to additional possibilities revealed by the data. There is a theoretical emphasis on explanatory frameworks rather than deterministic models, such that research findings are considered probabilistic rather than definitive. There is also a procedural emphasis on multiple methods and sources of study (“triangulation”) to limit the possible distorted interpretations inherent to any single approach. As with constructivist paradigms, there is a preference of natural settings for social science rather than laboratory-based research. However, unlike constructivism, post-positivist research generally has a focus on quantitative approaches. Qualitative research is also frequently used to provide further context and meaning to quantitative data. (Crotty, 1998; Guba & Lincoln, 1994; Guba, 1990).

3.3 Research Site Selection

Much of the research that has been conducted in the atmospherics field (at least in the retail and service sectors) has focused on the manipulation of isolated variables, frequently using experimental simulations. This has proven to have somewhat limited utility in the understanding of environments on a holistic level, possibly leading to factors being missed (Ballantine et al., 2010; Lin, 2004). Since this research was motivated by a desire to better understand the exhibition environment as a whole, and was based in a research tradition that favours natural environments over laboratory settings, existing exhibition environments were used as the sites of study rather than simulated environments or experimental manipulation of exhibition settings.

While this approach has limitations for studying the impact of individual variables, such exploratory study is warranted since it is argued that an environment’s gestalt is important (Hutchings et al., 2012; Lin, 2004) – perceived atmospheres can only be perceived in context. Atmospheric variables are hypothesised to mutually influence one another to a greater or lesser extent in the creation of a perceived atmosphere; this phenomenon cannot be studied by experimental manipulation of isolated variables. Thus, the research strategy was to select existing sites that were likely to demonstrate discernible variations in Perceived Atmosphere as it was measured in this study.
3.3.1 South Australian Museum

Located in the heart of Adelaide’s cultural precinct, the South Australian Museum (SA Museum) is the largest museum in the state of South Australia. It boasts 10 permanent exhibition galleries and over 750,000 visitors per year (SA Museum, 2010). The principal focus of its collections and exhibitions is the natural and cultural history of the Australia-Pacific region. At the commencement of this study, SA Museum offered to be the host institution and thus formed the principal study site. The majority of the research was conducted in the three largest permanent exhibition galleries:

- **Australian Aboriginal Cultures Gallery (updated 2012):** Originally opened in 2002, the exhibition spans approximately 1200 square metres over two levels of the museum: the ground floor (Aboriginal-G) and first floor (Aboriginal-1). The Gallery displays a selection of the museum’s collection of Australian Aboriginal material culture; the most extensive collection of its kind in the world. The gallery was re-opened after some updating in 2012, although the general design of the exhibition was largely unchanged. It is a relatively dark exhibition space with object displays organised by a combination of geographical and thematic groupings (Figures 3.1-3.2).

- **Pacific Cultures Gallery (renovated 2006):** The Pacific Cultures Gallery (referred hitherto as “Pacific”) is located in the refurbished original North Wing of the museum (ca. 1895). The majority of the collection is displayed in the original wood-framed display cases that line the walls; some larger objects dominate the centre of the space however the majority of the exhibition space is visible from most vantage points. Natural light enters the space via the roof. The case displays are very dense, “cabinets of curiosity” in the 19th century tradition with minimal labelling or interpretation, although some thematic panels were added in the 2006 renovation (Figure 3.3).

- **South Australian Biodiversity Gallery (opened 2010):** The Biodiversity Gallery (referred hitherto as “Biodiversity”) displays specimens and detailed models intended to convey the rich diversity of South Australian fauna. The exhibition has been organised according to four different ecosystems: arid, temperate, coastal and marine. Both lighting and colour schemes change subtly throughout the exhibition space to reflect these different natural environments, creating a quasi-immersive and theatrical environment. Several specimens have been displayed in diorama-like settings that are evocative of the respective geographic zones. In addition to the environmental zones, there are displays which exemplify and interpret evolutionary adaptations and environmental threats; these have a different but consistent colour scheme throughout the exhibition (Figure 3.4).
Figure 3.1. The Aboriginal Cultures Gallery (Ground Floor).

Figure 3.2. The Aboriginal Cultures Gallery (First Floor).
Figure 3.3. The Pacific Cultures Gallery.

Figure 3.4. The Biodiversity Gallery.
In addition, some of the museum’s smaller permanent exhibitions were used during the initial qualitative stage of the research (see Section 3.5):

- **Opal Fossils Gallery (opened 2002):** A gallery dedicated to the display of opalised fossils that have been found in the Flinders Ranges area of South Australia. There is a light blue colour scheme that dominates the space, along with a mural of the region from where the fossils were found. Floor level display cases are differently coloured, although the interpretive rationale for the colour choices is not immediately clear.

- **Fossils Gallery (opened 2005):** A gallery displaying fossils of the earliest multicellular animals, the Ediacara. At the time of data collection, the walls of the gallery were a deep red-orange colour, with a large mural photograph of Wilpena Pound (a geological feature of the Flinders Ranges well known to South Australians). It has since been redesigned and reopened in December 2013.

- **Minerals Gallery (opened 2000):** An exhibition featuring minerals from around the world as well as those from the South Australian region. A section of the gallery is dedicated to the display of meteorites. The colour scheme of the gallery itself is fairly neutral, although many of the minerals are brightly coloured.

- **Mawson Gallery (opened 2000):** An exhibition dedicated to the explorations of Sir Douglas Mawson, particularly his expeditions to the Antarctic in the early 20th century. There is a recreation of Mawson’s hut in the centre of the gallery and many of the displays in the gallery are items from his expeditions (or replicas of these). There is also a display of taxidermied animals from the Antarctic. Many of the walls in this area are coloured a dark green but colour has not been used as an overt interpretive feature.

### 3.4 Research Approach

As described above, the post-positivist research paradigm aims to strike a balance between verification and discovery; seeking generalisable findings while remaining open to new perspectives as the research project unfolds. It therefore lends itself to mixed-methods approaches where different types of data (typically a combination of quantitative and qualitative) provide alternative perspectives on the research question in complementary ways. This is generally described as “triangulation” (Morse, 1991; Tracy, 2010). Triangulation is a way of mitigating the limitations of any single type of data; furthermore if a given result is reinforced by multiple independent data sets then there can be a greater confidence in its validity. Accordingly, the
following three-phase, sequential mixed-methods (Ivankova, Creswell, & Stick, 2006) program of research was undertaken:

- Phase 1: qualitative exploration of exhibition environments
- Phase 2: development of a quantitative instrument to measure Perceived Atmosphere in an exhibition setting
- Phase 3: study of the relationship between Perceived Atmosphere and visitor experience, using both observable behaviour and self-report assessments of the nature of the experience.

This research program is summarised as a visual model in Figure 3.5 overleaf and is described in further detail in the following sections.
Figure 3.5. Visual model of sequential mixed-methods research. This visual model shows the relationship between Phase 1 (QUAL), Phase 2 (quan) and Phase 3 (QUAN) of the proposed research. Terminology, notation and formatting conventions are as per Ivankova et al. (2006).
3.5 Phase 1: Qualitative Exploration of Exhibition Environments

To supplement the literature derived from retail atmospherics and environmental psychology more generally, a phase of qualitative research was conducted. This was undertaken to provide the opportunity for visitor descriptions of exhibition environments to inform the research, as well as to ensure that the atmospheric descriptors derived from the literature were likely to be meaningful in the exhibition context.

Researchers are increasingly using online approaches such as social media to recruit study participants as it is fast, flexible, and often less resource-intensive than more traditional means of recruitment (Frandsen & Ferguson, 2014). Social media in general are gaining greater recognition as a useful tool for academic researchers, with many cultivating extensive online networks across a variety of social media platforms (Lupton, 2014). Taking advantage of the researcher’s existing networks in this realm, participants for the qualitative study were recruited in May 2012 through an online survey circulated through social media networks including LinkedIn, Twitter and Facebook, with a focus on Adelaide-based groups and pages (a text version of the survey is provided as Appendix One). The survey was intended as both a recruitment and sample segmentation tool, incorporating basic demographics as well as questions on museum visitation habits and participants’ prior knowledge and interest in natural history and anthropology (the main content areas of SA Museum). The link to the survey was circulated along with an encouragement to forward the survey to anyone who might be interested. Within the first week that the survey was available a total of 169 people responded, of whom 86 agreed to participate in an accompanied visit to the museum and gave contact details for follow-up. Survey responses were coded in a Microsoft™ Excel file on the basis of age, gender, museum visiting habits, and subject knowledge. Based on a visual analysis of responses to these categories, 19 respondents were selected as representing a “maximum variation sample” (Patton, 2002). This sample attempted to capture a broad cross section of age, gender, design knowledge, natural history/anthropology knowledge and museum visiting habits. These respondents were subsequently approached either by email or telephone to arrange a convenient time for the accompanied visit to take place. From this shortlist of 19, a total of 12 accompanied visits were arranged with 13 respondents (one participant brought his spouse to the accompanied visit). The participant sample is summarised in Table 3.1.

---

15 This Microsoft™ Excel file was automatically generated by the online survey platform. Responses were colour coded to facilitate visual analysis.

16 The survey did not include any questions about participants’ educational attainment. It subsequently transpired that many of the sample were tertiary educated and some were pursuing higher degrees. The sample thus represents a more highly educated population than the general public.
Table 3.1. Summary of Phase 1 Participants.

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Age Range</th>
<th>Museum Visit Experience, Subject Knowledge</th>
<th>Galleries Visited (in order of visit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angela</td>
<td>Female</td>
<td>18-24</td>
<td>Postgraduate history student with some professional experience in museum education.</td>
<td>Aboriginal-G Fossils Gallery Pacific</td>
</tr>
<tr>
<td>Bob</td>
<td>Male</td>
<td>55-64</td>
<td>Irregular museum goer with no design background but general interest in science.</td>
<td>Fossil Gallery Biodiversity Aboriginal-G Pacific</td>
</tr>
<tr>
<td>Carol</td>
<td>Female</td>
<td>45-54</td>
<td>Semi-regular museum goer with no specific subject knowledge</td>
<td>Fossils Gallery Biodiversity</td>
</tr>
<tr>
<td>Colin</td>
<td>Male</td>
<td>45-54</td>
<td>Semi-regular museum goer with professional science background but no specific design knowledge.</td>
<td>Fossil Gallery Opal Fossils Pacific</td>
</tr>
<tr>
<td>Geoff</td>
<td>Male</td>
<td>35-44</td>
<td>Semi-regular museum goer with general hobbyist level of knowledge</td>
<td>Pacific Biodiversity</td>
</tr>
<tr>
<td>Jonathan</td>
<td>Male</td>
<td>25-34</td>
<td>Regular museum goer with some knowledge of science and professional interest in design</td>
<td>Aboriginal-G Minerals Mawson Pacific</td>
</tr>
<tr>
<td>Lawrence and Valerie</td>
<td>Male, Female</td>
<td>45-54</td>
<td>Lawrence had not visited SA Museum before, Valerie used to bring her children when younger. Hobbyist level of design knowledge with no specific science knowledge.</td>
<td>Pacific Biodiversity Opal Fossils Fossil Gallery Aboriginal-1 Pacific</td>
</tr>
<tr>
<td>Natalie</td>
<td>Female</td>
<td>25-34</td>
<td>Regular museum goer and biology PhD student but no specific design knowledge.</td>
<td>Aboriginal-G Opal Fossils Pacific</td>
</tr>
<tr>
<td>Philip</td>
<td>Male</td>
<td>35-44</td>
<td>Irregular museum goer, more likely to visit museums when travelling. Has a science degree but no particular design knowledge.</td>
<td>Pacific Aboriginal-G Opal Fossils Minerals Biodiversity Opal Fossils Biodiversity</td>
</tr>
<tr>
<td>Rachel</td>
<td>Female</td>
<td>25-34</td>
<td>Regular museum visitor but had not visited SA Museum for several years. Does some display design for her work but no particular science knowledge.</td>
<td>Opal Fossils Minerals Biodiversit, Pacific</td>
</tr>
<tr>
<td>Robyn</td>
<td>Female</td>
<td>25-34</td>
<td>European student who has lived in Adelaide for two years. Completing a zoology PhD but no specific design knowledge.</td>
<td>Aboriginal-G Pacific Biodiversity</td>
</tr>
<tr>
<td>Sarah</td>
<td>Female</td>
<td>35-44</td>
<td>Had previously worked as an art teacher. Takes her children to the museum regularly.</td>
<td>Fossils Gallery Biodiversity Pacific Aboriginal-G</td>
</tr>
</tbody>
</table>

17 All names are pseudonyms. Names have been given to facilitate tracking of a given participant’s statements.
Following an initial briefing and informed consent procedure, participants were accompanied around a selection of the SA Museum’s permanent exhibition spaces in an order defined in advance by the researcher. Visit itineraries were intended to vary the experience of each participant and the order in which galleries were visited. Each participant visited an average of 3-4 exhibition spaces although this depended on the speed with which the visitor moved through each exhibition and the time constraints of the individual participant. The average duration of accompanied visits was 1 hour 20 minutes, ranging from 45 minutes to 1 hour 50 minutes. At the conclusion of the visit, participants were given a $15 gift voucher from the Museum shop as compensation for their time.

Accompanied visits were conducted using “think-aloud” interviews. Think-aloud interviews, also known as *protocol analysis* (Ericsson & Simon, 1984), are commonly used to study human problem solving and for usability testing of products and systems (Boren & Ramey, 2000; Hoppmann, 2007; Lundberg, 1984). During think-aloud interviews, participants articulate their thought processes as they carry out a task, move through a space, or solve a given problem. The think-aloud interview is thus a way of giving voice to the otherwise internalised processes that influence human decision-making in a specific and immediate context. Protocol analysis was the method used by Ballantine et al. (2010) in their qualitative study of shoppers’ perceptions of retail environments, leading to new insights into atmospheric variables in this context. Think-aloud interviews have also been used to study the thought processes of visitors completing set navigational tasks within a museum (Kraal & Lawry, 2013) and during formative evaluation of exhibitions (Economou, 2004).

As part of the briefing process, participants were instructed to think aloud everything that went through their mind as they moved through the exhibition space, describing what they were looking at, moving towards, and so on. The following script was used as a guide for the briefing process (but was not read verbatim):

*Together we will walk through up to four exhibition spaces together. While we do that, I would like you to think aloud everything that goes through your mind as we walk through the space – what attracts your attention, describing what you are moving towards, anything else you notice. I will keep fairly quiet through the process and take notes. I’ll avoid answering any questions you may have about the exhibitions – we can follow that up in our discussion afterwards if you like. Don’t worry about what you say making sense or explaining it to me – just say whatever comes into your head.*
The briefing process was refined slightly over the course of the accompanied visits. In particular, early participants became very focused on individual exhibits\(^{18}\) rather than the exhibition environment, meaning that fewer exhibition spaces were covered in a reasonable time period. The following guidance was therefore added:

*Try not to focus too much looking at individual exhibits. The plan is to get a general idea of each exhibition space rather than looking at each individual display in detail.*

Accompanied visits and debriefing interviews were audio recorded using a Livescribe™ Echo smartpen\(^{19}\) with handwritten notes taken in parallel using the accompanied Livescribe™ dot paper. This allows written notes to be linked to the relevant section of audio. Recording of accompanied visits was paused while participants moved from one gallery to the next. When recording recommenced on arrival at a new gallery, participants were reminded to give their initial impressions of the exhibition space and to think aloud as they went around.

At the conclusion of the accompanied visit stage of the process, a debriefing interview was conducted at a comfortable area within the museum (exact location dependent on circumstances of visit, location of crowds, etc.). This was an opportunity to recap the visit and invite general descriptions and comparisons between the exhibitions visited. The precise questions asked varied depending of the circumstances of the preceding visit, although the following interview guidelines were used:

- **General impressions of each exhibition space** – what are the things that stick in your mind about each exhibition environment?
- **Comparisons between exhibition spaces** – which exhibition environments did you prefer/were most comfortable in/ were most stimulated by? Can you tell me a bit more about that?
- **How would you describe the colour/lighting scheme of each space we visited?**
- **Referring back to specific comments made in think-aloud interviews.** “In exhibition [x] you said [y]. Can you tell me a bit more about that?/Can you explain that to me a bit more? etc.

---

\(^{18}\) This detailed exhibit focus was deemed to be a consequence of the interview process rather than participants’ own self-directed behaviour in the galleries. This was confirmed by tracking and timing studies which demonstrated that extended viewing of individual exhibits was rare.

Following each accompanied visit, the general circumstances of the visit and any issues were recorded as a fieldwork journal entry. Audio recordings were subsequently transcribed for analysis. A sample transcript of a debriefing interview is supplied as Appendix Two.

### 3.5.1 Strengths and Limitations of Think-Aloud Interviews

The think-aloud interview protocol generated a rich, real-time, first-person account of each visitor’s experience in the gallery with around 15 hours of interview recordings being produced from the 12 visits. This method therefore offers an opportunity for detailed analysis of the visitor experience as it unfolds, including interaction with the exhibition environment, exhibit content and the construction of meaning. Such studies that document what takes place at the “exhibit face” are currently limited (Davies & Heath, 2014; Heath & vom Lehn, 2004). Combining the real-time perspective of think-aloud interviews with more reflective debrief interviews and the researcher’s own observations of the participant’s actions offers multiple perspectives on the same event (Korol-Ljungberg, Douglas, Therriault, Malcolm, & McNeill, 2012).

Despite the benefit of having these multiple perspectives, not all relevant psychological processes are accessible through this method. Think-aloud interviews are generally used to study problem-solving situations where the locus of interest is cognitive processing taking place at the level of overt consciousness (Hoppmann, 2007; Lundberg, 1984). Emotional responses can also be elicited, although this may require more overt encouragement than was the case in this instance (Eva-Wood, 2004). In the current study, participants had no particular task or problem to solve; they were simply instructed to visit an exhibition gallery and describe what they saw and noticed. In the absence of any specific goal, they were not always able to articulate where they were going and why as they moved through a gallery. It is likely that these actions were not being processed at a conscious level and were thus not able to be verbalised. Furthermore, participants needed varying levels of encouragement and reminders to keep thinking aloud: It was clearly a process that came more naturally to some than others. Thus, the perspectives of those who were more capable of articulating what they were experiencing as a verbalised stream-of-consciousness may be over-represented in such a study. However, as qualitative enquiry, the goal of this phase was more one of “resonance” (Tracy, 2010) than general representativeness. The principal purpose of the data was to inform and triangulate the quantitative phase of research; this is illustrated through Chapters 4 and 5.

While there was evidence of participants’ personal meaning-making in the transcripts generated, such findings are beyond the scope of this particular research. This study is primarily concerned
with the exhibition environment and, to some extent, the design of individual exhibits. Accordingly, the emphasis of analysis was on visitors’ observations of the different exhibition galleries and the vocabulary they used to describe exhibitions and the exhibition environment in particular.

3.5.2 Thematic Analysis of Interview Transcripts

To aid analysis, selected quotations were grouped under themes that reflected the overall transcript content as well as the topic areas of interest, such as spaciousness and general design appearance including lighting and colour use. Quotations were also tagged depending on whether they were generated in a specific gallery during the accompanied visits (and thus relatively spontaneous and unprompted) or were from the post-visit debrief interviews (where responses were guided by the interview protocol described above). The results of this analysis are reported in Chapter Four.

3.6 Phase 2: Piloting and Refining the Perceived Atmosphere Instrument

Based on the themes and terminology that emerged from Phase 1, and supplemented by terms from the literature as applicable (Kaplan, 1988b; Küller, 1991; Mehrabian & Russell, 1974a; Ou et al., 2004b; Vogels, 2008b), a list of environmental descriptors representing Design Appearance, Spatiality and Information Rate were chosen for piloting as a quantitative Perceived Atmosphere Instrument. In the initial pilot, environmental descriptors were divided into two different categories: descriptive terms such as Dark-Light, Traditional-Modern, Familiar-Unfamiliar; and evaluative terms intended to indicate how applicable the term was, for instance Cheerful-Not Cheerful, Gloomy-Not Gloomy, Confusing-Not Confusing. Each item was presented as a seven-point semantic differential scale. This approach attempted to draw a distinction between general descriptions of the environment and evaluative judgements of it. The pilot Perceived Atmosphere Instrument comprised 24 descriptive terms and 16 evaluative terms (Table 3.2).
Table 3.2. Perceived atmosphere terms used in the pilot stage.

<table>
<thead>
<tr>
<th>Descriptive Terms (presented as opposites on 7-point semantic differential scales)</th>
<th>Evaluative Terms (presented on 7-point Likert scales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark – Light</td>
<td>Evenly Lit – Focused Lighting</td>
</tr>
<tr>
<td>Structured – Random</td>
<td>Linear – Winding</td>
</tr>
<tr>
<td>Familiar – Unfamiliar</td>
<td>Warm – Cool</td>
</tr>
<tr>
<td>Traditional – Modern</td>
<td>Ordinary – Striking</td>
</tr>
<tr>
<td>Spacious – Confined</td>
<td>Flat – Three-Dimensional</td>
</tr>
<tr>
<td>Varied – Repetitive</td>
<td>Open – Enclosed</td>
</tr>
<tr>
<td>Organised – Disorganised</td>
<td>Simple – Complex</td>
</tr>
<tr>
<td>Dynamic – Static</td>
<td>Subdued – Bright</td>
</tr>
<tr>
<td>Decorative – Functional</td>
<td>Sparse – Dense</td>
</tr>
<tr>
<td>Free to choose – Directed</td>
<td>Old – New</td>
</tr>
<tr>
<td>Wide – Narrow</td>
<td>Hidden – Obvious</td>
</tr>
<tr>
<td>Vibrant – Dull</td>
<td>Cluttered - Uncluttered</td>
</tr>
<tr>
<td>Cheerful</td>
<td>Immersive</td>
</tr>
<tr>
<td>Distracting</td>
<td>Confusing</td>
</tr>
<tr>
<td>Inviting Exploration</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Sterile</td>
<td>Gloomy</td>
</tr>
<tr>
<td>Oppressive</td>
<td>Exciting</td>
</tr>
<tr>
<td>Easy to Navigate</td>
<td>Overwhelming</td>
</tr>
<tr>
<td>Tense</td>
<td>Hostile</td>
</tr>
<tr>
<td>Clear</td>
<td>Tranquil</td>
</tr>
</tbody>
</table>

Pilot testing was performed in November 2012 at three exhibition galleries: the Pacific and Biodiversity galleries at SA Museum, and the Wild! Gallery at Melbourne Museum (Wild!). The Pacific and Biodiversity galleries were selected as the two most different environments within SA Museum; the Wild! gallery was selected as it has similar content to Biodiversity (both are rich in taxidermied animal specimens), but has a very different design and layout, including a double-height area with a white cube design aesthetic (Figure 3.6).
Data collection was initially envisaged to be as an electronic survey using a tablet device (Apple™ iPad), with a paper version as back-up for participants who did not feel comfortable using the tablet. While the tablet facilitated data entry, it made data collection more time consuming as with a single tablet only one person could complete the survey at a time. Ultimately, the majority of surveys were collected on paper and paper surveys were used for all subsequent data collection.

The target sample size for the pilot was 150, to be evenly split across each of the three galleries. A total of 172 surveys were collected as follows:

- Pacific: $n = 56$. 15 collected via iPad with remainder via paper survey
- Biodiversity: $n = 55$. 14 collected via iPad with remainder via paper survey
- Wild! Gallery: $n = 61$. 7 collected via iPad with remainder via paper survey\(^{20}\)

\(^{20}\) Responses collected via tablet and paper were compared using independent samples t-tests and chi-squared tests as appropriate, to confirm there were no significant differences with respect to survey input method used. The only difference identified was with respect to age, with respondents in the 18-34 age group being more likely to have used the tablet ($\chi^2(2) = 6.56, p = 0.038$). This is consistent with observations made during piloting that older visitors were more comfortable using a paper version.
Data collection was spread across different days of the week and time of day, with each gallery being sampled on both weekend and weekday periods. Visitors were approached at random and invited to participate in the study. A fieldwork journal was kept to document the general circumstances of data collection as well as the number of refusals. Refusals were as follows: Pacific – 24 refusals for 56 completed surveys (30% refusal rate); Biodiversity – 37 refusals for 55 completed surveys (40% refusal rate); Wild – 33 refusals for 61 completed surveys (35% refusal rate). Refusal rates lowered over the course of the data collection process, which is attributed to a refinement in the participant approach and recruitment process (in particular, making it clear from the outset that this was student research and not any kind of marketing pitch). The most common reasons for refusal were lack of English ability, difficulty in completing the survey while supervising children, and lack of time. The higher refusal rate in Biodiversity is attributed to a higher number of visitor groups with small children who were more likely to decline to participate. Data from the pilot study were entered into SPSS (Version 20) for statistical analysis. Demographic details of the pilot sample are summarised in Table 3.3.
Table 3.3. Demographic summary of the pilot sample (N = 172).

At the analysis stage, “History of Visiting” was collapsed from five categories into three: first time visitors, irregular visitors and frequent visitors.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>42</td>
<td>24.9%</td>
</tr>
<tr>
<td>25-34</td>
<td>52</td>
<td>30.8%</td>
</tr>
<tr>
<td>35-44</td>
<td>28</td>
<td>16.6%</td>
</tr>
<tr>
<td>45-54</td>
<td>15</td>
<td>8.9%</td>
</tr>
<tr>
<td>55-64</td>
<td>19</td>
<td>11.2%</td>
</tr>
<tr>
<td>65+</td>
<td>13</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>86</td>
<td>50.6%</td>
</tr>
<tr>
<td>Female</td>
<td>84</td>
<td>49.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visiting Group</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>15</td>
<td>8.9%</td>
</tr>
<tr>
<td>Family group (with at least one child &lt; 16 yrs)</td>
<td>43</td>
<td>25.4%</td>
</tr>
<tr>
<td>Adult couple or group</td>
<td>111</td>
<td>65.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History of Visiting</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>First time visitors</td>
<td>89</td>
<td>52.7%</td>
</tr>
<tr>
<td>Irregular visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First visit in 5+ years</td>
<td>27</td>
<td>16.0%</td>
</tr>
<tr>
<td>Visited 1-2 times in past 5 years</td>
<td>34</td>
<td>20.1%</td>
</tr>
<tr>
<td>Frequent visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visited 3-5 times in past 5 years</td>
<td>9</td>
<td>5.3%</td>
</tr>
<tr>
<td>Visited &gt;5 times in past 5 years</td>
<td>10</td>
<td>5.9%</td>
</tr>
</tbody>
</table>

3.6.1 Factor Analysis of Atmospheric Descriptors

Factor analysis using Principal Axis Factoring (Hair, Black, Babin, & Anderson, 2010) was conducted to identify any latent structure in the atmospheric descriptors. The Bartlett’s test of sphericity $\chi^2 = 1144.53, p < 0.005$ was significant for the 24 semantic differential descriptive terms, suggesting factor analysis was appropriate for this data set. The Kaiser-Meyer-Olkin Measure of Sampling Accuracy (KMO) was 0.712. Hair et. al (2010) indicates that a KMO score above 0.8 is preferred, although scores exceeding 0.7 are acceptable.
Four of the items had initial communalities below 0.3: Familiar-Unfamiliar (0.286), Decorative-Functional (0.239), Free to Choose-Directed (0.210) and Sparse-Dense (0.216). This suggests the factor structure poorly accounted for the variance in these items. Based on discussions during piloting and inspection of the scores of these individual items, it was concluded that the item Decorative-Functional was poorly understood and participants were sometimes unfamiliar with the word “Sparse”. Not surprisingly given the free-choice learning setting, people generally reported feeling “Free to Choose”, meaning there was little variation on this item. The Familiar-Unfamiliar item may have been interpreted in different ways by different people – either pertaining to the environment or the exhibition’s content itself. Accordingly, these items were removed and the factor analysis recalculated ($\chi^2 = 1002.30, p<0.005; KMO = 0.719$).

The scree test criterion (Hair et al., 2010) indicated a four-factor solution which accounted for 40.1% of the common variance$^{21}$. Following a Varimax rotation to aid interpretation, the factors were identified as shown in Table 3.4. The four factors were interpreted as follows:

- **Factor 1: Spatiality** → Light, Spacious, Wide, Bright, Open, Evenly Lit
- **Factor 2: Vibrancy** → Dynamic, Vibrant, Varied
- **Factor 3: Complexity** → Three-Dimensional, Winding, Modern, Striking, Complex
- **Factor 4: Structure** → Uncluttered, Structured, Organised.

The Spatiality factor included items representing spaciousness as well as those for lighting, commensurate with the close relationship that emerged between light and space in Phase 1. Similarly, the emergence of factors for Complexity and Structure is consistent with participant interviews as well as Kaplan’s (1987, 1988) model of environmental cognition which is based on Understanding and Exploration (Table 2.2). Vibrancy appears to be related to overall feel of the gallery, possibly encompassing those design elements that caught the attention of participants. It could also be considered analogous to the factor of activity, first identified by Osgood (Osgood et al., 1957). The emergence of such an interpretable structure in the atmospheric variables used in the pilot demonstrates that the semantic differential approach is able to describe and characterise Perceived Atmosphere. This was considered sufficient proof-of-principle to warrant scaling up this approach to a larger sample.

21 The four retained factors all had eigenvalues exceeding 1.3. There were a total of 7 factors with eigenvalues exceeding 1.0, although Kaiser’s criterion of choosing factors based on eigenvalues > 1 has been criticised for retaining too many factors (Pallant, 2010). Comparison of the resulting 4, 5, 6 and 7-factor matrices indicated that the four-factor solution based on the scree test criterion was the most parsimonious and interpretable in light of relevant theory.
Table 3.4. Rotated factor matrix of the Perceived Atmosphere items in the pilot sample (factor loadings <0.4 have been omitted for clarity).

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark-Light</td>
<td>-.755</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacious-Confined</td>
<td>.502</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide-Narrow</td>
<td>.495</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subdued-Bright</td>
<td>-.489</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Enclosed</td>
<td>.474</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evenly lit-Focused lighting</td>
<td>.442</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm-Cool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hidden-Obvious</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic-Static</td>
<td>.789</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibrant-Dull</td>
<td>.630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varied-Repetitive</td>
<td>.573</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old-New</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat-3 Dimensional</td>
<td></td>
<td></td>
<td></td>
<td>.723</td>
</tr>
<tr>
<td>Linear-Winding</td>
<td>.502</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional-Modern</td>
<td>.488</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary-Striking</td>
<td>.483</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple-Complex</td>
<td>.466</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluttered-Uncluttered</td>
<td></td>
<td></td>
<td>- .623</td>
<td></td>
</tr>
<tr>
<td>Structured-Random</td>
<td>.610</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organised-Disorganised</td>
<td>.566</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.6.2 Factor Analysis of Evaluative Terms

The 16 evaluative items were similarly analysed using Principal Axis Factoring. After omitting items with low communalities (Distracting, 0.276; Sterile, 0.211; Overwhelming, 0.266; and Hostile, 0.291), the remaining 12 items were entered into a factor analysis using Principal Axis Factoring with Varimax rotation (Bartlett’s test of sphericity $\chi^2 = 700.772$, p<0.005; KMO = 0.821). Both eigenvalues and scree criterion indicated a three factor solution accounting for 49.7% of the common variance, as shown in Table 3.5.
Table 3.5. Rotated factor matrix of evaluative terms (factor loadings <0.4 have been omitted for clarity).

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exciting</td>
<td>.790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inviting Exploration</td>
<td>.771</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immersive</td>
<td>.682</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasant</td>
<td>.631</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheerful</td>
<td>.536</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tranquil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td></td>
<td>.912</td>
<td></td>
</tr>
<tr>
<td>Easy to Navigate</td>
<td></td>
<td>.572</td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td></td>
<td></td>
<td>-0.458</td>
</tr>
<tr>
<td>Tense</td>
<td></td>
<td></td>
<td>.773</td>
</tr>
<tr>
<td>Gloomy</td>
<td></td>
<td></td>
<td>.621</td>
</tr>
<tr>
<td>Oppressive</td>
<td></td>
<td></td>
<td>.427</td>
</tr>
</tbody>
</table>

The factor analysis essentially split the evaluative items into positive terms (Exciting, Inviting Exploration, Immersive, Pleasant, Cheerful) and negative terms (Tense, Gloomy, Oppressive), with an additional factor that appears to represent Clarity (Clear, Easy to Navigate, Not Confusing). The Clarity factor is conceptually similar to Structure, which emerged in the factoring of the atmospheric descriptors.

Overall, the evaluative terms appear to be less useful in characterising the exhibition environment than the descriptive terminology, as they do not characterise the environment beyond simple positive or negative judgements. The aim of this research is to move beyond simple judgements of what constitutes a good exhibition environment, into defining Perceived Atmosphere more meaningfully. Accordingly, the evaluative items were deleted from the main survey, in favour of an expanded set of semantic differentials for quantifying Perceived Atmosphere as well as a series of statements for cognitively evaluating different characteristics of the environment (see Section 3.8).
3.6.3 Revising and Finalising the Perceived Atmosphere Instrument

As a result of the piloting of the atmospheric descriptors and evaluative terms described above, the Perceived Atmosphere Instrument was expanded and revised as follows. Four items that were either poorly understood or did not seem to adequately represent the concepts of interest were deleted:

- Familiar-Unfamiliar
- Decorative-Functional
- Free to Choose-Directed
- Sparse-Dense

The wording of three items was refined:

- Structured-Random to Structured-Unstructured
- Organised-Disorganised to Organised-Random
- Evenly Lit-Focused Lighting to Evenly Lit-Targeted Lighting

A further 10 items were added, based on both the literature and the concepts that emerged in the qualitative interviews:

- Hard-Soft
- Flowing-Discontinuous
- Colourful-Neutral
- Dramatic-Plain
- Active-Passive
- Logical-Jumbled
- Symmetrical-Asymmetrical
- Cosy-Formal
- Energetic-Serene
- Small Scale-Large Scale

These 30 items were subsequently tested as part of the full Atmosphere and Experience Questionnaire pilot by 65 visitors to Pacific and Biodiversity galleries. Wording and instructions associated with the survey were slightly refined as a result. With the main (Phase 3) survey sample, factor analyses were recalculated on these 30 items and summated scales created based on the emergent factors. Since the interpretation and subsequent use of these factors form an integral part of interpreting the results of the study overall, this second factor analysis is presented as part of the results and discussion of the Phase 3 study in Chapter 5 (Section 5.2.1).
3.7 Phase 3: Data Collection Approach and Participants

3.7.1 Description of the Participant Sample

A total of 780 visitors to the SA Museum participated in Phase 3 of the study, either through completion of the self-administered Atmosphere and Experience Questionnaire (N = 602); being unobtrusively tracked and timed as they visited an exhibition gallery (n = 238); or both (n = 60)\(^{22}\). The main survey sample size was selected such that it would be sufficient for robust factor analyses and statistical comparisons both within and between exhibition galleries\(^{23}\). The track-only sample was intended to give a general overview of patterns of behaviour in each gallery; a target of 75 visitors per gallery was chosen as a logistically feasible sample to collect in the timeframe while still being large enough to discern overall patterns of behaviour\(^{24}\). Although the tracked visitors and surveyed visitors are mostly different individuals, both are random samples of visitors to the same galleries, with sufficient similarities to suggest they are comparable. A similar rationale has been used to compare responses to separate entrance and exit surveys for the same exhibition (Pekarik et al., 1999). The overall participant sample is summarised visually in Figure 3.7.

Both visitor surveys and visitor tracking were conducted during two periods of data collection in the first half of 2013. The majority of participants were tracked/surveyed during January-March 2013, with the remainder participating during a second round of data collection in June 2013. Data collection was spread across both weekdays and weekends and throughout the operating hours of the museum.

For the tracking and timing, visitors were randomly selected on a “next available” basis – that is, the first visitor to enter the gallery was tracked and timed until they had exited; the next visitor to enter would then be tracked until exit and so on. Where visitors were in groups, a single group member was randomly selected to be tracked. Visits of duration less than one minute or visitors who were clearly using the gallery as a thoroughfare were excluded.

\(^{22}\) Logistical constraints limited the number of participants who were both tracked and surveyed to a small subset suitable for preliminary analysis, due to the time consuming nature of the tracking and recruitment process. Much of the non-survey visitor tracking was conducted while the Phase 3 questionnaire was being developed and refined.

\(^{23}\) Initial target sample was three galleries with 150 participants per gallery; an additional sample (target = 100) was collected from Aboriginal-G to compare Perceived Atmosphere between Aboriginal-G and Aboriginal-1.

\(^{24}\) A separate visitor tracking study conducted across both levels of the Aboriginal Cultures Gallery in 2011 had found that the overall pattern and frequency of visitor behaviours was essentially stable once a sample of approx. 50-60 visitors had been counted and analysed (Forrest & Parsons, 2012). A minimum sample of 45 visitors is generally considered sufficient for tracking and timing studies (Beverly Serrell, personal communication).
To recruit participants to complete the survey, visitors to the exhibition gallery of interest were similarly approached on a next available basis. In practice, except in particularly busy periods, all eligible visitors within a gallery were approached and invited to participate. Potential participants were informed that the study was a research project, that their involvement was completely voluntary, and that participation would require completion of a survey that would take approximately 10 minutes of their time. Visitors who agreed to participate were given a Participant Information Sheet and instructed to: “Keep looking around the exhibition as much or as little as you were going to anyway. When you’re done, come back to [indicated location in gallery] where you can pick up the survey.” This approach was taken as an alternative to recruiting upon exit, which would have been impractical for a lone researcher given each exhibition has multiple entrances and exits. While the chosen recruitment approach may possibly have a priming effect, visitors were not aware of the questions to be asked and were given limited information about the survey’s content. If they asked for further details during recruitment, visitors were told the survey was about “how you would describe this environment and your experience in it” and reassured that the survey was not a test of what’s in the gallery so that visitors would be less likely to feel they needed to pay more attention than they otherwise would have. The same recruitment strategy was used in all exhibition spaces. In most instances, visitors completed the survey while in the gallery. Seating was provided as well as some activities to occupy accompanying children. Visitors who returned a survey were given a voucher for a free hot beverage at the museum café as a token of appreciation for their participation.
From a total of 1203 visitors approached, 605 surveys\textsuperscript{25} were returned, representing a response rate of 50%. This is comparable to visitor surveys conducted elsewhere\textsuperscript{26}. Where visitors gave a reason for refusing to participate, the reason for refusal was recorded. The most common reasons given were: not enough time (24% of all refusals), poor or no English spoken (19%) and child-related reasons (17%). This indicates that family visitors and international visitors will be under-represented in the survey sample. Given these results, a more purposive recruitment strategy was used for the 60 participants who were tracked then surveyed. Families comprising a single adult with very young children and visitors who were heard to speak a language other than English were excluded in order to increase the predicted response rate. A summary of the participant recruitment process is presented in Table 3.6.

Table 3.6. Summary of response and refusal rates for visitor surveys.

<table>
<thead>
<tr>
<th>Visitor Survey Sample</th>
<th>Total Visitors Approached</th>
<th>Participant Information Sheets Given</th>
<th>Refusals</th>
<th>Non-Returns\textsuperscript{27}</th>
<th>Returned Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1111</td>
<td>701 (63%)</td>
<td>410 (40%)</td>
<td>156 (22%)</td>
<td>545 (49%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visitor Track-Survey Sample</th>
<th>Total Visitors Approached</th>
<th>Participant Information Sheets Given</th>
<th>Refusals</th>
<th>Returned Incomplete</th>
<th>Returned Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>85</td>
<td>66 (78%)</td>
<td>19 (22%)</td>
<td>6 (7%)</td>
<td>60 (71%)</td>
</tr>
</tbody>
</table>

As with the pilot samples, survey data were coded and entered into SPSS (Version 20) for statistical analysis and the data set inspected for errors. Where questions were left blank or were completed ambiguously, a missing value was recorded. Missing values appeared to be random with no systematic patterns, although in general the semantic differential questions were more likely to have missing data\textsuperscript{28}. In all analyses, unless otherwise specified, cases with missing data were excluded “pairwise” or “analysis by analysis” to avoid unduly limiting the data set (Pallant, 2010).

\textsuperscript{25} Three of these were omitted at the data entry stage as large sections had been left incomplete.

\textsuperscript{26} Personal communication with Carolyn Meehan, Museum Victoria. Tröndle et al. also recently reported approximately 1 in 2 museum visitors agreeing to participate in their on-site study (Tröndle et al., 2012).

\textsuperscript{27} The proportion of visitors who accepted a participant information sheet but did not return to complete a survey.

\textsuperscript{28} The item with the most missing values was the semantic differential Traditional-Modern with 17 cases (<3%) classed as missing.
3.7.2 Visitor Tracking Protocols

Across the entire sample of 238 tracked visitors (Figure 3.7), 47.1% of those tracked were men and 52.9% were women. These visitors appeared to be visiting in groups comprising the following:

- Alone: $n = 51$ (21.4%);
- Family group with children: $n = 103$ (43.3%);
- Adult couple or group: $n = 84$ (35.3%).

Compared to the main survey sample (see demographic summary of this sample in Section 3.7.3), considerably more adults visiting with children were tracked (43% vs. 27% of the survey sample). Part of this difference may be due to visitors with small children being more likely to decline to complete a survey. Cross-tabulating the data indicated that family visitors were over-represented in Biodiversity in comparison to the other two: $\chi^2(4) = 15.08, p = 0.005).$ This reflects the distribution of the main survey population.

3.7.2.1 Coding Visitor Behaviour

As visitors were tracked, their behaviour at each exhibit was observed and coded using a protocol based on that used by the Australian Museum29. This and other coding protocols in the literature (Barriault & Pearson, 2010; Bitgood, 2011; Van Schijndel, Franse, & Raijmakers, 2010) generally recognise three levels of observed engagement with exhibits. The definitions used in this study are shown in Table 3.7.

As well as time spent at exhibits, other behavioural cues such as discussing objects or labels with companions or taking photographs, would raise the overall engagement score if the time spent was otherwise borderline between two categories. Conversely, if a visitor was present at an exhibit but was clearly not attending to it for the entire time, this would reduce the engagement score accordingly. Owing to the large size of some exhibits30, some exhibits may have been skimmed, attended to or engaged with on multiple occasions, although behaviour was coded according to the maximum level of engagement achieved at that exhibit. (e.g. attending to two parts of the same exhibit is coded as Attend (3), not Engage (4)).

---

30 In this study, the definition of an individual “exhibit” is somewhat arbitrary as in several cases display cases run continuously across large areas. Thus, exhibits were defined such that they created logical zones on a plan of the gallery, or where preliminary tracking had identified clear distinctions in use. Accordingly Aboriginal-1 was divided into 25 exhibits or zones, Pacific 31, Biodiversity 40.
Table 3.7. Coding protocol for observed visitor behaviour.

<table>
<thead>
<tr>
<th>Behaviour Code</th>
<th>Definition</th>
<th>Level of Engagement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not encountered</td>
<td>-</td>
<td>Visitor did not encounter exhibit or pass in its vicinity (excluded from engagement calculations).</td>
</tr>
<tr>
<td>1</td>
<td>Ignore</td>
<td>None</td>
<td>Visitor passed by but seemingly ignored the exhibit.</td>
</tr>
<tr>
<td>2</td>
<td>Skim</td>
<td>Level 1</td>
<td>Exhibit was skimmed in passing but was not stopped at (or stopped less than 2 seconds).</td>
</tr>
<tr>
<td>3</td>
<td>Attend</td>
<td>Level 2</td>
<td>Exhibit was attended to briefly (visitor stopped and looked at exhibit for more than 2 seconds but less than 10 seconds).</td>
</tr>
<tr>
<td>4</td>
<td>Engage</td>
<td>Level 3</td>
<td>Exhibit was attended to in some depth (visitor stopped and looked at exhibit for a minimum of 10 seconds).</td>
</tr>
</tbody>
</table>

For each visitor, engagement scores were averaged across each exhibit encountered, to give an overall average level of engagement. To distinguish between this observed measure of engagement and the self-report engagement measures referred to elsewhere in this study, this observational-based measure will hitherto be referred to as “Attentional Engagement”, since it is based on time spent attending to exhibits, an indicator of visitor attention (Bitgood, 2010; Serrell, 1998). This attentional engagement score has a theoretical minimum of 1 (all encountered exhibits were ignored) and a maximum of 4 (engagement with all encountered exhibits). Across the sample, the average level of attentional engagement was between 2 and 2.5, translating to engagement between the skim and attend levels. Visitor behaviour in different exhibitions is compared in greater detail in Chapter 5, Section 5.3.5. The subset of this sample that also completed the Atmosphere and Experience Questionnaire will be discussed in Section 5.3.6.

3.7.3 Demographic Summary of Surveyed Visitors

The Atmosphere and Experience Questionnaire, which is described more fully in Section 3.8, included a small number of basic demographic questions in order to characterise participants and to assess the overall representativeness of the participant sample (Table 3.8). Although existing visitor data for SA Museum is limited, the participant sample appears to reflect results from previous surveys. In particular, there was a slightly higher proportion of females and more than a third of all visitors were in the 18-29 age group. This consistent with previous visitor data collected at SA Museum (Crilley & Moskwa, 2010).
Around one half of participants were first-time visitors to the museum. Observations made during fieldwork suggest that the majority of these first-time visitors were either interstate or overseas tourists. A further 30% were infrequent visitors to the museum and 20% were characterised as frequent visitors, having visited at least three times in the past five years.

Half of the participants were visiting as couples or adult groups and a further 20% were solo visitors. Solo visitors were slightly more likely to be male, while family visitors were more likely to be female. Just over one quarter of the sample was family visitors, although visitor observation (sample described in Section 3.7.2 above) confirms that family visitors are somewhat under-represented in this sample.

Table 3.8. Participant demographics (N = 602).
(N.B. Some totals add up to less than 602 due to a small number of incomplete responses.)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Range</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>226</td>
<td>37.5%</td>
</tr>
<tr>
<td>30-39</td>
<td>107</td>
<td>17.8%</td>
</tr>
<tr>
<td>40-49</td>
<td>103</td>
<td>17.1%</td>
</tr>
<tr>
<td>50-59</td>
<td>64</td>
<td>10.6%</td>
</tr>
<tr>
<td>60+</td>
<td>98</td>
<td>16.3%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>275</td>
<td>45.7%</td>
</tr>
<tr>
<td>Female</td>
<td>323</td>
<td>53.7%</td>
</tr>
<tr>
<td><strong>Visiting Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>127</td>
<td>21.1%</td>
</tr>
<tr>
<td>Family group (with at least one child &lt; 16 yrs)</td>
<td>165</td>
<td>27.4%</td>
</tr>
<tr>
<td>Adult couple or group</td>
<td>307</td>
<td>51.0%</td>
</tr>
<tr>
<td><strong>History of Visiting SA Museum</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First time visitors</td>
<td>312</td>
<td>51.8%</td>
</tr>
<tr>
<td>Irregular visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First visit in 5+ years</td>
<td>89</td>
<td>14.8%</td>
</tr>
<tr>
<td>Visited 1-2 times in past 5 years</td>
<td>84</td>
<td>14.0%</td>
</tr>
<tr>
<td>Frequent visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visited 3-5 times in past 5 years</td>
<td>53</td>
<td>8.8%</td>
</tr>
<tr>
<td>Visited &gt;5 times in past 5 years</td>
<td>61</td>
<td>10.1%</td>
</tr>
</tbody>
</table>
The age and gender of participants was evenly distributed across the galleries. Family visitors were more likely to be surveyed in the Biodiversity, which is positioned as one of the SA Museum’s more family friendly exhibitions. First-time visitors were over-represented in Aboriginal-1; Aboriginal Cultures is the gallery that is most frequently promoted to tourists.

Visitors were asked to indicate their main reason for visiting the museum by selecting one of five statements based on the Identity model of museum visitors’ motivation (Falk, 2009). The relative frequency of the respective visit identities among visitors to SA Museum was consistent with those that have been observed in other comparable settings (e.g., Falk & Storksdieck, 2010; Rowe & Nickels, 2011). The most common categories were Explorers and Facilitators, with relatively few Rechargers (Table 3.9).

Table 3.9. Stated principal visit purpose of participants

<table>
<thead>
<tr>
<th>Visit Purpose</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>To satisfy a general interest or curiosity (Explorers)</td>
<td>168</td>
<td>27.9%</td>
</tr>
<tr>
<td>To accompany my children/partner/friends (Facilitators)</td>
<td>132</td>
<td>21.9%</td>
</tr>
<tr>
<td>Because it is one of the city’s main attractions (Experience Seekers)</td>
<td>109</td>
<td>18.1%</td>
</tr>
<tr>
<td>To see things I have a particular interest in (Professional/Hobbyists)</td>
<td>85</td>
<td>14.1%</td>
</tr>
<tr>
<td>To take time out from the stresses of daily life (Rechargers)</td>
<td>45</td>
<td>7.5%</td>
</tr>
<tr>
<td>Multiple responses given</td>
<td>60</td>
<td>10.0%</td>
</tr>
</tbody>
</table>

First time visitors were more likely to be Experience Seekers or Explorers, and less likely to be Facilitators. Regular visitors were considerably more likely to be Facilitators, who were also more likely to be family visitors. Couples and adult groups were more likely to be Explorers or Experience Seekers. Hobbyists were slightly more prevalent among visitors aged 50+. 
3.8 Phase 3: Instrument Development and Scale Refinement

This section will describe the various components of the Atmosphere and Experience Questionnaire, their rationale for inclusion and (where relevant) how they were developed and refined. The final version of the questionnaire is provided as Appendix Three. It comprised:

- The Perceived Atmosphere Instrument, comprising the 30 semantic differentials described in Section 3.6. These 30 items were entered into a Factor Analysis to identify the key underlying dimensions of Perceived Atmosphere. Since the subsequent interpretation of these factors is essential to addressing the research aims of this project, it is presented as part of the results and discussion of the Phase 3 study in Chapter 5.

- Affective response scales, comprising 24 Likert scales based on Primary Emotions Theory (Plutchik, 1980). The rationale for this approach and the development of summated scales for further analysis is presented in Section 3.8.1.

- Cognitive response scales, based on the level of agreement to 11 statements on a seven-point scale ranging from Strongly Disagree (= 1) to Strongly Agree (= 7). The theoretical basis of these items and the use of them to produce summative scales is described in Section 3.8.2.

- The Experience Measures checklist as developed by Packer et al. (2013), comprising 75 items representing 15 aspects of the visitor experience. Incorporating a published instrument into the questionnaire allowed benchmarking of this sample against those collected in other museums. Furthermore, since the 15 dimensions cover both affective and cognitive responses, it can be used to triangulate findings from the Affective and Cognitive response scales developed specifically for this study.

- A small number of demographic and visit history/purpose questions, as described in section 3.7.3 above. These were included primarily as control variables.

3.8.1 Affective Responses: Scale Development

3.8.1.1 Preliminary Testing of Alternative Approaches for Measuring Visitor Affect

As was argued in Section 2.17.2, the affective dimension of the museum visitor experience has historically received less research attention than cognitive, content-based learning outcomes. To address this gap, this study sought to further explore the role of visitor affect, drawing upon theory and methodology from servicescape research. Servicescape researchers have adapted a number of scales from the psychological literature to measure affect and emotion: PAD dimensions (Mehrabian & Russell, 1974b), the Positive and Negative Affect Scale (PANAS) (Watson, Clark, &
Tellegen, 1988) and scales derived from primary emotions models such as those proposed by Plutchik (1980) and Izard (1977). Since the landmark study of Donovan and Rossiter (1982), which first applied Mehrabian and Russell’s S-O-R model to atmospherics research, the associated PAD model has been widely applied to service settings. However, its limitations in this context have been recognised (Chebat & Dubé, 2000; Liu & Jang, 2009). Direct comparison of respective models has produced conflicting results (Machleit & Eroglu, 2000), suggesting that the specific context of a given study may influence which measure is the most appropriate. Thus, as part of the survey used for piloting the Perceived Atmosphere Instrument (the Phase 2 study described in Section 3.6 above), two scales for visitor emotion were included in order to determine which would be most appropriate for this study: The PAD dimensions or a scale based on Plutchik’s eight primary emotions.

To represent the PAD dimensions, nine of the 18 semantic differentials were selected, three for each dimension of pleasure, arousal and dominance, choosing those that were considered most likely to be appropriate in a museum setting. To represent the Plutchik primary emotions model, three items were selected for each of the primary emotions, resulting in 24 emotion words used with 7-point Likert-type rating scales. Results on these measures from the completed 172 Phase 2 surveys (described in Section 3.6 above) were compared.

Table 3.10. Rotated factor matrix showing a three-factor solution for the nine PAD semantic differentials (factor loadings <0.4 are omitted for clarity).

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annoyed-Pleased</td>
<td>.916</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Despairing-Hopeful</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed-Contented</td>
<td>.671</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleepy-Wide Awake</td>
<td>.525</td>
<td>.422</td>
<td></td>
</tr>
<tr>
<td>Relaxed-Stimulated</td>
<td></td>
<td>.585</td>
<td></td>
</tr>
<tr>
<td>Calm-Excited</td>
<td></td>
<td>.547</td>
<td></td>
</tr>
<tr>
<td>Guided-Autonomous</td>
<td></td>
<td>.468</td>
<td></td>
</tr>
<tr>
<td>Submissive-Dominant</td>
<td></td>
<td></td>
<td>.605</td>
</tr>
<tr>
<td>Cared for - In Control</td>
<td></td>
<td></td>
<td>.506</td>
</tr>
</tbody>
</table>

An exploratory factor analysis of the PAD scales extracted three factors with an eigenvalue exceeding 1 (Table 3.10). However, five of the nine items (Submissive-Dominant, Cared For-In
Control, Calm-Excited, Guided-Autonomous and Relaxed-Stimulated) had low initial communalities (<0.3). Since omitting such a large proportion of items was not feasible, the factor matrix including all nine items is presented here but should be interpreted with caution (Table 3.9). In this analysis, it appears Sleepy-Wide Awake was not interpreted in terms of arousal, but loaded on both pleasure (Factor 1) and dominance (Factor 3). In addition, Guided-Autonomous loaded on the arousal factor (Factor 2). Discussions during piloting suggest that the word “autonomous” was not well understood by some visitors.

An exploratory factor analysis was similarly conducted on the 24 items derived from Plutchik’s eight primary emotions. Three items with low communalities were removed (Sociable, Cautious and Bewildered) and the factor analysis recalculated (KMO = 0.880, Bartlett’s test of sphericity $\chi^2 = 1565.67$, p< 0.005). The scree test indicated a four factor solution\(^{31}\). The factor matrix is shown in Table 3.11.

In this research, the purpose of the affective response scale was to study the relationship between Perceived Atmosphere and visitor affect. Thus, the most appropriate scale would be the one that is most likely to provide an insight into this relationship. To determine this, summated scales based on the PAD dimensions (excluding the items that did not load as anticipated in the factor analysis) and the four factors derived from the 24 primary emotions terms were tested in bivariate correlations with the prospective Perceived Atmosphere dimensions as described in section 3.6.1. The nature and strength of the correlations with the primary emotion measures appeared to give a richer description than those observed with the PAD dimensions. Therefore, the primary emotion-based scale was retained in favour of the PAD dimensions.

There were some modifications to the emotion items based on the response to the pilot study. Six terms were removed either because the words were poorly understood by participants or had low communalities in the factor analysis: Sociable, Cautious, Bewildered, Disgusted, Contented and Aggressive. These were replaced with six alternatives from the list of primary emotion variants proposed by Plutchik (1980). These terms: Amazed, Focused, Disappointed, Patient, Frustrated and Inhibited, were anticipated to be better understood by participants and be more applicable in a museum context.

\(^{31}\) Although five factors had eigenvalues exceeding 1, the eigenvalue of the fifth factor was 1.001. It was therefore deemed suitable for omission.
Table 3.11. Rotated factor matrix showing a four-factor solution for the 24 primary emotions terms used in the Phase 2 survey (factor loadings <0.4 are omitted for clarity).

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sad</td>
<td>.755</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>.682</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed</td>
<td>.676</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fearful</td>
<td>.666</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxious</td>
<td>.592</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discouraged</td>
<td>.583</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disgusted</td>
<td>.555</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resentful</td>
<td>.456</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contented</td>
<td></td>
<td>-.421</td>
<td>.410</td>
<td></td>
</tr>
<tr>
<td>Inquisitive</td>
<td></td>
<td></td>
<td></td>
<td>.714</td>
</tr>
<tr>
<td>Interested</td>
<td></td>
<td></td>
<td></td>
<td>.679</td>
</tr>
<tr>
<td>Fascinated</td>
<td></td>
<td></td>
<td></td>
<td>.614</td>
</tr>
<tr>
<td>Delighted</td>
<td>.522</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>.509</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hopeful</td>
<td></td>
<td></td>
<td>.791</td>
<td></td>
</tr>
<tr>
<td>Agreeable</td>
<td></td>
<td></td>
<td>.732</td>
<td></td>
</tr>
<tr>
<td>Surprised</td>
<td></td>
<td></td>
<td>.628</td>
<td></td>
</tr>
<tr>
<td>Calm</td>
<td></td>
<td></td>
<td>.609</td>
<td></td>
</tr>
<tr>
<td>Fed Up</td>
<td></td>
<td></td>
<td></td>
<td>.701</td>
</tr>
<tr>
<td>Annoyed</td>
<td></td>
<td></td>
<td></td>
<td>.569</td>
</tr>
<tr>
<td>Aggressive</td>
<td></td>
<td></td>
<td></td>
<td>.553</td>
</tr>
</tbody>
</table>

3.8.1.2 Factor Analysis of Affective Items in the Atmosphere and Experience Questionnaire

The Phase 3 survey included 24 items as seven-point Likert scales based on primary emotions theory (Plutchik, 1980), as can be seen in the final questionnaire provided at Appendix Three. Visitors were asked to indicate whether the exhibition environment was likely to make them feel...

---

32 Each primary emotion was represented by three semantic variants in the Phase 2 pilot study but following additional piloting some items were adjusted. The relationship between the 24 items and the Plutchik primary emotions are as follows: Fear (Fearful, Anxious, Inhibited); Surprise (Surprise, Amazed, Fascinated); Acceptance (Agreeable, Patient, Calm); Disgust (Fed Up, Resentful, Disappointed); Anger (Angry, Annoyed, Frustrated); Sadness (Sad, Discouraged, Depressed); Anticipation (Interest, Inquisitive, Hopeful); Happiness (Happy, Delighted). The item Focused was included as a variant of Attentive, which is located near Happiness in Plutchik’s circumplex model but is not necessarily a semantic variant of happy.
each emotion more than in daily life, less than in daily life or whether the environment would have no effect. A score of four was set as a neutral response.

The eight primary emotions are intended to encompass the full gamut of emotions; not all of these are expected to be applicable in a museum context. To simplify the construct and create summated scales for use in further analyses, a factor analysis on the 24 items was conducted. Preliminary assessment of the data set indicated that it was suitable for factor analysis (Kaiser-Meyer-Olkin measure of sampling accuracy = 0.947; Bartlett’s test of sphericity significant at the p<0.0005 level). As the principal purpose of the factor analysis in this instance was data reduction rather than the identification of latent constructs, Principal Components Analysis (PCA) was the method used (Hair et al., 2010). The relative merits of PCA and Common Factor Analysis (such as Principal Axis Factoring or PAF) have been widely debated in the literature (Gorsuch, 1990; Hair et al., 2010; Snook & Gorsuch, 1989; Velicer & Jackson, 1990b). With larger datasets, the two methods tend to produce similar results (Velicer & Jackson, 1990a). In this instance, both PCA and PAF produced similar three-factor solutions.

Both eigenvalues and scree plot tests indicated that a three-component solution accounting for 59.78% of the total variance was the most appropriate. Significant cross-loadings observed using a Varimax rotation suggested that an oblique rotation, which allows the factors to be correlated, may be more appropriate (Hair et al., 2010). The resulting solution is shown in Table 3.12. Component 3 (see below) was reversed prior to labelling, allowing the construction of three summed scales for quantifying affective responses in an exhibition context:

- **Component 1: Displeasure** → Sad, Frustrated, Depressed, Fearful, Angry, Resentful, Discouraged, Disappointed. Most of the negative emotion terms loaded onto this factor, which included both high arousal items (e.g. Angry) and low arousal items (e.g. Depressed).
- **Component 2: Affective Engagement** → Surprised, Amazed, Interested, Fascinated, Delighted, Inquisitive, Focused, Agreeable. This factor includes the majority of the positive affect items, but mostly the high pleasure-high arousal items.
- **Component 3: Relaxation** → Calm, Patient, -(Anxious), -(Annoyed), -(Fed up). This factor combines negative loadings on two positive affect, low-arousal measures with positive loadings on two negative affect terms of mixed arousal levels. However in the context of the overall scores given on the measure, this grouping is considered to represent an overall

---

33The factor solutions were essentially identical when the item Inhibited was excluded. The low communalities associated with this item and observations made during fieldwork suggest that this term may have been poorly understood by participants and it was therefore omitted from the analysis.
positive affect with a lower level of arousal than the items loading on Component 2. To facilitate subsequent analysis and interpretation, the factor was reversed to align with the items having the strongest factor loadings (Calm and Patient).

*Happy* and *Hopeful* were excluded from the scale development since they loaded strongly on both Components 1 and 2.

*Table 3.12.* Pattern matrix of the three-factor solution for affective response (factor loadings below 0.4 are omitted).

<table>
<thead>
<tr>
<th></th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sad</td>
<td>-.902</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
<td>-.827</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed</td>
<td>-.814</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fearful</td>
<td>-.808</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angry</td>
<td>-.709</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resentful</td>
<td>-.707</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discouraged</td>
<td>-.694</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disappointed</td>
<td>-.633</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hopeful</td>
<td>.482</td>
<td>.429</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>.467</td>
<td>.454</td>
<td></td>
</tr>
<tr>
<td>Surprised</td>
<td>.844</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazed</td>
<td>.839</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interested</td>
<td>.770</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fascinated</td>
<td>.748</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delighted</td>
<td>.743</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inquisitive</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focused</td>
<td>.636</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agreeable</td>
<td>.419</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calm</td>
<td></td>
<td>-.731</td>
<td></td>
</tr>
<tr>
<td>Patient</td>
<td></td>
<td>-.569</td>
<td></td>
</tr>
<tr>
<td>Anxious</td>
<td></td>
<td>.555</td>
<td></td>
</tr>
<tr>
<td>Annoyed</td>
<td></td>
<td>.547</td>
<td></td>
</tr>
<tr>
<td>Fed Up</td>
<td></td>
<td>.462</td>
<td></td>
</tr>
</tbody>
</table>
### 3.8.1.3 Evaluation and Testing of Summated Scales

Summated scales for Displeasure, Affective Engagement and Relaxation were produced by taking the mean score of the individual items comprising each factor, reversing scores were necessary (Table 3.13). The mean of Displeasure was below the neutral score of 4, indicating that the exhibition environments decreased visitors’ overall level of Displeasure. By contrast, both Affective Engagement and Relaxation were above four, indicating that the exhibition environments made visitors feel more affectively engaged and more relaxed. The three scales were tested for satisfying the assumptions of normality and for scale reliability. Cronbach alpha scores for the scales were as follows: Displeasure = 0.918; Affective Engagement = 0.899; Relaxation = 0.793. These all exceed the accepted minimum threshold of 0.7 (Hair et al., 2010). None of the three affective response dimensions varied significantly by exhibition gallery, gender, age, visit purpose, visit history or visit group composition, as tested by analyses of variance (ANOVAs) and independent samples t-tests as appropriate.

*Table 3.13. Mean and Standard Deviation (SD) scores of the three summated scales for affective response.*

<table>
<thead>
<tr>
<th></th>
<th>Displeasure</th>
<th>Affective Engagement</th>
<th>Relaxation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.24</td>
<td>4.87</td>
<td>4.78</td>
</tr>
<tr>
<td>n</td>
<td>577</td>
<td>581</td>
<td>586</td>
</tr>
<tr>
<td>SD</td>
<td>1.04</td>
<td>.99</td>
<td>.95</td>
</tr>
</tbody>
</table>

Histograms of the composite variables were inspected visually to identify any unusual patterns in the distribution. This revealed a strong spike in the distribution of Displeasure at four, which represents a neutral score on a seven-item scale (Figure 3.8). Thus for around one third of respondents, the exhibition had no influence on the level of Displeasure they felt. The functional significance of this measure, that is, its ability to contribute to meaningful insights, may therefore be marginal.
3.8.2 Cognitive Responses: Scale Development

This study acknowledges the subjective nature of visitor experience and is more concerned with visitors’ own interpretations of their experience than any externally-defined measures such as acquisition of exhibition-based knowledge. Thus to develop suitable self-report measures of cognitive engagement, this study drew upon two theories from the literature: Packer’s Learning for Fun framework (Packer, 2006), based on the curiosity-driven exploratory behaviour of museum visitors, and Kaplan’s cognition-based framework for environmental preference (Kaplan, 1988b). The Learning for Fun criteria (a sense of discovery or fascination, appeal to multiple senses, availability of choice, and a sense of effortless engagement) are derived from visitors’ own descriptions of their experiences in museums. Kaplan’s concepts of coherence, legibility, complexity and mystery are more general concepts pertaining to how people appraise and make sense of different types of environments. These are compatible frameworks for considering how visitors physically and conceptually navigate the exhibition environment. According to Kaplan, environments can be considered primarily as information landscapes (Kaplan, 1987). Preferred environments are those that offer sufficient exploratory capacity to be of interest while being understandable enough to be navigated without excessive cognitive effort. Meanwhile, the Learning
for Fun criteria are based on the premise that visitors are inherently curious and derive satisfaction from having that curiosity satisfied in a seemingly effortless way.

The sense of discovery/fascination described by Packer in the museum context can be considered analogous to Kaplan’s “Exploration” constructs of Complexity and Mystery, which relate to the information richness of the scene both on initial appraisal and on further exploration. Similarly, the sense of effortlessness described by Packer could be related to Kaplan’s “Understanding” constructs of coherence and legibility. When an environment is legible and coherent, less cognitive effort is required to make sense of it. The relationships between Packer’s Learning for Fun criteria and Kaplan’s model of environmental preference are shown visually in Figure 3.9.

Discovery/Fascination and Effortlessness are considered to be analogous constructs common to both Kaplan’s and Packer’s model. In addition, Packer’s Availability of Choice is in some respects similar to Complexity as they both suggest variety of the environment. However, Availability of Choice implies a sense of autonomy about the environment that is not necessarily an element of Complexity. They are therefore kept separate in this representation.

![Diagram](image)

*Figure 3.9.* Diagrammatic representation of the combined model of cognitive engagement used in this study.
These concepts were represented by the following items in the Atmosphere and Experience Questionnaire. Visitors indicated their agreement with each statement on a seven-point Likert scale, ranging from Strongly Disagree (= 1) to Strongly Agree (= 7):

- *This exhibition’s design helps spark my interest* (Discovery/Fascination and Complexity)
- *This environment engages all my senses.* (Appeal to Multiple Senses)
- *I sometimes found myself so absorbed I lost track of time* (Effortless Engagement)
- *My attention was focused while in this exhibition* (Discovery/Fascination)
- *It takes a lot of effort to stay focused on this exhibition* (Effortless Engagement - reversed)
- *The exhibition provides enough options to choose from* (Availability of Choice)
- *This exhibition’s design and layout helps me make sense of what the exhibition is all about* (Legibility and Coherence)
- *This environment really invites me to explore it* (Mystery)
- *It’s hard to focus on one particular object or display because there is so much here* (Complexity without Coherence)
- *When looking around this exhibition, I’m not sure where to start or where to go next* (Legibility - reversed)
- *This exhibition is logically presented* (Coherence)

Preliminary analysis of responses to these statements showed strong correlations between the individual items. To simplify the construct and create more robust measures for cognitive engagement, a factor analysis was conducted in order to facilitate the construction of summated scales from the individual items. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.913 and Bartlett’s Test of Sphericity was statistically significant \((p<0.001)\), indicating the data set was suitable for factor analysis. As with the dimension reduction conducted on the affective measures, PCA with an oblique rotation was used. Both eigenvalues and screeplot indicated a two factor solution (Table 3.14).

Together, the statements grouped as Component 1 describe experiences that were judged to be able to attract and sustain visitors’ attention. This combined measure was thus denoted as “Cognitive Engagement” and a summated scale was created from the mean of these seven items accordingly. Cronbach alpha of these items was 0.890, which indicates very good scale reliability. The mean of the summated scale for Cognitive Engagement is 4.92 \((SD = 1.10)\). As four was the neutral point on the seven-point scale, this indicates an overall positive level of cognitive engagement.
Table 3.14. Pattern matrix for cognitive response measures.

<table>
<thead>
<tr>
<th></th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>This environment really invites me to explore it.</td>
<td>.846</td>
</tr>
<tr>
<td>I sometimes found myself so absorbed I lost track of time.</td>
<td>.826</td>
</tr>
<tr>
<td>This environment engages all my senses.</td>
<td>.821</td>
</tr>
<tr>
<td>This exhibition's design helps spark my interest.</td>
<td>.764</td>
</tr>
<tr>
<td>This exhibition provides enough options to choose from.</td>
<td>.761</td>
</tr>
<tr>
<td>My attention was focused while in this exhibition.</td>
<td>.694</td>
</tr>
<tr>
<td>This exhibition's design and layout help me make sense of what the exhibition is about.</td>
<td>.603</td>
</tr>
<tr>
<td>When looking around this exhibition, I'm not sure where to start or where to go next.</td>
<td></td>
</tr>
<tr>
<td>It's hard to focus on any one particular object or display because there is so much here.</td>
<td></td>
</tr>
<tr>
<td>It takes a lot of effort to stay focused on this exhibition.</td>
<td></td>
</tr>
<tr>
<td>This exhibition is logically presented.</td>
<td></td>
</tr>
</tbody>
</table>

The statements grouped in Component 2 describe an excessive amount of complexity, or at least complexity in the absence of a sufficient level of coherence to make it intelligible without what was perceived to be excessive cognitive effort. This was interpreted as “Cognitive Overload” and a summated scale was created from the mean of the four items. Cronbach alpha of this measure was 0.709 which indicates acceptable scale reliability. The mean of the summated scale of Cognitive Overload is 3.65 (SD = 1.14), indicating that on average visitors were on the negative side of neutral on this measure, i.e., they tended not to experience cognitive overload.

3.8.2.1 Evaluating and Testing of Summated Scales

As with the other summated scales developed in this study, levels of Cognitive Engagement and Cognitive Overload were compared across visitor types and exhibition galleries to determine whether there were any statistically significant differences. No significant differences based on gender, age, past history of visiting SA Museum or visiting group composition were identified\textsuperscript{34}.

\textsuperscript{34} Two of the ANOVAs were statistically significant: ANOVA of Cognitive Engagement by age group F(4,588) = 3.026, p = 0.017, and ANOVA of Cognitive Overload by Visit History F(2,590) = 3.090, p = 0.046. However Tukey HSD post hoc tests on both failed to reveal significant differences between groups after Bonferroni adjustment.
Comparing both Cognitive Engagement and Cognitive Overload by Visit Purpose using one-way ANOVAs showed statistically significant differences for Cognitive Engagement only: $F(5,588) = 4.59, p<0.001$, although an eta squared of 0.038 indicates a relatively small effect size. Summary statistics are shown in Table 3.15. Tukey post hoc tests demonstrated that Experience Seekers reported a significantly lower level of cognitive engagement than Professional/Hobbyists or Rechargers. The difference between Professional/Hobbyists and Facilitators was also significant in the post hoc tests. The overall pattern of Cognitive Engagement is as would be predicted by the identity model, supporting the criterion validity of the Cognitive Engagement scale (Streiner & Norman, 2008).

Table 3.15. Summary statistics of Cognitive Engagement by Visit Purpose.

<table>
<thead>
<tr>
<th>Visit Purpose</th>
<th>Identity Category</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To see things I have a particular interest in</td>
<td>Professionals/Hobbyists</td>
<td>5.21 (1.11)</td>
</tr>
<tr>
<td>To take time out from the stresses of daily life</td>
<td>Rechargers</td>
<td>5.20 (1.20)</td>
</tr>
<tr>
<td>To satisfy a general interest or curiosity</td>
<td>Explorers</td>
<td>4.93 (0.94)</td>
</tr>
<tr>
<td>To accompany my children/partner/friends</td>
<td>Facilitators</td>
<td>4.77 (1.06)</td>
</tr>
<tr>
<td>Because it is one of the city's main attractions</td>
<td>Experience Seekers</td>
<td>4.62 (1.19)</td>
</tr>
<tr>
<td>Multiple responses given</td>
<td></td>
<td>5.16 (1.18)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4.92 (1.10)</td>
</tr>
</tbody>
</table>

Since the primary focus of Facilitators is to support the experience of their companions, this may be related to a lower personal level of cognitive engagement. Similarly, Experience Seekers are generally more interested in seeing the highlights and getting a general overview than in deeper levels of engagement (Falk, 2009). By contrast, Professionals/Hobbyists consider themselves to be knowledgeable and have very specific visit goals (Falk, 2009), which may correspond to a higher reported level of cognitive engagement. Similarly, the higher level of cognitive engagement reported by Rechargers may be a function of the items that comprise the Cognitive Engagement
subscale, since they reflect the kind of effortless engagement that has been associated with restorative experiences (Kaplan & Kaplan, 2009; Packer & Bond, 2010)³⁵.

### 3.9 Research Approach: Conclusion

This chapter has described the study’s research philosophy as well as the overall approach to recruiting participants, data collection and instrument/scale refinement across all three phases of the study (Figure 3.5). Results from the Phase 1 study will be presented and discussed in detail in the next chapter. Phase 2 was an instrument development phase, from which the larger-scale Phase 3 study emerged. This Phase 3 study will be explored further in Chapter 5.

³⁵ It should be noted that visitors have been categorised into identity categories based on a single item only. Therefore, care should be taken when comparing these results with other examples in the literature where visitor identity has been defined on a more comprehensive basis (e.g. Falk, Heimlich, & Bronnenkant, 2008).
Chapter Four: Results and Discussion – Qualitative Exploration of Perceived Atmosphere

4.1 Introduction

This chapter presents the results of the Phase 1 qualitative study as described in Section 3.5, and discusses these results in light of existing theory and their implications for exhibition design practice. The purpose of the accompanied visits and subsequent debrief interviews was to explore how visitors perceive and describe different exhibition environments, with a view to informing the development of the Perceived Atmosphere Instrument. In addition, the transcripts can be considered a form of triangulation (Morse, 1991; Tracy, 2010) with the quantitative data that will be presented in Chapter 5. For the purposes of clarity, they are presented separately here.

For Phase 1 of the sequential mixed-methods study (Figure 3.5), interview recordings were transcribed by the researcher and then analysed using theoretical thematic analysis (Braun & Clarke, 2006). This approach is used when there is a theoretical interest in a particular aspect of the data and this guides the focus of the analysis. The areas of interest were descriptions of the exhibition environment and how exhibits were displayed, rather than how visitors described or interpreted specific content such as label text. As a part of the analysis process, selected excerpts from visitor transcripts were grouped under five main themes:

1. Orientation and Navigation
2. Spaciousness and Display Density
3. Design and Display Styles
4. Lighting
5. Colour.

Within each of these broad themes, several sub-themes emerged. The following sections will expand upon these themes and subthemes, illustrated by selected visitor quotations. Some words and phrases have been highlighted in bold to aid interpretation. At the end of each quotation, it is indicated whether it emerged during the think-aloud interviews (by naming the gallery in which it arose) or from the debriefing interview.
4.2 Orientation and Navigation

The think-aloud process offered a first-person insight into what strategies visitors used to make their way through an exhibition environment, what attracted their attention and what difficulties they experienced. Various aspects of Orientation and Navigation emerged during think-aloud interviews. These have been divided into six sub-themes, as shown in Figure 4.1.

Figure 4.1. Subthemes of Orientation and Navigation.

Several transcripts specifically included descriptions of navigational strategies or rationales for taking a specific route around the exhibition:

Now I’m faced with a bit of a . . . a choice to go into what looks like zones . . . (Jonathan, Aboriginal Gallery-G)

Just scanning along the whole lot, I’m looking for an interesting one. (Carol, Fossils Gallery)

So if we now head over as we start to walk back and see these middle things . . . (Angela, Pacific Gallery)
Might go round here there’s a large display in the middle of the room . . . (Geoff, Biodiversity Gallery)

In addition, there were instances where participants indicated they were looking for guidance during their visit, either from signage or maps:

OK I’d like to have a map, to get an idea of where to go . . . In the museum I’m usually following it. [laugh] (Robyn, Aboriginal Gallery-G)

Valerie: it’s very difficult to choose where you’re going to go from here. You almost need like directions about where you should be starting.

Lawrence: . . . Yeah this is very confusing. (Biodiversity Gallery)

. . .and I’m a little bit annoyed with myself for not picking up- This is the south east zone, so I’m thinking that might be south east.. of, South Australia, and now I’m checking out for other signs . . . (Jonathan, Aboriginal Gallery-G)

During the accompanied visits, some participants described how they had either deliberately skipped or inadvertently missed certain exhibit areas:

Always find museums really big, so, I get less tempted to, go back if I’ve missed something [R: mm-hmm] so, that’s how I’m feeling right now just to keep moving through the display rather than go back and miss- or go back revisit an area I’ve missed. (Philip, Biodiversity Gallery)

I didn’t even notice until I just looked up now which is probably supposed to be the main thing you see when you first walk in actually. (Rachel, Opal Fossils Gallery)

When visitors realised they had inadvertently missed displays, they usually continued on their planned trajectory and did not double back. This is a commonly observed visitor behaviour (Bitgood, 2006b, 2009a; Bourdeau & Chebat, 2001), and was also apparent in the visitor tracking studies (see Section 5.3.5).

Different aspects of the exhibit layout either helped or hindered participants’ navigation and enjoyment of the gallery. However, this was more commonly described in retrospect than during the visit itself, with the theme arising primarily during debrief interviews:

. . . the, Aboriginal Culture exhibit is more, it was set out a bit more, friendlier in a way. [R: In what way would you call it ‘friendly’?] It just looks nicer to look out like the way they’ve put the pieces together, and grouped them into certain orders. Like whereas the other one
Pacific] I’d see spears and then walk a bit further and more spears and, yeah that one I just, **I like the order it was, categorised** and yeah and just looks nicer to look through. (Natalie, during debrief)

. . . [Biodiversity] was really, it sort of, it led you round, and . . . was sort of easy to navigate in an orderly manner if that makes sense. . . It sort of just flows. (Carol, during debrief)

I found [Aboriginal Gallery-G] to be quite a dark area, and a windy [winding] area you can’t see, I guess where you need to go or where you might want to go, it’s a gallery to me that makes you wind around, which is probably intentional but, sometimes it’s nice to be able to see a big view and work out ‘yes I’m interested in one particular aspect I’m heading over there’, whereas you are forced to wander around, the Aboriginal gallery to find something. (Philip, during debrief)

I don’t think many people go in [Pacific Gallery] go ‘I want to look at every single object in there’, they want to be able to pick and choose . . . the fact **that room’s very open** gives you an opportunity to do that. (Sarah, during debrief)

It is noteworthy that in the above quotation, Natalie describes the orderliness of the exhibition as being a friendly characteristic of the space. This suggests a level of comfort and reassurance associated with order being present, at least for those visitors who seek it. This placing a sense of order on the world, or the reassertion of “ontological security” as it has been described, is one of the benefits that a visitor may derive from a museum visit: “a museum is like a convenience store where ontological security is neatly packaged up, ready to serve” (Rounds, 2006, p.140).

A recurring theme throughout the accompanied visits was participants describing how particular objects and features attracted their attention. This was frequently described in terms of being “caught” or “grabbed”, or conversely not feeling like anything particularly grabbed them:

*There is a big pelican display that **caught my attention** cause of the, the actual pelican is suspended from the roof of the display and the video behind it, um, I find that quite, um . . . adds a bit of movement . . .* (Geoff, Biodiversity Gallery)

. . .they were the two things that **caught my eye**, soon as I walked in, one the huge, hanging feature and the other the wall. Absolutely magnificent (Lawrence, Opal Fossils Gallery)

*Yeah, interesting display, but **nothing really grabs me** there I guess I’m kind of familiar with arid Australia . . . .* (Colin, Biodiversity Gallery)
. . . it grabs my attention because my Grandpa used to paint like that (Rachel, Pacific Gallery)

Another way attention capture was identified was in the use of words such as impressive and striking to describe exhibits:

It’s very, very impressive with the pelican and the lights and the sky behind it and . . . You can actually almost visualise that pelican flying over that. (Valerie, Biodiversity Gallery)

Title “King of Worms” is a bit striking . . . I might just go and read that a bit more and see what it says. . . (Bob, Fossils Gallery)

Figure 4.2. The pelican exhibit in the Biodiversity Gallery.

Attention has been described as a pivotal aspect of the visitor experience, with the implication being that managing visitor attention is the key challenge of exhibition design (Bitgood, 2013). In his attention-value model, Bitgood positions attention as the product of both the person and the setting, comprising a continuum of three stages: capture, focus and engage (Bitgood, 2013). The transcripts above show examples of visitors’ attention being captured, which piques their curiosity (focus) and then draws them in to investigate more closely (engage). This piquing and satisfying of curiosity has also been described by Rounds (2004) as hallmarks of the “foraging” behaviours that visitors
undertake during a museum visit. Furthermore, attention capture and engagement is analogous to the “resonating” process described by Roppola (2012). She describes resonance as the mechanism by which visitors feel drawn into physical, perceptual and cognitive relationship with exhibits. Resonant features of the exhibition environment can include “size, beauty, light, colour, movement, images and sound” (Roppola, 2012, p. 131). These properties are apparent in the pelican exhibit described by Geoff and Valerie above, which incorporates a taxidermied pelican specimen suspended in front a video backdrop evocative of the bird’s flight path (Figure 4.2). More broadly, attention is one of the mechanisms by which atmospherics is proposed to influence customer/visitor behaviour as described by Kotler (1974) and shown in the museum atmospherics model (Figure 2.9).

As a corollary of objects attracting attention, three participants described what could be considered signs of “object satiation” (Melton, 1935) after looking at multiple similar displays or within an exhibition area as a whole:

- . . . not really interested in this, not because it’s not interesting but because I’ve seen so many, minerals and I’m thinking oh I must have been looking at crystals and minerals for 5 or 10 minutes already . . . (Jonathan, Minerals Gallery)
- . . . and at this point I’m probably a bit bored of the display so I’ll probably move on. (Geoff, Biodiversity Gallery)
- . although we haven’t covered every square inch I think if I was wandering around normally I would probably head to another, area. (Philip, Pacific Gallery)

Together these quotations on the theme of Orientation and Navigation serve to illustrate how participants used both the physical cues of the environment and specific object displays to inform the way they moved through each exhibition space. Visiting strategies could be systematic, such as devising ways of covering an exhibition gallery systematically, or selective, for instance scanning areas for items of interest. Irrespective of the chosen strategy, both gallery layout and signage were generally seen as important facilitators. A sense of flow or order was desirable, although participants were also willing to be diverted by displays that they found particularly impressive or striking. However, interest in exhibits and displays waned over the course of a visit as object satiation set in.
4.3 Spaciousness and Display Density

The concept of spaciousness manifested itself in two main ways: the perceived spaciousness of exhibition galleries themselves, and the level to which exhibit displays were seen as either well-spaced or cluttered (Figure 4.3).

Environmental spaciousness was more commonly discussed in relative terms, particularly when comparing different exhibition galleries during the debrief interviews, for example:

. . . yeah that was a nice feeling in that [Opal Fossils] display area. [R: Yeah. OK in what ways would you call it ‘nice’?] Well, it felt more open less enclosed, you didn’t you didn’t feel you were in a cave you felt you were in an area where- you didn’t feel so constricted. (Philip, during debrief)

I like the one in the Aborigine culture the most it has, well it has the right, distance between the displays, um, that you’re comfortable if there’s someone standing in front of one you can comfortably walk around um, so I felt comfortable there, it was definitely too open in the Pacific one and then for some reason not enough room in the Biodiversity area. I felt, not that I felt, claustrophobic but it was, was sometimes a little bit, well not enough room in this section. (Robyn, during debrief)

Other comments were with respect to spaciousness were regarding display density, particularly within specific display cases.

The display looks very. . . very sparse, in terms of the, cabinet’s very clean and. . . I guess I’m just comparing it to some of the others displays like the, kangaroo scene behind us

Figure 4.3. Subthemes of Spaciousness.
which is more filled out in terms of the, the dirt goes right to the edges and um, it’s a lot bussier, er, whereas this one seems like, they’re not trying to, simulate the natural environment they’re just showing individual, items. (Geoff, Biodiversity Gallery)

. . . so I’m sort of skipping through a little bit, there’s a lot to see in each window so, you probably could spend a lot of time just looking though it is a sort of repetitive, display of, like a mass display I suppose so you don’t have to look forever. . . . (Rachel, Pacific Gallery)

That’s very cluttered, the, the wall to the left of us as we first went in here it’s very, very cluttered . . . (Lawrence, Pacific Gallery)

Well . . . well there’s just so much. I think- I get the sense I’m a bit overwhelmed by the sheer mass of stuff so I’m, I’m wanting to filter, filter down how much it’s impressing on me. (Colin, Pacific Gallery)

It’s an impressive, impressive display of shields though, I like that. . . . It’s given them, even though there’s a lot of shields there, they’ve been given space. . . visual space I quite like that. (Lawrence, Aboriginal Gallery-1)

Figure 4.4. A representative display case in the Pacific Gallery, showing large numbers of objects with minimal labelling.
The density of objects in display cases tended to inform the overall impressions that participants had of a space. Object-rich displays could be seen as cluttered and repetitive, particularly when no overall organising theme or structure was apparent (Figure 4.4). This could be considered an example of the fragmented channelling described by Roppola (2012), where complexity in the absence of coherence can inhibit engagement with displays.

4.4 Design and Display Styles

In contrast to barriers presented by exhibits perceived to be overly cluttered or repetitive, participants described how design features such as thematic organisation, a sense of physical proximity or a variety of display styles across a space could enhance their engagement. The themes that emerged as participants described and compared individual displays are summarised in Figure 4.5.

![Figure 4.5. Subthemes of Design and Display Styles.](image)

Participants favourably described display approaches that afforded physical proximity to objects rather than objects being “locked up” or “hidden” in display cases that put people at a distance (Figure 4.6):

That’s excellent. I li- you know this the fact that you’ve got, creatures hanging from the ceiling, [Valerie: mm] by fishing wire. Rather than locked up behind glass. (Lawrence, Opal Fossils Gallery)
Oh, it’s good that they’re not, that they don’t have to put them behind glass so that, people might, obviously you don’t want people but, you know you could, if you wanted to reach out and touch them. It’s still a bit, more interesting than, being all behind glass. (Carol, Fossils Gallery)

Actually I reckon the more screens and close up stuff and interactive stuff you could have the better. (Carol, Opal Fossils Gallery)

This one this seems to be a really old school traditional museum gallery, um, with, the objects behind glass there’s a big distance between you and the objects that you’re looking at. (Angela, Pacific Gallery)

![Figure 4.6. A view of the Opal Fossils gallery showing the overhead displays.](image)

In addition to proximity, a sense of three-dimensionality, such as making use of a range of heights to create texture and depth emerged. This can be related to Kaplan’s (1987, 1988) sense of environmental richness or complexity, which makes an environment more appealing to explore:

They’ve made it interesting by, the texture of the wall and the blocks coming out and you sort of, feel like some are a bit more *hidden*, and then some are sort of really *obvious* . . .

(Sarah, Fossils Gallery)
I like the way it’s got a bit of **depth** in it and it’s got a background landscape behind it, so it. . . gives more of an impression of the, the habitat, rather than just a blank wall and it’s um, it seems like a domed, um a domed wall behind there so you can see sort of get a **three-dimensional** effect from the sky down to the horizon . . . (Geoff, Biodiversity Gallery)

This is quite nice this **textural** display here sort of got, a recreation of an intertidal zone . . . yeah it’s a, it’s **inviting** to interact with it . .. (Colin, Biodiversity Gallery)

And it’s good how they’ve got this stuff on the walls, just useful for your **eye naturally goes up**, to that. (Carol, Fossils Gallery)

Such a sense of visual complexity and display diversity could be seen as a way of providing an entry point into a topic that may otherwise be seen as dull or uninteresting: “. . . the wall [in Fossils] is trying to break up what could be a very very dry topic . . .” (Sarah, during debrief).

Appreciation of complexity was enhanced when participants perceived a sense of balance and organisation in the display approach, a phenomenon described by Roppola (2012) as synchronous channelling:

[in Aboriginal Gallery] I thought there was a nice **balance** between the objects with the detailed captions if you wanted to read them um but otherwise those key organising panels of ‘Fire’ and ‘Drugs’ and those ones. I liked that they were **done thematically** and that it allowed you to work through and see various um aspects of the society in kind of an organised fashion. (Angela, during debrief)

And I always find there’s enough **balance of information** here that’s intelligent enough and just really great visual, visual stimulus just makes you want to look around all the time. (Sarah, during debrief)

. . . normally I- I find these bloody LCD screens wherever you go in public space you are confronted with these blasted LCD screens, it seems like they’re compelled to, to watch TV . . . normally I resent it but here it’s **unintrusive** and, it’s actually useful, it **integrates well** with the static display. (Colin, Biodiversity Gallery)

Another noteworthy entry point into subject matter was a sense of realism, which helped create a feeling of involvement, again reducing the perceived distance between visitor and display:

*And it’s good they’re getting there, there’s lots of, there seems to be, a drift towards putting things in an environment rather than in a case. In a box. Everything’s sort of grouped and*
certainly try and display them either like in a natural habitat or, with, environment as in the case of the fossils. (Carol, during debrief)

. . . like I said that display [in Biodiversity] that had the fish under the water and then the birds and there’s that three level, there’s an attempt there to put the things in a naturalistic context, whereas in the, Indigenous gallery and the Pacific Island gallery, they’re out of context there’s no, there is no context there. {Inaudible} it’s, basically you look at it dispassionately rather than engaging with it. (Bob, during debrief)

Participants frequently compared the highly traditional museum displays in Pacific with more modern exhibition styles used elsewhere in the museum. More so than with any other environmental feature, individual perspectives on this appeared to be strongly influenced by prior experiences and expectations, or participants’ museum frames (Roppola, 2012). Several participants made favourable associations between the traditional display environment and positive past experiences in the museum:

I’ve been coming to this room since I was a girl, and I was so glad when they renovated that they didn’t actually really change it very much . . . (Sarah, Pacific Gallery)

Despite saying that the [Pacific Gallery] sort of aged, I think I liked that one the best walking around cause, yeah just what I remember the museum being like more than anything. . . . I can remember going there for example on school excursion and it’s yeah it does look the same and has that sort of familiar smell. But, mostly I’m, I’m almost surprised I said that one because, like I like the modern look of the, of the last two but yeah that one is probably more of a comfortable space. (Natalie, during debrief)

I quite like that, traditional, traditional museum space . . . but there’s also, I mean, there’s also something kind of comforting? About that sort of old school museum approach . . . (Angela, during debrief)

Yeah sort of more of a historical way to display things that maybe you don’t see as much these days with more interactive stuff. But I think, I don’t know there’s something about it that um, the historical side of the way it’s displayed is also, interesting in itself just the display of it not the- I haven’t even looked at what’s in it yet [Laughs]. . . (Rachel, Pacific Gallery)

For these participants, the traditional displays of the Pacific Gallery conjured up feelings of comfort, familiarity and interest. It resonated with their previous experience and thus reinforced their “narrative of identity” (Rounds, 2006). In contrast, other participants without these fond
associations could find it off-putting, as encapsulated by this exchange in the Pacific Gallery between first-time visitor to SA Museum Lawrence and his wife Valerie:

Lawrence: Yeah it just looks like all the furniture is really old.
Valerie: Mmm. . . . It is [laughs] Probably the original furniture.
Lawrence: [laughs] That’s probably why it looks like it. Yeah, it is, yeah.
Valerie: In that it reminds you a bit of granny’s place. Like I’m walking into a granny’s place [Lawrence: Yeah, yeah] So I’m wonder if that-
Lawrence: [interrupts] With them old you know, sort of like the, the legs you know looking like a billiard table and just um looking old yeah.
Valerie: Maybe that puts you know children oﬀ because it does look old I don’t know.

There were also differing perspectives on the juxtaposition of traditional and modern display styles in the one gallery:

and when I first came through I was just blown away by it because they’ve mixed all the traditional with, with contemporary. (Sarah, Aboriginal Gallery-G)

The um, audio visual is . . . only having listened to it for a few minutes I mean obviously it’s a relatively contemporary video, , which is at odds with the exhibits which are, mostly fairly old I would guess. (Bob, Pacific Gallery)

During the debrief interviews, it emerged that one of the design features that conferred a sense of modernity was lighting:

. . . the openness, the use of 3D, oh sorry, the use of multimedia, and the presentation of some of the exhibits is, is a more contemporary feel to it like in that the fish gallery and the birds and that sort of stuff. And it’s more, naturalistic. (Bob, debrief)

R: You said [Aboriginal Gallery-G] looked more modern. What made it look more modern to you?
Natalie: I think it was sort of like the cabinet style and the glass and the lighting, and things like that. . . .
R: And what was it about the lighting that you thought made it look more modern?
Natalie: It lit up certain parts of the exhibit, and, just yeah, I’m not really sure what it was about the lighting I just sort of noticed, certain things were lit up, and yeah the focus around the room was darker overall. (during debrief)
4.5 Lighting

As described in Section 2.11, lighting works in concert with other environmental characteristics to help create an emergent or “molar” atmosphere (Quartier et al., 2008). In doing so, lighting can play an important role in setting the overall tone or mood of a space, although its effects can be subtle and may only be registered subconsciously. Nonetheless, reference to exhibition lighting did emerge spontaneously during the accompanied visits. In addition, participants were specifically requested to reflect on the lighting conditions of each space during the debrief interview. References to lighting are represented diagrammatically in Figure 4.7.

![Diagram of Lighting Subthemes]

**Figure 4.7.** Subthemes of Lighting.

With the exception of the Pacific Cultures Gallery, the exhibition galleries in SA Museum have little or no natural light. When natural light was present, several participants found it noteworthy, particularly in contrast to other exhibition areas. Natural lighting also enhanced a sense of spaciousness, in keeping with Stenglin’s theory that natural light serves to make spaces feel more unbound (Stenglin, 2004):

*I suppose it’s a really large airy room because it’s got the top, natural light coming in through the the louvers at the top this is one of the original part of the buildings.*
(Sarah, Pacific Gallery)

*but I like it that there is actually a little bit sunlight, natural sunlight, although I know it’s not good for the, objects [Me: mm-hmm] to have it. I still like it.*
(Robyn, Pacific Gallery)

*the clerestory double clerestory window, which, does give it a great sense of space.*
(Colin, Pacific Gallery)
I like that, I’m heading out, probably to a nice, stone and lit hallway too . . . (Jonathan, leaving Aboriginal Gallery and heading to lobby, a daylit area)

Whereas natural light was universally viewed as a positive feature, participants were divided on the way they responded to the lower light of exhibition galleries. For some participants, lower gallery lighting had a focusing effect, enhancing interest in the displays and possibly a heightened sense of mystery:

*I think the darkness leads you keep looking in each window one after another and just spending time with just that without being distracted, which is, which is really nice . . .*  
(Sarah, Biodiversity Gallery)

*And I think the darkness again helps you really focus on, the information . . .*  
(Sarah, Aboriginal Gallery-G)

*I like how there’s- it’s hard to see in here, it makes you want to step into the space, check it out . . .* (Jonathan, reconstructed hut in Mawson Gallery)

*I guess the first thing that occurs to me is that the space is really dark, so that all of the lit exhibits with their white background, light colours really tend to pop into what I’m noticing.*  
(Angela, Aboriginal Gallery-G)

*The lighting in the cases was really good, they were like well-lit and easy to read, um, yeah I, I don’t think you’d want really want bright light it’s good because again it draws you to the next case to the next case to the next case.*  
(Carol, debrief interview)

For these visitors, low gallery lighting was a feature, so long as the exhibits themselves were sufficiently well illuminated. However for other visitors, the low gallery lighting actively discouraged further exploration and engagement:

*But if I look past them, I look past the, the, atrium out to the, the again it’s incredibly dark it’s not, it’s not inviting me over there. It’s dark. . . .*(Lawrence, Aboriginal Gallery-1)

*And also is very dark. Almost like, the shop’s not open. . . The display cases are not dark where you’re wandering around is dark.*  
(Philip, Aboriginal Gallery-G)

*Um, it’s dark again. But I know . . . the objects the exhibits, they are sensitive to the light so it’s OK but a little bit more light would be nice.*  
(Robyn, Biodiversity Gallery)

*But it’s it’s so dark . . . it’s very oppressive you’ve got low ceilings which are dark in colour. . . so you feel like the roof’s sort of closing in on you.*  
(Lawrence, Biodiversity Gallery)
It doesn’t, **doesn’t encourage me to stay** in the area, the dark area . . . I can’t tell you how high the roof was, but the **darkness makes me think it was quite, a low area** as well.

*(Philip, debrief interview)*

These quotations also demonstrate that in contrast to the opening up or unbinding effect of natural light described above, low light had a binding effect. For some participants this provided a comfortable sense of enclosure, encouraging focus and exploration of displays. Other participants felt overly bound and thus oppressed or claustrophobic. This reflects Stenglin’s (2004) model of binding (Figure 2.2).

During the debriefing interviews, it emerged that the juxtaposition of different spaces and the order in which galleries were visited could influence how lightness and spaciousness of different areas were perceived.

. . .yeah, I mean [low lighting in in Aboriginal gallery was] not so much a problem, like at no time did I feel that I couldn’t see where I was going or, that I was frightened of the dark or anything [laugh] more that, maybe it’s because you go in from this big atrium kind of area where it’s very light and open and airy, and maybe there’s a just a **contrast between the two different spaces.** . . . so once I was in it, I didn’t notice it and it wasn’t a problem in any way, but definitely when I first walked in it was just an instant reaction of ‘wow, it’s much darker in here’ [R: sure] than it has been, where I’ve just been. *(Angela, debriefing interview)*

*I think if I went in the reverse order, I would have felt a bit more constricted down below [R: mm-hmmm] . . .but in the order that it was things were opening up, in a sense . . . *(Jonathan, debriefing interview)*

As observed by Stenglin (2004) at a range of museum buildings, rapid transitions between light, open spaces and darker, enclosed ones can be overwhelming. While there is no evidence from the interviews that participants in this study felt overwhelmed, there is support for the notion that juxtaposing very different kinds of spaces tends to magnify their impact on visitors. In some cases, this could be used to advantage to create a dramatic effect. In other cases, spatial transitions may need to be managed more gradually to avoid a sense of disorientation.
In addition to differences in lighting levels in general, participants recognised lighting as a design feature. Similarly to the three-dimensionality of displays described above, varied lighting was seen to create a sense of complexity and interest:

. . . noticing that a lot of the weapons that are backlit, as opposed to the weapons on my right here, that are, are not backlit, and are, transferently lit with some sort of a downlight. . . . together the contrast is what I like here . . . (Jonathan, Aboriginal Gallery-G)

There’s three rows of drawers here, very mysterious, with a spotlight on them, so. . . see I’ll open them . . . (Geoff, Biodiversity Gallery)

I think that the overriding impression I have is, how much, they’ve changed from what I recall the museum to be like you know a State Museum to be like, in that the lighting has changed to targeted lighting and that the displays, there’s clearly a lot more imagination going in to how to display things. (Colin, debrief interview)

4.6 Colour

Colour was mentioned by all participants, either through describing the colour of specific objects or commenting on how colour had been used as a design or interpretive feature (Figure 4.8). The colour of an object was frequently one of the features that caught the attention of participants, as described in the theme of Orientation and Navigation above:

. . . the text which, was the second thing I looked at, the colour was the first thing I noticed, berry-type red colour . . . and that’s what drew me over here, I’ve never seen that red, colour before, I really like it I like the, contrast it brings. (Jonathan, Aboriginal Gallery-G)

These big coral walls are amazing . . . Just all the detail and the colour which, the colour’s amazing. (Sarah, Biodiversity Gallery)

This one in particular which attracts me for its colourful, colourfulness. (Angela, Pacific)

I do like this one because it’s got all the coloured birds in, sort of, even though probably in real life don’t really look like that at all, but it, the colours probably do bring me looking through it a bit more. (Rachel, Biodiversity Gallery)
Colour was also credited with making text panels and objects more attractive:

*Oh that’s a nice bright information panel, I like that, the ‘Pacific Gallery since 1895’ . . . the text is bigger, and it’s also colourful . . . so that’s good I like that.* (Lawrence, Pacific)

*I like that, that lime-y sort of green that goes with it because that does help, highlight the actual art.* (Valerie, Pacific Gallery)

*I’m sort of thinking about how they’ve used different colours in the, display boxes cause it’s sort of, I think it’s a good idea cause it’s all sort of bland colours of fossils.* (Rachel, Opal Fossils Gallery)

Furthermore, participants recognised colour choices as reflecting the gallery’s interpretive intent or as being evocative of a particular environment (Figures 4.9):

*[T]he carpet, the carpet is . . . chosen I would suggest to harmonise with the {mussie} patterns, with the mulberry the mashed mulberry paper, the traditional sort of cultural statement of the Melanesian Polynesian Pacific people.* (Colin, Pacific Gallery)

*. . . and it didn’t occur to me at the time but I mean in retrospect that red colour kind of [Fossils Gallery] seems to connect to the area itself of the Flinders and that red, you know, coming out of that, so it seems to be quite complementary when I think about it, having been there.* (Angela, debrief interview)

*OK well I think my immediate thought was it’s all very blue . . . and it’s definitely the sea.* (Rachel, Opal Fossils Gallery)
I think it’s good that [Fossils Gallery is] a really strong colour because it’s very vibrant and it and it, it makes it [inaudible] really warm rich colour, and then the sense maybe that you’re actually on a cliff wall, that is like a cliff wall of where you might find things (Sarah, debrief interview)

Figure 4.9. A view of the Fossils Gallery showing the three-dimensionality of the display wall and the rich red background colour.

This recognition of the interpretive intent of colour is an example of colour working as an atmospheric “message” (Kotler, 1974). However, colour messages need to be fairly overt to be recognised and subtle changes in colour palette were easily missed. For instance in the Biodiversity Gallery, there are notionally four different colour schemes representing the four different ecological zones: arid, temperate forest, coastal and marine. However these differences are subtle, with the only marked transition being that between the marine environment and the other three (Figure 4.10). This transition, which is reinforced by an archway separating the marine gallery from the rest of the exhibition, was usually the only change that participants noticed:

Well I think there the colour scheme changed. So previously it was rather reddish, probably cause of the dioramas, but then afterwards it was all bluish. But I could not have seen the actually change from the desert to the forest area, there was nothing much of difference, to me. (Robyn, debrief interview)
In some cases the absence of colour in the gallery environment was noteworthy:

*It was all, it was all pretty neutral I thought, it was um, not only was it neutral, it was a bit, antiseptic? [R: Antiseptic, OK] Yeah, yeah. . . in the sense that, it wasn’t a space that was, yeah. It was neither welcoming nor, unwelcoming it was just, neutral. It didn’t have a particular feel to go with it.* (Bob, debrief interview, talking about the Aboriginal Gallery)

*Yeah it is gloomy. It doesn’t sort of, yeah. Doesn’t invite you to sort of you know, feel happy.* [Lawrence: Mmm] To me colour is inviting and happy. You know the more colour you got the happier, well you can’t be overwhelmed by colour but you need colour to, to work on somebody’s mood. (Valerie, debrief interview)

However, colour was not always an important definer of the look and feel of a space. When prompted in the debrief interview, some participants indicated that colour may only be noticeable when it somehow inappropriate:
I think [the lighting and colour schemes] must be good because I don’t really notice them, you know. . . (Sarah, debrief interview)

[the lighting and colour schemes must] have been pleasant because otherwise I probably would have commented on it. It’s OK. . . . (Robyn, debrief interview)

Targeted lighting means that, the wall tones are unobtrusive you don’t really notice it. (Colin, debrief interview)

4.7 Conclusions from Qualitative Research

The accompanied visits described in this section offer first-hand, real-time accounts of how visitors perceive exhibition environments and make sense of the spatial cues they find therein. Overall, the participant interviews reinforce the notion that the exhibition environment does have a considerable influence on the visitor experience. However, the salience of environmental cues differs between participants, a point that will be revisited later in this thesis (Section 5.4). Some participants described environmental and design cues in detail during the accompanied visits, whereas environmental features were only apparent to others upon reflection in the debrief interviews.

At the outset of this study, the relevant literature had suggested three main elements of Perceived Atmosphere: Design Appearance, Spatiality and Information Rate. These can be related to the themes that emerged from the transcripts: lighting is a facet of Design Appearance but can also influence perceptions of spaciousness; the visual complexity of different displays styles contributes to both Design Appearance and Information Rate; and navigational strategies are informed by both Spatiality and Information Rate. These conceptual relationships are shown visually in Figure 4.11.
In terms of the way visitors interpreted and responded to the exhibition environment, there was evidence of Kotler’s (1974) three processes of attention, message and affect, which form part of the Museum Atmospherics model presented in Figure 2.9. Attention capture was an important factor in how participants oriented and navigated through the space, as well as in choosing which exhibits to look at in greater detail. Participants also took specific messages from the exhibition atmosphere: some of these were interpretive messages, such as colour choices as described above; others were about how the museum was presenting itself as an institution and how this had changed over time:

That’s one of the things I notice about the new galleries or the remodelled galleries in the museum is the, addition of the multimedia . . . because, when I first went to visit museums probably when I was a kid in England, and museums were like libraries. You had to be quiet [laugh]. And not run, and all those sorts of things. (Bob, Biodiversity Gallery)

I think that the overriding impression I have is, how much, they’ve changed from what I recall the museum to be like . . . . in that the lighting has changed to targeted lighting and that the displays, there’s clearly a lot more imagination going in to how to display things and, that, it’s not as dry as it used to be . . . (Colin, during debrief)
Changes to the exhibition environment were interpreted as a message and also influenced participants on an affective level – for instance by promoting a feeling of being “refreshed”:  

[The change in environment between galleries was] noticeable I think and made you sort of ‘OK this is another exhibit’ and you’re sort of refreshed and like it’s something new.  
(Rachel, during debrief)

Thus the atmospheric cues of the exhibition environment communicated to participants on a variety of levels and influenced their behaviour.

4.7.1 Implications for Exhibition Design

Although the focus of this qualitative phase of research was primarily to inform the subsequent quantitative phases, the way participants described their perceptions of and responses to the exhibition environment suggest several implications for exhibition design:

- Visitors appreciate choice, but also like to be aware of the consequence of those choices. Signage and other visual cues can help ‘chunk up’ a space so that visitors can appraise from a distance what different areas of an exhibition are about, and how they fit together conceptually. Such cues can assist visitors in making choices and not feel like they’ve missed anything. Visitors looking for orientational cues tend to seek out high level signage\(^{36}\). Such signage can be provided throughout an exhibition without affecting the pathway of those visitors who seek to take a more serendipitous path.

- Objects should be labelled in a clear and consistent way so that visitors can find it readily. When an object attracts visitors’ attention, they seek out further information but will quickly lose interest if it is absent or otherwise difficult to find.

- Where practical, visitors should be given the opportunity to get close to objects, see them from a variety of angles and not feel like there are large barriers between themselves and the object.

- Lighting can be used to dramatic effect, but it can also be offputting to some visitors. Care should be taken in managing rapid transitions between light and dark spaces. Exhibits should be well lit irrespective of the ambient lighting, although visitors are understanding when conservation requirements necessitate low light levels.

\(^{36}\) This was also evident in the tracking study, where visitors were frequently observed to stop and look above and around at decision points in the gallery.
• Colour can be used to good effect for reinforcing interpretive content and for signposting how an exhibition is organised. However, subtle changes to the colour palette are easily missed, particularly if they are in a darker environment where colour changes will be less obvious.

Although based on a small sample size of only 13 participants, transcripts from these interviews add to the increasing body of qualitative research that points to the significance of the exhibition environment in the visitor experience (for instance Packer, 2014; Roppola, 2012; Schorch, 2013). The environmental cues that participants used to navigate and make sense of the exhibition environment are consistent with the concepts of resonating and channelling described by Roppola (2012). Furthermore the importance of spaciousness echoes the “spatial feeling” described by Schorch (2013), and the environmental themes of space, light and colour mirror the environmental cues Packer (2014) described as restorative. While this study has replicated these findings, few studies have attempted to study the role of the exhibition environment in a quantitative sense and it was for this reason that the Perceived Atmosphere Instrument described in Chapter 3 was developed. Results and implications of the quantitative study of atmosphere and experience are presented in the next chapter.
Chapter Five: Results and Discussion – Quantitative Analysis of Perceived Atmosphere and its Relationship with Visitor Experience

5.1 Introduction

The aim of this research was to explore how visitors perceive different museum exhibition environments and how this relates to their overall experience. The visitor experience is taken to comprise affective, cognitive and behavioural elements that have been measured by a combination of visitors’ self-report responses and observable behaviour as described in Chapter 3.

The research followed a three phase, sequential mixed-methods approach as described in Figure 3.5. This Chapter presents the Results and Discussion of the third and final phase of the study, which was conducted across four exhibition spaces in the SA Museum. It is divided into four sections. Section 5.2 describes how the Perceived Atmosphere Instrument used to identify the principal dimensions of Perceived Atmosphere in a museum setting. This section also describes the use of these dimensions to characterise the different exhibition environments used in the study. Section 5.3 describes the relationship between Perceived Atmosphere and visitor experience as measured through a range of self-report measures and observable behaviour. A specific subset of visitors that emerged in the study, the Environment Focused (EF) visitors, are discussed in Section 5.4. Finally, the overall findings and implications of the Phase 3 study are briefly summarised in Section 5.5.

5.2 Visitors’ Perceptions of the Exhibition Environment

One of the principal goals of this study was to quantify how visitors perceive different exhibition environments so that this could be related to other aspects of the museum visitor experience. Accordingly, a Perceived Atmosphere Instrument was developed and piloted as described in Section 3.6. This section will describe the use of this instrument and identify the principal characteristics of Perceived Atmosphere.

5.2.1 Factor Analysis of Atmospheric Descriptors

To determine the underlying dimensions of Perceived Atmosphere, a factor analysis was conducted on the 30 Perceived Atmosphere items (seven-point semantic differential scales). First, the raw data was screened to ensure suitability for factor analysis. A sample size of 602 allows up to 20 observations per variable for 30 variables, comfortably exceeding the minimum recommended sample size of 10 observations per variable for a robust factor analysis (Hair et al., 2010; Pallant,
Bartlett’s Test of Sphericity was significant at the p<0.005 level, indicating significant correlations between at least some of the variables. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.853, suggesting a strong level of intercorrelation. Together these tests show that the data set is suitable for factor analysis (Hair et al., 2010).

As the main purpose of the factor analysis was to identify latent constructs represented by the original variables, Principal Axis Factoring was the method chosen (Hair et al., 2010). The scree test criterion (Hair et al., 2010; Pallant, 2010) was then used to determine the number of factors to extract, indicating a four-factor solution. To aid in interpretation of the four factors, a Varimax orthogonal rotation was used, as this rotation method tends to produce the clearest separation of factors (Hair et al., 2010). The rotated factor matrix is shown in Table 5.1. Of the 30 items in the Perceived Atmosphere Instrument, 22 loaded onto one of the four factors with a loading of at least 0.4, which was taken as the cut-off point for a meaningful factor loading (Ford, MacCallum, & Tait, 1986; Pallant, 2010).

The four factors have been interpreted as follows and are taken to be principal dimensions of Perceived Atmosphere in an exhibition context:

- **Factor 1: Vibrancy** → Dramatic, Active, Vibrant, Striking, Dynamic, Colourful, Energetic, Three Dimensional
- **Factor 2: Spatiality** → Wide, Spacious, Open, Uncluttered
- **Factor 3: Theatricality** → Winding, Modern, Asymmetrical, Targeted Lighting, Dark, New
- **Factor 4: Order** → Ordered, Organised, Structured, Flowing.

---

37 The four factors accounted for 42.13% of the variance when the analysis was recalculated using only the 22 items with significant factor loadings. A factor solution accounting for less than half of the variance is relatively low, although it should be noted that in common factor analysis a positive bias in these estimates is less likely than it is with principal components analysis (Widaman, 1990). In any case, confirmatory factor analysis with a different data set would address the validity of this factor solution.

38 Hair et al. (2010) observe that there are no hard-and-fast rules for selecting an orthogonal or oblique rotational technique, as both have advantages and disadvantages. In this instance, the items loading on each factor were almost identical for both orthogonal (Varimax) and oblique (direct oblimin) rotations. Such an outcome is common when there is an unambiguous pattern of correlations among the items (Pallant, 2010).
Table 5.1. Four factor solution for Perceived Atmosphere (for ease of interpretation, factor loadings below 0.4 are omitted).

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dramatic-Plain</td>
<td>.719</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active-Passive</td>
<td>.712</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibrant-Dull</td>
<td>.705</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary-Striking</td>
<td>-.597</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic-Static</td>
<td>.583</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colourful-Neutral</td>
<td>.572</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energetic-Serene</td>
<td>.515</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat-Three-Dimensional</td>
<td>-.442</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varied-Repetitive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subdued-Bright</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cosy-Formal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple-Complex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Scale-Large Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wide-Narrow</td>
<td>.704</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacious-Confined</td>
<td>.672</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-Enclosed</td>
<td>.509</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluttered-Uncluttered</td>
<td>-.462</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hidden-Obvious</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear-Winding</td>
<td>.584</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional-Modern</td>
<td>.545</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symmetrical-Asymmetrical</td>
<td>.538</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evenly Lit-Targeted Lighting</td>
<td>.518</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark-Light</td>
<td>-.498</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old-New</td>
<td>.473</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm-Cool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard-Soft</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordered-Jumbled</td>
<td></td>
<td></td>
<td></td>
<td>.777</td>
</tr>
<tr>
<td>Organised-Random</td>
<td></td>
<td></td>
<td></td>
<td>.622</td>
</tr>
<tr>
<td>Structured-Unstructured</td>
<td></td>
<td></td>
<td></td>
<td>.524</td>
</tr>
<tr>
<td>Flowing-Discontinuous</td>
<td></td>
<td></td>
<td></td>
<td>.454</td>
</tr>
</tbody>
</table>
These factors are distinct from those identified elsewhere, although there are parallels with the previous studies that informed this research. For instance Vibrancy could be considered analogous to the liveliness dimension that emerged in the retail context (Vogels, 2008b) or the activity factor originally identified by Osgood et al. (Osgood et al., 1957) and replicated in colour research (Gao & Xin, 2006; Kuo, 2007; Ou et al., 2004a; Sato et al., 2000). Spatiality (or perceived enclosure) and Order (encompassing legibility and coherence) are factors that have previously been shown to be important predictors in environmental cognition and preference studies (Kaplan, 1988b; Stamps, 2012). The relationship between these four factors and the hypothesised atmospheric variables of Design Appearance, Spatiality and Information rate is shown in Figure 5.1. The Spatiality factor is essentially the same as the hypothesised Spatiality variable. Vibrancy is similar to Design Appearance, in the sense that it conjures up a general mood of a space, but also includes some items such as Three Dimensional that were predicted to be a part of Information Rate. Order represents some aspects of Information Rate, particularly legibility and coherence, although does not encompass the visual complexity items, which loaded onto Theatricality. Theatricality also includes some Design Appearance variables, such as Modern, although overall this factor is difficult to interpret in light of existing theory, as discussed below.

Although there are similarities between these four factors and the four-factor solution that emerged from the pilot, there are also differences with respect to the factors extracted and the specific items loading on them (refer to Section 3.6.1 for the factor analysis of the pilot sample). Such differences are to be anticipated: the sample size of the pilot ($N = 172$ with 24 atmosphere items in the pilot survey) translates to approximately seven observations per item, which is at the lower level of acceptability for a meaningful factor analysis. Normally, five observations per variable is considered the bare minimum and at least 10 observations per variable is usually necessary to produce a factor solution that will be generalisable beyond a particular data set (Hair et al., 2010; Pallant, 2010). In previous studies of this nature (Vogels, 2008a, 2008b), larger sample sizes have led to the emergence of additional factors. However, one notable difference between this sample and the pilot is that lighting items (Targeted Lighting, Dark) no longer load onto Spatiality and instead load onto Theatricality.
Compared to the other three factors, Theatricality is difficult to interpret in light of previous research. It is a diverse grouping of items, comprising modernity as well as variety in both lighting and layout. Symmetrical-Asymmetrical has been previously shown to be an indicator of Information Rate (Mehrabian & Russell, 1974a) and Linear-Winding was included in the instrument as a prospective measure of Mystery (Franz & Wiener, 2008; Kaplan, 1988a). Information Rate was anticipated to include elements of novelty, mystery and complexity at the commencement of this study. However, other items that were prospective indicators of Information Rate such as complexity (Simple-Complex) and variety (Varied-Repetitive) did not load strongly onto this or any other factor. Theatricality thus seems conceptually distinct from the theoretical construct of Information Rate. One possibility is that this grouping of items is a particular feature of the exhibition galleries used in the study, in which the newer galleries happen to have a more complex layout and are more theatrically lit. This may also account for the loading of lighting items onto the Theatricality factor here in comparison to the pilot study, where they loaded onto Spatiality. It is worth noting that the pilot sample included two galleries with relatively high light levels: one very traditional in design (Pacific) and the other contemporary (Wild! Gallery); whereas Pacific was the only gallery with appreciable natural light levels in the main study. Including lighting as an aspect of Spatiality would be consistent with other research that suggests lighting distribution affects perceptions of spaciousness (Wänström Lindh, 2013). Further use of the Perceived Atmosphere
Instrument across a wider range of exhibition environments will be required to validate or otherwise resolve the Theatricality factor, however this is beyond the scope of this project.

In preparation for subsequent analyses, summated scales representing each factor were produced by taking the mean score of the individual items, reversing item scores where necessary. These scales were tested for satisfying the assumptions of normality and for scale reliability. Cronbach alpha scores for the scales were as follows: Vibrancy = 0.839; Spatiality = 0.702; Theatricality = 0.684; Order = 0.783. A Cronbach alpha score of 0.7 is generally agreed as the lower limit for scale reliability, however scores exceeding 0.6 are deemed permissible in exploratory research (Hair et al., 2010). On this basis, the summated scale for Theatricality was retained for use in subsequent analyses.

5.2.1.1 Relating Environmental Description to Environmental Judgement

One aim of the Perceived Atmosphere Instrument is to allow research to go beyond previous studies that have determined that visitors have more pleasant experiences in environments they deem to have good environmental characteristics (e.g. Bonn, Joseph-Mathews, Dai, Hayes, & Cave, 2007). Thus the semantic differentials used in the Perceived Atmosphere Instrument are intended to be more descriptive than evaluative, allowing a more detailed examination of what environmental qualities are the most important predictors of a good exhibition environment. In order to compare the relationship between Perceived Atmosphere and general perceptions of “pleasantness”, visitors were asked two evaluative questions as seven-point Likert scales ranging from Strongly Disagree (= 1) to Strongly Agree (= 7):

- **It is enjoyable to spend time in this environment**
- **I had a worthwhile experience in this exhibition**

These two evaluative judgements of the exhibition were compared to the four atmospheric perception dimensions using bivariate correlations (Table 5.2).

---

39 Summated scales were selected in preference to factor scores as summated scales are more interpretable and replicable across multiple data sets (Hair et al., 2010).
Table 5.2. Bivariate correlations between Perceived Atmosphere and evaluative judgements. ** denotes that correlation is significant at the 0.01 level (2-tailed).

<table>
<thead>
<tr>
<th></th>
<th>It is enjoyable to spend time in this environment</th>
<th>I had a worthwhile experience in this exhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pearson Correlation</strong></td>
<td>.54**</td>
<td>.47**</td>
</tr>
<tr>
<td><strong>Sig. (2-tailed)</strong></td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>n =</strong></td>
<td>565</td>
<td>564</td>
</tr>
</tbody>
</table>

| **Vibrancy** | **Pearson Correlation** | .02                                      | .06                                      |
|              | **Sig. (2-tailed)**     | .679                                    | .148                                    |
|              | **n =**                 | 562                                    | 560                                    |

| **Spatiality** | **Pearson Correlation** | .30**                                    | .26**                                    |
|                | **Sig. (2-tailed)**     | <.001                                   | <.001                                   |
|                | **n =**                 | 580                                    | 578                                    |

| **Order**      | **Pearson Correlation** | .35**                                    | .32**                                    |
|                | **Sig. (2-tailed)**     | <.001                                   | <.001                                   |
|                | **n =**                 | 582                                    | 580                                    |

The strongest correlation was between perceptions of Vibrancy and deeming an environment enjoyable to spend time in ($r = 0.54, p < 0.001$). In addition, there were moderate correlations between Spatiality and Order and the evaluative judgements. By contrast, perceptions of Theatricality were unrelated to either measure. Taken together, these results show that the Perceived Atmosphere Instrument offers a characterisation of the environment that is more nuanced than a simple evaluative judgement. Of the four atmospheric dimensions, it appears that Vibrancy is the environmental quality that is most likely to make an environment feel enjoyable and conducive to a worthwhile experience. This relationship between Vibrancy and experience will be explored in greater depth throughout this chapter.
5.2.1.2 Atmospheric Perceptions by Visitor Type

Although no demographic differences in Perceived Atmosphere were hypothesised, it is possible that different types of visitors differ in the way they perceive environments according to the Perceived Atmosphere dimensions. Such differences would be of theoretical interest, however, they may reduce the practical utility of the Perceived Atmosphere Instrument to distinguish between different exhibition environments, since effects of the exhibition environment may be confounded with differences between visitors. Atmospheric perceptions were therefore compared across different demographic characteristics to identify any characteristics that may act as confounders.

Comparison by Gender

Males and females were compared using independent samples t-tests (Table 5.3). No significant differences were found between males and females, except on perceptions of Spatiality, where females gave higher mean ratings than males. The theoretical and functional significance of this finding is unclear. A gender-wise comparison of Spatiality across galleries showed that the mean Spatiality score was consistently higher for females, although the differences were only statistically significant for Pacific and Biodiversity (\( p = 0.046 \) and \( p = 0.001 \) respectively). Thus it is possible that this represents a Type 1 error, the assignation of statistical significance to a chance variation (Pallant, 2010).

A two-way ANOVA revealed no interaction between Gender and Gallery, although Gallery and Gender each had a significant main effect on perceptions of Spatiality at the \( p<0.001 \) level. The effect sizes of each independent variable was comparable (partial \( \eta^2 = 0.033 \) and 0.030 for Gallery and Gender respectively). Gender differences in various aspects of spatial perception have been documented previously (McGee, 1979), and it is possible that this difference is a manifestation of this phenomenon. However, this finding would need to be replicated in order to warrant further detailed investigation.
Table 5.3. Statistical comparison of Perceived Atmosphere by gender.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>t-tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vibrancy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>4.29 (0.96)</td>
<td>$t(560) = -1.040, p = 0.299$</td>
</tr>
<tr>
<td>Females</td>
<td>4.38 (1.04)</td>
<td></td>
</tr>
<tr>
<td><strong>Spatiality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>4.84 (1.01)</td>
<td>$t(576) = -4.334, p &lt; 0.001$</td>
</tr>
<tr>
<td>Females</td>
<td>5.2 (0.99)</td>
<td></td>
</tr>
<tr>
<td><strong>Order</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>5.11 (0.96)</td>
<td>$t(577) = -1.548, p = 0.122$</td>
</tr>
<tr>
<td>Females</td>
<td>5.25 (1.07)</td>
<td></td>
</tr>
<tr>
<td><strong>Theatricality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>4.05 (0.89)</td>
<td>$t(555.83) = -1.109, p = 0.268$</td>
</tr>
<tr>
<td>Females</td>
<td>4.14 (1.0)</td>
<td></td>
</tr>
</tbody>
</table>

Comparison by Age

Atmospheric perceptions were similarly compared across the five age categories (18-29, 30-39, 40-49, 50-59, 60+), using one-way between-groups ANOVA. A Pearson chi squared test of independence indicated no statistically significant association between Age Group and Gallery. No differences between age groups were found in their perceptions of Spatiality, Theatricality or Order. However, comparison of Vibrancy perceptions by age group was statistically significant; $F(4, 557) = 3.409, p = 0.009$. Post hoc Tukey HSD tests revealed statistically significant differences between the following age groups:

- 18-29 and 60+  ($p = 0.025$)
- 30-39 and 60+  ($p = 0.027$)

Although these are the only statistically significant differences, a means plot of Vibrancy by Age Group shows that perceptions of Vibrancy generally increase with age (Figure 5.2). This suggests that older visitors are likely to perceive a given space as more Vibrant than younger visitors. It is possible that this is a function of expectations (older visitors having a lower threshold for what they would deem to be “vibrant” or “active” in a museum setting), or broader differences in the way older people perceive a given set of sensory stimuli. A two-way ANOVA confirmed there was no interaction between Gallery and Age Group, and that the main effect size of Gallery was larger than that for Age Group (partial $\eta^2 = 0.085$ and 0.024 respectively). Thus the effect size of Age Group on perceptions of Vibrancy is relatively small and unlikely to have functional significance.
Comparison by Visit Group, Visit Purpose, Visit History

Participants’ history of visiting the museum (First Time Visitors cf. Irregular Visitors cf. Regular Visitors) had no statistically significant relationship with Perceived Atmosphere. Similarly there were no statistically significant differences between solo visitors, visitors in couples/adult groups or family visitors.

To test whether the purpose of visiting the museum influenced Perceived Atmosphere, one-way ANOVAs were conducted using self-reported visitor identity (Falk, 2009) as an independent variable. This showed no statistically significant difference in perceptions of Vibrancy, Spatiality or Order. There was a borderline significant result for Theatricality; \( F(5,554) = 2.260, p = 0.047 \), although post-hoc tests showed no between-groups differences that were significant at the 0.05 level after Bonferroni adjustment for multiple comparisons (Vogt & Johnson, 2011).

5.2.1.3 Summary of Perceived Atmosphere Dimensions

Factor analysis of the 30 items on the Perceived Atmosphere Instrument produced four clear factors, which have been characterised as Vibrancy, Spatiality, Order and Theatricality. When these items are converted to summated scales, they appear to produce robust measures of Perceived Atmosphere that are not affected by visitors’ visit purpose or visit history, and only marginally by gender and age. As visitor characteristics do not appear to be serious confounders, the four factors of Perceived Atmosphere are good candidate variables for being able to quantify and distinguish

*Figure 5.2. Means plot of Vibrancy by age group.*
between perceptions of distinct exhibition environments. This will be explored in the following section.

### 5.2.2 Characterising Exhibition Environments using Perceived Atmosphere

For the dimensions of Vibrancy, Spatiality, Order and Theatricality to have practical significance, they must be able to distinguish between different exhibition environments in meaningful ways. The exhibition galleries used in this study were specifically chosen on the basis of differences in their design and layout. Thus, to determine the utility of the Perceived Atmosphere dimensions in characterising these distinct environments, this section compares the Vibrancy, Spatiality, Order and Theatricality scores of each space and briefly interprets the results.

Mean scores for the Perceived Atmosphere dimensions in each gallery are shown in Table 5.4. Figure 5.3. The differences between the galleries were tested for significance using ANOVA and, where applicable, Tukey HSD post-hoc tests. These results are shown in Table 5.5. Eta squared ($\eta^2$) scores show that Exhibition Gallery accounts for nearly 10% of the variance in Vibrancy, a moderate effect size, whereas the 3% of variance explained in Spatiality indicates a relatively weak effect size. Exhibition Gallery accounts for 36% of the variance in Theatricality; this is considered a very strong effect size for the social sciences (Pallant, 2010) and is a further indication that this dimension may be a particular feature of the exhibition galleries used in this study.

**Table 5.4**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Exhibition Gallery</th>
<th>Aboriginal</th>
<th>Pacific</th>
<th>Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrancy</td>
<td>0.85</td>
<td>0.72</td>
<td>0.58</td>
<td>0.68</td>
</tr>
<tr>
<td>Spatiality</td>
<td>0.45</td>
<td>0.40</td>
<td>0.38</td>
<td>0.35</td>
</tr>
<tr>
<td>Order</td>
<td>0.58</td>
<td>0.54</td>
<td>0.53</td>
<td>0.52</td>
</tr>
<tr>
<td>Theatricality</td>
<td>1.20</td>
<td>1.15</td>
<td>1.10</td>
<td>1.05</td>
</tr>
</tbody>
</table>

**Figure 5.3.** Visual comparison between the Vibrancy, Spatiality, Order and Theatricality measures for each gallery. (For illustrative purposes, data has been recoded such that zero is equivalent to the neutral point, that is, a score of four on a seven-point scale).
Table 5.4. Summary descriptive statistics of the Perceived Atmosphere dimensions.

<table>
<thead>
<tr>
<th>Gallery</th>
<th>Mean</th>
<th>Spatiality</th>
<th>Order</th>
<th>Vibrancy</th>
<th>Theatricality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal-G</td>
<td></td>
<td>4.97</td>
<td>5.10</td>
<td>4.21</td>
<td>4.42</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>1.09</td>
<td>1.05</td>
<td>.98</td>
<td>.83</td>
</tr>
<tr>
<td>Aboriginal-1</td>
<td></td>
<td>5.23</td>
<td>5.15</td>
<td>4.35</td>
<td>4.37</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>.90</td>
<td>1.03</td>
<td>.92</td>
<td>.82</td>
</tr>
<tr>
<td>Pacific</td>
<td></td>
<td>5.09</td>
<td>5.27</td>
<td>3.95</td>
<td>3.18</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>.96</td>
<td>.95</td>
<td>.99</td>
<td>.68</td>
</tr>
<tr>
<td>Biodiversity</td>
<td></td>
<td>4.78</td>
<td>5.17</td>
<td>4.79</td>
<td>4.56</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>1.09</td>
<td>1.06</td>
<td>.94</td>
<td>.73</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5.02</td>
<td>5.18</td>
<td>4.33</td>
<td>4.10</td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td>1.01</td>
<td>1.02</td>
<td>1.00</td>
<td>.95</td>
</tr>
</tbody>
</table>

Table 5.5. Statistical comparisons of Perceived Atmosphere between different exhibition galleries.

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>$\eta^2$</th>
<th>Significant between-gallery differences (Tukey’s HSD)</th>
</tr>
</thead>
</table>
| Vibrancy $F(3, 562) = 20.38, p < 0.001$ | 0.098 | Pacific < Aboriginal-1, $p = 0.001$  
Aboriginal-1 & Aboriginal-G < Biodiversity, $p < 0.001$  
Pacific < Biodiversity, $p < 0.001$ |
| Spatiality $F(3, 577) = 5.85, p = 0.001$ | 0.03 | Biodiversity < Aboriginal-1, $p < 0.001$  
Biodiversity < Pacific, $p = 0.032$ |
| Order $F(3, 579) = 0.65, p = 0.583$ | N/A | N/A |
| Theatricality $F(3, 559) = 104.89, p < 0.001$ | 0.36 | Pacific < all others, $p < 0.001$ |
The measured differences in Perceived Atmosphere are interpretable in light of the observed physical characteristics of each exhibition space:

- **Biodiversity Gallery** is the newest gallery (opened 2010) and the only one to use colour to delineate between different zones of the exhibition, albeit using a subtle palette. This may contribute to the relatively high Vibrancy score. Another factor could be the subject matter – animal displays may be seen as inherently more “active” than ethnographic ones. Biodiversity was perceived as the least spacious gallery; this may be due to its long and relatively circuitous layout (it is the only exhibition in the study that does not offer a single vantage point covering the entire length of the space).

- **Pacific Gallery** is highly traditional in style, principally comprising refurbished 19th century display cases. It is also the only exhibition to have appreciable levels of natural light and limited use of display lighting. Together these features are reflected in the low Theatricality score – the mean of 3.18 is below the score of four which represents neutral on a seven-point semantic differential scale. The display style is similar across the entire gallery, with densely packed display cases and minimal object labelling. While the colour palette used in the backgrounds of the wall cases alternates between shades of green, pink and terracotta, the general impression of the gallery is one of neutral shades. These characteristics appear to have culminated in a low Vibrancy score, with the mean of 3.95 being just below the neutral score of four.

- **Aboriginal Gallery** is an exhibition spanning two floors of the museum. As there is no direct access between the two floors from within the exhibition, they have been treated as two independent exhibition environments in this study (Aboriginal-G and Aboriginal-1). The two spaces are of comparable size with one floor being directly above the other. The display style of the respective floors is essentially the same, using thematic and geographical groupings of objects and interpretive labels. The display cases and graphics have a limited colour palette. It was thus anticipated that the two galleries should produce comparable ratings on each of the atmospheric dimensions, with the possible exception of Spatiality (the ground floor has a lower ceiling height than the first floor, a feature that may have affected perceptions of spaciousness). Comparisons of the two galleries by independent samples t-test did show statistically a significant difference on perceptions of Spatiality, \( t(263) = 2.101, p = 0.037 \), with Aboriginal-G being perceived as the less spacious gallery as hypothesised. However, when all four galleries were compared using ANOVA, there was no statistically significant difference between Aboriginal-G and Aboriginal-1 in the Tukey post hoc tests. Tukey’s HSD incorporates a Bonferroni adjustment of the alpha level to take

\[40\]
Aboriginal-G was not originally planned to form part of this phase of the study, although a sample of N = 102 responses was subsequently collected from this gallery specifically to test this hypothesis.
into account multiple comparisons (Vogt & Johnson, 2011) and by this more stringent criterion statistical significance was lost. There were no other statistically significant differences between the two Aboriginal Gallery floors.

Considering Spatiality more generally, some of the reported differences between galleries were slightly different from what may have been anticipated based on the galleries’ physical characteristics. The Pacific Gallery has the highest ceiling clearance of any of the exhibition spaces and has the highest ambient light levels, properties that were both hypothesised to increase the gallery’s perceived spaciousness (Custers et al., 2010; Mahnke & Mahnke, 1987). Furthermore, the majority of the displays in the exhibition are wall-mounted, with the majority of showcases in the centre of the room being at tabletop level (the Pacific Gallery functions as an event space out of hours, hence the relatively low density of displays in the middle of the room). This means the full extent of the gallery is within line-of-sight from most parts of the room. Despite this, there was no statistically significant difference between perceptions of spaciousness between Pacific and Aboriginal-1, an exhibition with a lower ceiling clearance (comparable to that in Biodiversity but not as low as that in Aboriginal-G) and more full-height displays in the centre of the exhibition. However, the juxtaposition of these full-height displays is such that Aboriginal-1 still allows views along almost the full length of the gallery along a central axis. Thus it is possible that the presence of these long vistas, or larger isovists (Franz & Wiener, 2008) contributes more to a sense of spaciousness than ceiling clearance. It should also be noted that Aboriginal-1 has a floor cut-out that overlooks a part of Aboriginal-G, and so another possibility is that this vista enhances the sense of space.

Studies into the relative importance of horizontal expanse and ceiling height in conferring a sense of spaciousness have yielded conflicting results (Lin, 2004; Stamps, 2010). Given these mixed results, spaciousness may be better understood in terms of the ecological concept of affordances (Gibson, 1977). In contrast to physical parameters of an environment, affordances pertain to environmental properties in relation to a perceiver: We perceive features of the environment in terms of what actions they afford us. For instance, while benches, chairs, stools and sofas all vary in physical characteristics, they share the common affordance of sitting (Gibson, 1977). Whereas the full range of affordances is always present in an environment or an object, the particular affordances that are perceived are situation-dependent: Different needs lead to the perception of different affordances (Gibson, 1977).

While it follows that Aboriginal-1 is also visible from Aboriginal-G, the positioning of objects within the void space between the two galleries makes the ceiling cut-out a less prominent feature in Aboriginal-G.
Recent experimental evidence supports the notion that limiting the behavioural affordances of an environment reduces perceptions of spaciousness without changing its physical properties (Meagher & Marsh, 2010). The locomotory affordances of a space can be considered in terms of visual permeability (Stamps, 2005b). The layout of both Pacific and Aboriginal offers greater visual permeability than that of Biodiversity. In addition, the more jagged layout of display cases in Biodiversity creates more convex spaces, which can further enhance the sense of enclosure (Stamps, 2005a). In the museum context, it may be that physical properties such as ceiling height or presence of natural light are less important than the affordance of visual permeability. Such long vistas afford the actions of being able to read and navigate the space, find exhibits that are most of interest, reunite with companions, and so on.

Quotations from the accompanied visits in Phase 1 indicate that physical characteristics do contribute to a sense of spaciousness:

\[\ldots \text{[Pacific’s] double clerestory window, which, does give it a great sense of space. }\ldots\]

(Colin)

However other visitor quotations reinforce the notion that having “enough room” and being free to act without interfering with others (i.e. space as an affordance) is an important determinant of spaciousness:

\[I \text{ like how they’ve spaced things out that I could kneel down and have a read with someone who was interested in a different thing }\ldots\]

(Jonathan)

The qualitative interviews also demonstrated that dense object displays could serve to counteract a sense of spaciousness (Section 4.3). The display density in Pacific was frequently mentioned in accompanied visits to the gallery, sometimes in the context of being cluttered. Since Uncluttered is one of the subscales of Spatiality, it is possible that the display density of Pacific is a factor. Supporting this hypothesis, analysis of the single seven-point semantic differential Cluttered-Uncluttered shows that Aboriginal-1 was considered the most Uncluttered gallery ($M = 5.10$) and Pacific the least Uncluttered ($M = 4.54$). This difference was significant in an independent samples $t$-test $t(325) = 3.385, p = 0.001$. Thus, the display density of Pacific may be serving to reduce the overall perception of Spatiality despite the large and open nature of the exhibition space.

In any case, the eta squared score indicates the effect size of gallery on perceptions of spaciousness is relatively small, accounting for only 3% of the variance. Consequently, these hypotheses should
be regarded with caution. Further research will be needed to determine the nature and significance of different physical characteristics in creating perceptions of spaciousness in an exhibition setting.

On perceptions of Order, there were no statistically significant differences between the galleries. Each gallery had a mean Order score above five, suggesting a moderate-high perception of Order on a seven-point scale. Although Order is not a useful measure for distinguishing between galleries in this study, it nonetheless may be a faithful reflection of the level of Order visitors perceived within each gallery. The SA Museum has a consistent overarching style of exhibiting, which is an object-rich approach comprising display cases of objects grouped either thematically or geographically. This may have resulted in each space being perceived as similarly Ordered. Use of the Perceived Atmosphere Instrument in a broader range of settings such as science centres or museums with a more eclectic display approach may reveal differences in perceptions of Order. Alternatively, it may underscore Rounds’ (2006) assertion that museums are inherently organised environments that impose some kind of order on the world: “Use of some ordering principle is precisely what distinguishes an exhibit from a bunch of stuff in a room” (Rounds, 2006, p. 140).

5.3 Relating Perceived Atmosphere to the Visitor Experience

A key aim of this study is to examine how Perceived Atmosphere relates to the visitor experience, which consists of cognitive, affective and behavioural elements. This study used a number of ways to characterise the visitor experience and then relate it to Perceived Atmosphere:

1. Experience Measures: This adjective checklist is a previously validated instrument designed to provide a snapshot of the visitor experience across a number of different dimensions including affective and cognitive responses as well as social, spiritual and physical aspects (Packer et al., 2013).

2. Affective and Cognitive Responses: These self-report scales were developed specifically for this study as described in Section 3.8.1-3.8.2.

3. Visitor Behaviour: Tracking and timing of visitors through the exhibition galleries to determine level of attentional engagement.

Results from each of these approaches will be presented and discussed in turn.

5.3.1 Characterising Visitor Experience Through Experience Measures

To provide a general overview of the visitor experience in a way that facilitates comparison across sites, an adjective checklist developed by Packer et al. (2013) was used. This Experience Measures
Checklist consists of 75 adjectives which together describe 15 dimensions of visitor experience: Attention, Fascination, Aesthetic Appreciation, Peacefulness, Autonomy, Togetherness, Personal Growth, Reflective Engagement, Connection, Compassion, Privilege, Excitement, Spiritual Engagement, Physical Activity and Tension. This simple-to-complete instrument thus captures physical, emotional, intellectual and spiritual dimensions of the visitor experience. It has been validated across a range of museums and other educational leisure settings (Packer et al., 2013).

The reported visitor experience in each exhibition gallery is compared in Figure 5.4. The dimensions with statistically significant differences (one-way ANOVA) were: Privilege $F(3, 597) = 2.84, p = 0.037, \eta^2 = 0.014$; Compassion $F(3, 597) = 7.07, p<0.001, \eta^2 = 0.034$; and Peacefulness $F(3, 597) = 2.69, p = 0.046, \eta^2 = 0.013$. Visitors to Aboriginal-1 showed the highest level of Privilege and Peacefulness. Biodiversity visitors experienced the most Compassion (in particular a concern for animals). Interestingly, while not all the differences are statistically significant, a marked difference was seen in the experiences of Aboriginal-G and Aboriginal-1. Visitors to Aboriginal-G appeared to have a less positive experience overall, with the exception of Reflective Engagement. The reasons for this are unclear. Museum fatigue would not appear to be a significant factor, as the visitors to Aboriginal-G and Aboriginal-1 had both spent comparable periods of time in the museum prior to completing the survey (slightly over one hour in both instances).

42 It should be noted that the majority of the Aboriginal-1 sample was collected in February-March (autumn), while the Aboriginal-G sample was collected in June (winter). While it is not obvious why the time of year may influence visitor experience, it is possible that there are seasonal differences in visitors coming to the museum.

43 Visitors were asked to indicate what time they had arrived at the museum and this was subtracted from the time the survey was handed in completed to give an estimate of the amount of time the participant had spent at the museum (rounded to the nearest 15 minutes). The mean visit duration was 1.20 hours, with a minimum of 0.25 hours and a maximum of 4.25 hours. However, the reliability of this measure is uncertain and it should be used with caution.
There were considerable differences in reported experience according to visit motivation. Nine of the 15 dimensions demonstrated statistically significant differences between motivational groups by one-way ANOVA:

- Fascination $F(5, 593) = 3.854, p = 0.002, \eta^2 = 0.031$
- Aesthetic $F(5, 593) = 3.796, p = 0.002, \eta^2 = 0.031$
- Together $F(5, 593) = 4.160, p = 0.001, \eta^2 = 0.034$
- Privilege $F(5, 593) = 2.342, p = 0.040, \eta^2 = 0.019$
- Compassion $F(5, 593) = 5.322, p<0.001, \eta^2 = 0.043$
- Connection $F(5, 593) = 3.175, p = 0.008, \eta^2 = 0.026$
- Peacefulness $F(5, 593) = 3.621, p = 0.003, \eta^2 = 0.030$
- Spiritual Engagement $F(5, 593) = 4.557, p<0.001, \eta^2 = 0.037$
- Physical Activity $F(5, 593) = 2.631, p = 0.023, \eta^2 = 0.022$

Overall patterns of engagement are shown in Figure 5.5. Rechargers scored higher than other visitors on most measures, most markedly on Peacefulness. A high Peacefulness score is consistent with rechargers visiting the museum for restorative purposes (Packer, Bond, & Ballantyne, 2010). Experience Seekers were lower on all measures but in particular demonstrated a lower level of Compassion which may be indicative of seeking out the “highlights” more than engaging with content more deeply (Falk, 2009). Those who gave multiple purposes for visiting also reported higher levels for all experience dimensions.
Figure 5.4. Comparison of exhibition galleries by the 15 dimensions of visitor experience developed by Packer et al. (2013). Means for each gallery have been compared to the overall mean for the $N = 602$ sample. (AACG = Aboriginal Cultures Gallery; PCG = Pacific Cultures Gallery; SABG = Biodiversity Gallery).
Figure 5.5. Comparison of experience by visit purpose.
5.3.2 Relating Perceived Atmosphere and Experience Measures

As an initial exploration of the relationship between Perceived Atmosphere and visitor experience, bivariate correlation analyses were conducted between the four Perceived Atmosphere dimensions and the 15 Experience Measures dimensions. Statistically significant correlations with coefficients exceeding 0.2 are shown in Table 5.6. There were no significant correlations between Theatricality and any of the experience dimensions. There were also no meaningful correlations between any of the Perceived Atmosphere dimensions and the experience dimensions of Togetherness, Reflective Engagement, Autonomy, Physical Activity or Tension.

Table 5.6. Bivariate correlations between Perceived Atmosphere and experience dimensions. Only Pearson coefficients greater than \( r = 0.2 \) and \( p < 0.001 \) are shown.

<table>
<thead>
<tr>
<th>Perceived Atmosphere Dimensions</th>
<th>Experience Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Fascination</td>
</tr>
<tr>
<td></td>
<td>Aesthetic</td>
</tr>
<tr>
<td></td>
<td>Excitement</td>
</tr>
<tr>
<td></td>
<td>Privilege</td>
</tr>
<tr>
<td>Vibrancy</td>
<td>.30</td>
</tr>
<tr>
<td>Order</td>
<td>.21</td>
</tr>
<tr>
<td>Spatiality</td>
<td>.27</td>
</tr>
</tbody>
</table>

Experience dimensions that had a significant correlation with more than one of the Perceived Atmosphere dimensions were used as dependent variables in multiple regression analyses with the relevant atmosphere dimensions as independent variables. The ENTER method of multiple regression was used so that the contribution of all the independent variables is shown in the regression model (Pallant, 2010). This enables the unique contribution of each atmospheric variable to be quantified, as summarised in Table 5.7. The strongest effects are those of Vibrancy on both Excitement and Fascination, although the adjusted \( R^2 \) values for the multiple regression models indicates that Perceived Atmosphere dimensions only account for around 12-13% of the variance in these items.

\(^{44}\) In general, a correlation coefficient of 0.3 is considered the lower threshold for practical significance, translating to \( r^2 = 0.09 \), or 9% of the variance being accounted for by the relationship (Pallant, 2010). A lower threshold is shown here for two reasons. Firstly, the Experience Measures have only six possible values (the integers 0-5); this limited range may not be sensitive enough to detect some functionally significant correlations. Secondly, the lower threshold serves to highlight correlations that may warrant further investigation using more sensitive instruments.

\(^{45}\) The correlation coefficient between Theatricality and Compassion was 0.148, \( p<0.005 \), statistically significant but below the \( r = 0.2 \) cutoff.
Table 5.7. Summarised results of multiple regression analyses of relevant experience measures as dependent variables (DVs), with Vibrancy, Order and Spatiality as independent variables (IVs). Regression coefficients are statistically significant at the $p < 0.05$ level unless denoted “N.S.”.

<table>
<thead>
<tr>
<th>DVs</th>
<th>Fascination</th>
<th>Aesthetic Appreciation</th>
<th>Excitement</th>
<th>Privilege</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibrancy</td>
<td>0.211</td>
<td>0.171</td>
<td>0.290</td>
<td>0.188</td>
</tr>
<tr>
<td>Order</td>
<td>0.103</td>
<td>0.103</td>
<td>0.094 N.S.</td>
<td>0.027 N.S.</td>
</tr>
<tr>
<td>Spatiality</td>
<td>0.152</td>
<td>0.06 N.S.</td>
<td>0.026 N.S.</td>
<td>0.204</td>
</tr>
</tbody>
</table>

Adjusted $R^2$ of regression model

<table>
<thead>
<tr>
<th></th>
<th>Fascination</th>
<th>Aesthetic Appreciation</th>
<th>Excitement</th>
<th>Privilege</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.128</td>
<td>0.066</td>
<td>0.119</td>
<td>0.108</td>
</tr>
</tbody>
</table>

5.3.3 Characterising the Visitor Experience Through Affective and Cognitive Measures

Scales for affective and cognitive engagement were developed as described in Sections 3.8.1 and 3.8.2 respectively. They can be summarised as follows:

1. Affective measures:
   a. **Affective Engagement**: based on a set of emotion words derived from Plutchik’s (1980) theory of primary emotions. It includes words such as Amazed and Interested and generally indicates a state of positive affect with high arousal.
   b. **Relaxation**: a second affective measure based on a set of words derived from primary emotions theory. In contrast to Affective Engagement, Relaxation reflects a lower level of arousal. Furthermore, it is as much a measure of the absence of negative affect as it is a measure of positive affect (several items on this scale are negative emotion words that are reversed).
   c. **Displeasure**: also derived from primary emotions, this scale is a combination of negative affect terms having both high and low levels of arousal.

2. Cognitive measures:
   a. **Cognitive Engagement**: based on a series of statements derived from environmental cognition theory (Kaplan, 1988b) and the Learning for Fun framework (Packer, 2006). It measures visitors’ own experiences of cognitive engagement, rather than testing engagement through increased assimilation of exhibit content.
   b. **Cognitive Overload**: based on environmental cognition statements that indicate an inability to make sense of the environment due to a perceived lack of coherence or too much to take in.
5.3.3.1 Comparing Differences in Cognitive/Affective Engagement between Galleries

The differences between galleries with respect to Cognitive Engagement were statistically significant, albeit with a relatively small effect size: $F(3,593) = 6.64, p<0.001$, eta squared = 0.032. Post hoc tests identified that the level of cognitive engagement in Pacific was significantly lower than both Aboriginal-G and Biodiversity. In addition, the difference between Pacific and Aboriginal-1 approached but did not reach statistical significance ($p=0.071$ after Bonferroni adjustment). The difference between the Pacific and the other three galleries is clear (Figure 5.6). Overall, visitors to Pacific reported being less cognitively engaged than visitors to the other galleries. Despite Pacific having a lower mean score of Cognitive Engagement, it should be noted that the mean is still above the neutral score of 4, suggesting that visitors still reported being cognitively engaged in Pacific, just less so than in the other exhibitions.

![Figure 5.6. Means plot of Cognitive Engagement by exhibition gallery. (AACG = Aboriginal Cultures Gallery; PCG = Pacific Cultures Gallery; SABG = Biodiversity Gallery).](image)

The difference in Cognitive Overload between galleries approached statistical significance (one-way ANOVA, $F (3,592) = 2.508, p = 0.058$). Although not statistically significant, the means plot of Cognitive Overload is noteworthy in that it mirrors that of Cognitive Engagement across galleries (Figure 5.7). Thus Cognitive Overload appears to negate Cognitive Engagement, and indeed there is a strong negative correlation between the two measures ($r = -0.58, p<0.001$). It also suggests that the reason why the overall level of Cognitive Engagement was lower in the Pacific Gallery was not due to lack of interest, but more due to the sheer quantity of densely displayed objects with minimal organisation or labelling. This is supported by the qualitative research (Section 4.3) and the
relatively low Uncluttered rating this gallery received (Section 5.2.2). It is also reinforced by the visitor tracking results, which will be presented in Section 5.3.4.

![Means plot of Cognitive Overload by exhibition gallery](image)

Figure 5.7. Means plot of Cognitive Overload by exhibition gallery (AACG = Aboriginal Cultures Gallery; PCG = Pacific Cultures Gallery; SABG = Biodiversity Gallery).

None of the affective measures varied significantly by gallery as tested by one way ANOVA, although there were correlations between Perceived Atmosphere dimensions and affective responses, as described in the following section. This indicates that the perception of the exhibition environment has the greater impact on affective responses, at least as they were measured in this study. This finding mirrors Kotler’s (1974) observation that the perceived atmosphere is not necessarily the same as the actual or intended atmosphere, and it is the perceived atmosphere that customers/visitors respond to on an affective level.
5.3.4 Relating Perceived Atmosphere to Affective and Cognitive Responses

Perceived atmosphere, affective and cognitive responses are represented in this study by the following summated scales:

1. **Perceived Atmosphere**
   a. Vibrancy (eight items derived from factor analysis of semantic differentials)
   b. Spatiality (four items derived from factor analysis of semantic differentials)
   c. Order (four items derived from factor analysis of semantic differentials)
   d. Theatricality (six items derived from factor analysis of semantic differentials)

2. **Affective Response**
   a. Affective Engagement (eight items based on Plutchik’s primary emotions)
   b. Relaxation (five items based on Plutchik’s primary emotions)
   c. Displeasure (eight items based on Plutchik’s primary emotions)

3. **Cognitive Response**
   a. Cognitive Engagement (based on seven environmental cognition statements)
   b. Cognitive Overload (based on four environmental cognition statements).

The following section will analyse relationships between these measures and interpret the results.

5.3.4.1 Bivariate Correlations Between Atmosphere and Affective/Cognitive Responses

Correlation analysis was used as an initial exploration of the relationships between Perceived Atmosphere and Affective and Cognitive Responses. As shown in Table 5.8, there were significant correlations for all the Perceived Atmosphere dimensions except Theatricality. Theatricality has therefore been omitted from subsequent analyses.

The strongest correlations ($r > 0.6$) were found between Vibrancy and both Cognitive and Affective Engagement. Affective and Cognitive Engagement are themselves strongly correlated ($r = 0.75, p < 0.001$), which is consistent with the reciprocal relationship between affective and cognitive engagement that has been observed previously in museums and heritage sites (Dahl, Entner, Johansen, & Vittersø, 2013; Rojas & Camarero, 2006). There was also a positive correlation between Vibrancy and Relaxation, while Vibrancy was negatively correlated with both Displeasure and Cognitive Overload.
**Table 5.8.** Pearson bivariate correlation coefficients of Perceived Atmosphere dimensions and affective and cognitive visitor response measures. **denotes correlation is significant at the 0.01 level (2-tailed).

<table>
<thead>
<tr>
<th>Perceived Atmosphere</th>
<th>Cognitive Engagement</th>
<th>Cognitive Overload</th>
<th>Affective Engagement</th>
<th>Relaxation</th>
<th>Displeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrancy</td>
<td>.72**</td>
<td>-.43**</td>
<td>.62**</td>
<td>.36**</td>
<td>-.32**</td>
</tr>
<tr>
<td>Order</td>
<td>.47**</td>
<td>-.53**</td>
<td>.44**</td>
<td>.37**</td>
<td>-.27**</td>
</tr>
<tr>
<td>Spatiality</td>
<td>.38**</td>
<td>-.41**</td>
<td>.37**</td>
<td>.41**</td>
<td>-.25**</td>
</tr>
<tr>
<td>Theatricality</td>
<td>.05</td>
<td>-.01</td>
<td>.02</td>
<td>-.03</td>
<td>.07</td>
</tr>
</tbody>
</table>

There were moderate correlations between Order and both Affective and Cognitive Engagement, and to a lesser extent Relaxation. The strongest negative relationship was between Order and Cognitive Overload. As would be anticipated, a perceived lack of order (i.e., complexity in the absence of coherence), is related to a sense of cognitive overload.

Spatiality was most strongly correlated with Relaxation (positive) and Cognitive Overload (negative). This suggests visitors felt more relaxed and less overloaded in spacious environments. In other words, Spatiality could be considered to be a predictor of restoration in a museum setting. This is supported by qualitative research into restorative museum experiences, which indicates that the spaciousness of the environment is an important contributor to restoration (Packer, 2008, 2014).

Taken together, this indicates that visitors feel more affectively and cognitively engaged, more relaxed and less overloaded and dissatisfied in environments they perceive to be more vibrant, ordered and spacious. These relationships will be explored in greater depth in the next section.

**5.3.4.2 Analysis of Relationships by Multiple Regression**

This research is concerned with determining the extent to which cognitive and affective elements of the visitor experience can be predicted by perceptions of the exhibition environment, as represented by the Perceived Atmosphere constructs (specifically Vibrancy, Spatiality and Order). To examine this, a series of multiple regression analyses were conducted, using each of the cognitive and affective response measures as the Dependent Variable in turn (Figure 5.8). For each calculation,

---

46 ENTER method
the atmospheric measures of Vibrancy, Order and Spatiality were included as Independent Variables.47

![Diagram](image)

**Figure 5.8.** Diagrammatic representation of the multiple regression analyses conducted. Each of the items listed to the right was included as a dependent variable in turn, resulting in five separate regression calculations.

The regression analyses were repeated for each individual exhibition gallery to confirm consistency in the relationships between Perceived Atmosphere and visitor responses across different exhibitions. Results from the multiple regression analyses for the whole sample are summarised in Table 5.9.

**Table 5.9.** Standardised regression coefficients (beta) from five separate multiple regressions with Perceived Atmosphere dimensions as independent variables. The regression was repeated with each of the cognitive/affective measures as a dependent variable. The multiple regressions shown here were conducted with the full sample (N=602 across four galleries) but were repeated across individual galleries.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrancy</td>
<td>.63</td>
<td>-.23</td>
<td>.52</td>
<td>.22</td>
<td>-.24</td>
<td></td>
</tr>
<tr>
<td>Order</td>
<td>.17</td>
<td>-.36</td>
<td>.16</td>
<td>.15</td>
<td>-.12</td>
<td></td>
</tr>
<tr>
<td>Spatiality</td>
<td>.09</td>
<td>-.15</td>
<td>.12</td>
<td>.26</td>
<td>-.11</td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.56</td>
<td>.35</td>
<td>.43</td>
<td>.23</td>
<td>.13</td>
<td></td>
</tr>
</tbody>
</table>

47 Robyn’s description of exhibition spaces in Section 4.3 (p. 128) suggested the possibility of an inverse-U relationship between Spatiality and visitor responses. Analysis of scatter plots as well as residuals from the multiple regression analyses (Pallant, 2010) did not indicate there was a curvilinear relationship between Spatiality and the affective/cognitive measures in this study.
These analyses confirm that Vibrancy is the strongest predictor of both affective and cognitive engagement. In addition, there is a weak positive relationship between Spatiality and Relaxation, and a weak negative relationship between Order and Cognitive Overload. These relationships were found to be consistent across individual exhibition galleries, confirming that exhibition gallery is not a confounding variable in these relationships. There are no strong relationships between any of the atmospheric variables and Displeasure, suggesting that Perceived Atmosphere is not a significant factor in visitors’ feeling displeased\(^\text{48}\).

The adjusted \(R^2\) values of the multiple regression models show that Perceived Atmosphere dimensions together account for 56% of the variance in Cognitive Engagement and 43% of the variance in Affective Engagement in this sample. This confirms that Perceived Atmosphere is a significant factor in the overall quality of visitor engagement.

### 5.3.4.2 Testing for Mediator Effects in the Perceived Atmosphere-Affective/Cognitive Experience Relationship

Vibrancy is the strongest predictor variable for both Cognitive and Affective Engagement. However, given the strong correlation between Cognitive and Affective Engagement described above (\(r = 0.75, p < 0.001\)), it is possible that one of these variables acts as a mediator for the other in their relationship with Vibrancy (Baron & Kenny, 1986). To test for a mediation effect, alternative path models were compared using SPSS AMOS v20. These are shown in Figures 5.9a and 5.9b.

\[\text{Vibrancy} \rightarrow \text{Affective Engagement} \rightarrow \text{Cognitive Engagement}\]

\[\text{Vibrancy} \rightarrow \text{Cognitive Engagement} \rightarrow \text{Affective Engagement}\]

\(\text{Figure 5.9a. Path model showing Affective Engagement mediating the effect of Vibrancy on Cognitive Engagement. Standardised coefficients are shown. The strength of the Vibrancy-Cognitive Engagement relationship is reduced by the presence of Affective Engagement as a mediator variable, but there remains a considerable independent relationship.}\)

\(^{48}\) As shown previously, responses to Displeasure clustered around the neutral score of four, indicating that the items comprising this scale were not considered to be particularly salient by visitors.
Figure 5.9b. Alternative path model showing Cognitive Engagement mediating the effect of Vibrancy on Affective Engagement. Standardised coefficients are shown. The strength of the Vibrancy-Affective Engagement relationship is reduced considerably by the presence of Cognitive Engagement as a mediator variable. This supports the hypothesis that Cognitive Engagement is a mediator in the Vibrancy-Affective Engagement relationship, although the mediation is not total.

For both models, the size and significance of direct and indirect (mediation) effects were tested using a published SPSS syntax that applies the Sobel test and bootstrapping techniques to a simple mediation model (Preacher & Hayes, 2004). This confirmed that both the direct and indirect paths were significant in both models. With Cognitive Engagement as the mediator, the size of the indirect effect was significant at the $p<0.001$ level according to the Sobel test. In the bootstrap results the 95% confidence interval was between 0.38 and 0.53, which is well outside the zero value that would indicate no mediation. Thus the mediating effect of Cognitive Engagement in the relationship between Vibrancy and Affective Engagement was statistically significant. However, repeating the same tests on the alternative model, with Affective Engagement as a mediator, also showed statistical significance, albeit with a smaller indirect effect size. This suggests that a simple mediation model may not be the most appropriate interpretation of the data. While Cognitive Engagement is a better mediator of Affective Engagement than the reverse, both have an independent relationship with Vibrancy. Furthermore, the data appears to support the notion that Affective and Cognitive Engagement positively influence one another in a feedback loop (Figure 5.9c).
This reciprocal relationship between affect and cognition may at first appear at odds with the S-O-R model of environmental response, which does not address cognition directly but nonetheless asserts that the primary response to environmental stimuli is emotional in nature (Mehrabian & Russell, 1974b). However, the relationship between affect and cognition in evaluating a servicescape (as well as in environmental appraisal more generally) has been widely debated (Lin, 2004, Kaplan 1987). While debates regarding the primacy of affect versus cognition are beyond the scope of this study, it appears that many of the disagreements are semantic rather than irreconcilable differences in theory (Kaplan, 1987; Schorr, 2001).

Drawing upon gestalt theory, Lin (2004) has argued that there is an initial (often subconscious) cognitive processing of the servicescape’s sensory stimuli into a perceptual image. This is followed by affective processing of the perceptual image (emotional response) and subsequent cognitive processing or evaluation (Lin, 2004). Such a model is consistent with the findings above as well as with cognitive appraisal theory, which theorises emotions as being the product of cognitive assessments of a situation or event (Smith & Ellsworth, 1985). However, the relationship observed in this study appears more complex than be accounted for by simple cause-and-effect models. The relationship between affect and cognition is undoubtedly complex and most likely recursive:

[E]vidence from across the branches of emotion theory indicates that many cognitive processes influence emotions, emotions influence many cognitive processes, these effects are rapid and spontaneous, and they play out differently for different individuals. These findings suggest complex, bidirectional causal relations that organise parts as well as wholes. . . (Lewis, 2005, pp. 172-3)
This notion of interlinking affect and cognition is supported by studies into the evolutionary, social and neurobiological bases of learning (Immordino-Yang & Damasio, 2007).

The literature suggests mechanisms by which Vibrancy could influence both affective and cognitive engagement. As described previously, the items comprising Vibrancy (Dramatic, Active, Vibrant, Striking, Dynamic, Colourful, Energetic, Three-Dimensional) appear to be analogous to the dimensions of activity (Osgood et al., 1957) and liveliness (Vogels, 2008a). Although Vibrancy is distinct from novelty or complexity, in this study perceptions of Vibrancy appear to enhance cognitive assessments of the novelty and complexity of the environment as represented by Cognitive Engagement. Supporting this notion, Vibrancy appears to encompass those environmental features that were found to catch, grab and draw the attention of Phase 1 participants, for instance:

Dynamic displays such as videos:

*Ok well first thing that attracts me is the video wall, over there (Geoff, Biodiversity)*

The video catches my attention . . . and I guess that I’m trying to work out what video is about. (Angela, Aboriginal Gallery)

Individual objects and displays considered striking:

*Title “King of Worms” is a bit striking [Me: uh-huh, yes] I might just go and read that a bit more and see what it says. [5 secs]. . I see. (Bob, Fossils Gallery)*

Colourful items:

*[T]he colour was the first thing I noticed, berry-type red colour . . . and that’s what drew me over here. (Jonathan, Aboriginal Gallery)*

Displays with a sense of three-dimensionality:

*This is quite nice this textural display here sort of got, a recreation of an intertidal zone . . . yeah it’s a, it’s inviting to interact with it . . . (Colin, Biodiversity)*

Vibrancy also tends to describe the overall arousing qualities of the environment. There is a direct physiological relationship between sensory arousal and emotional response, however this finding has not been well integrated into psychological models of emotion because the two fields have progressed with relatively little cross-fertilisation (Bagozzi et al., 1999; Lewis, 2005). Nonetheless,
this may be the mechanism through which Vibrancy is having a small but significant direct effect on Affective Engagement.

5.3.5 Characterising Visitor Experience through Observed Behaviour

As described in Section 3.7.1, a sample of visitors to three of the galleries of interest to this study (Pacific Gallery, Biodiversity Gallery and Aboriginal Gallery-1) were unobtrusively tracked and timed, with behaviour coded in terms of Attentional Engagement as described in Section 3.7.2. This was a separate sample from those that were surveyed, with the exception of a subset that were both tracked and surveyed (see Figure 3.6 for a visual summary of the Phase 3 study participants). This track-survey subset has been included in the overall tracking sample, and is discussed in further detail in Section 5.3.5.

5.3.5.1 Comparing Attentional Engagement Across Galleries

Mean dwell time (duration spent in the exhibition gallery, in minutes) for the three galleries was: 8.21 minutes for Aboriginal-1; 9.65 minutes for Pacific; and 14.56 minutes for Biodiversity. The dwell time curve for each gallery (Figures 5.10a-c) showed the characteristic positive skew that has been documented in the literature (Serrell, 1998).

*Figure 5.10a.* Frequency histogram of visitor dwell time (in minutes) for Aboriginal-1.
Figure 5.10b. Frequency histogram of visitor dwell time (in minutes) for the Pacific Gallery.

Figure 5.10c. Frequency histogram of visitor dwell time (in minutes) for the Biodiversity Gallery.

Sweep Rate Index (SRI) and %DV are measures developed by Serrell (1998) as a way of benchmarking and comparing exhibitions. SRI is calculated as the square footage of the exhibition...
space divided by the average dwell time of the tracked sample. The lower the SRI, the slower
visitors are moving through the exhibition. The %DV pertains to the percentage of visitors classed
as diligent, that is, stopping at at least 50% of the exhibits in an exhibition. The SRI and %DV
figures for the three exhibitions are shown in Table 5.10, alongside the average reported by Serrell
(2011) across over 100 different exhibitions. These results suggest a lower than average level of
engagement compared to Serrell’s full sample, although these figures are not atypical for large
natural history exhibitions with few interactive elements, such as the exhibitions used in this study.

Table 5.10. SRI and %DV measures for each exhibition.

<table>
<thead>
<tr>
<th>Gallery</th>
<th>SRI (sqft/min)</th>
<th>%DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboriginal Gallery-1</td>
<td>865</td>
<td>10.3</td>
</tr>
<tr>
<td>Pacific Gallery</td>
<td>900</td>
<td>9.5</td>
</tr>
<tr>
<td>Biodiversity Gallery</td>
<td>575</td>
<td>13.0</td>
</tr>
<tr>
<td>Overall average reported by Serrell (2011)</td>
<td>300</td>
<td>26</td>
</tr>
</tbody>
</table>

The SRI and %DV measures are designed as single measures to compare galleries and do not lend
themselves to statistical comparisons between individual visitors in a given sample. Hence
alternative measures of attentional engagement have been used here. To compare time spent in each
exhibition while taking gallery size into account, dwell time for each visitor was divided by gallery
size and compared by one-way ANOVA: \( F(2,235) = 6.94, p < 0.001 \). Post-hoc tests showed that
this size-adjusted dwell time in Biodiversity was significantly higher than the other two galleries.

Average attentional engagement was calculated as described in Section 3.7.2.1 (Table 5.11) and
compared across galleries by one-way ANOVA: \( F(2,235) = 5.36, p = 0.005 \). Post-hoc tests (Tukey
HSD) revealed a statistically significant difference between Pacific and Aboriginal-1, \( p = 0.004 \). No
other statistically significant differences were found. However, this broad aggregate score may
mask differences in the overall profile of attentional engagement – for instance a visitor who either
ignores exhibits or engages with them would have a similar score for “average level of attentional
engagement” as a visitor who skims or attends most exhibits but seldom engages. Thus the
proportion of exhibits that visitors encountered and ignored, skimmed, attended or engaged was
compared across galleries (Figure 5.11). This shows that each gallery has a distinctive engagement
profile: Aboriginal Gallery-1 has a relatively low proportion of ignored exhibits, with a similar
proportion of exhibits being skimmed, attended or engaged. In contrast, while Pacific and

---

49 As each individual dwell time is divided by gallery size and not the overall average dwell time of the sample, this is
distinct from SRI.
Biodiversity have similar proportions of ignored exhibits, their patterns of engagement show opposite trends – in Pacific the proportion of exhibits engaged decreases with attention level, whereas it increases in Biodiversity.

Table 5.11. Summary of average levels of Attentional Engagement across the three galleries.

<table>
<thead>
<tr>
<th>Exhibition</th>
<th>Average Level of Attentional Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Aboriginal Cultures Gallery</td>
<td>2.37 (.50)</td>
</tr>
<tr>
<td>Pacific Cultures Gallery</td>
<td>2.13 (.42)</td>
</tr>
<tr>
<td>SA Biodiversity Gallery</td>
<td>2.30 (.49)</td>
</tr>
</tbody>
</table>

Figure 5.11. Comparison of Attentional Engagement profiles across galleries.

Comparisons between galleries by one-way ANOVA showed statistically significant differences in the proportion of exhibits ignored, skimmed and engaged: $F(2,235) = 6.44, p = 0.002$; $F(2,235) = 6.55, p = 0.005$; $F(2,235) = 5.29, p = 0.006$ respectively. Post-hoc tests showed the following significant differences:

- Exhibits ignored: Aboriginal Gallery-1 < Pacific & Biodiversity
- Exhibits skimmed: Biodiversity < Aboriginal Gallery-1 & Pacific
Exhibits engaged: Pacific < Aboriginal Gallery-1 & Biodiversity

There were no significant differences in the proportion of exhibits attended in each gallery.

Thus Aboriginal Gallery-1 and Biodiversity showed similar overall levels of attentional engagement however there are differences in the overall profile of engagement – visitors to Biodiversity ignored more exhibits, but once their attention was captured by an exhibit they were less likely to skim it and more likely to stop and engage further. One factor that may account for this difference is exhibit labelling: Biodiversity depends almost entirely on screen-based labels which cannot be appraised at a glance. Once an object arouses a visitor’s curiosity to seek further information, the screen-based interactive labels take more time to navigate or otherwise have a greater holding power compared to traditional graphic labels. This feature of the screen-based labels was apparent in the accompanied visits in Phase 1:

. . . there’s a, very spiky looking lizard here which, catches my eye because of the way how spiky it is Number 10 . . it’s, it’s like a little dragon, so yeah I probably, go round the corner and look at the [touchscreen] display just to, see if I can get a name for that, and I recognise it next time . . . (Geoff, Biodiversity Gallery)

[I’ll] have a look at Number 21 cause my wife’s favourite bird is, is probably that one let’s have a look. [Uses touchscreen 3 secs] Splendid Fairy Wren so yep that’s my wife’s favourite bird. . . . (Philip, Biodiversity Gallery)

And a wombat. Just see if he’s a Southern Hairy Nosed Wombat. [5 secs using touchscreen] OK, that is all birds. “Next” aha! [inaudible] emu, all birds and, more birds, and emu and a lizard, aha! 54. A Southern Hairy Nosed Wombat. (Carol, Biodiversity Gallery)

In contrast, the rather minimal labelling in Pacific may account for the lower level of attentional engagement – an object may arouse curiosity in the first instance, but in the absence of further information to satisfy this curiosity, attention is not held for long. Evidence of this also emerged in the Phase 1 accompanied visits:

I’m missing all the labels for the thing I’m seeing. [R: uh-huh] . . . there’s no, not much information I can get here, so, I’m just strolling by, wandering . . . (Robyn, Pacific Gallery)
I’m just sort of having a quick look at what other countries are in this room . . . It doesn’t seem to be giving me more information about each display just what each is. (Rachel, Pacific Gallery)

In some respects, this relationship between objects and labels is analogous to the attracting and facilitating stimuli described by Ballantine et al. (2010) in the retail setting. Museum objects (or other eye-catching displays) act as attracting stimuli while labels act as facilitating stimuli in that they allow visitors to convert this initial interest into deeper engagement. In the retail setting, facilitating stimuli were able to enhance or inhibit the effect of attracting stimuli. In the Pacific Gallery, the perceived absence of facilitating stimuli in the form of labels appeared to make the objects of less interest. In contrast, the touchscreens in the Biodiversity Gallery were more successful as facilitating stimuli, enhancing the attracting nature of the objects on display.

5.3.5.2 Comparing Exhibit Encounters Across Galleries

As an indication of how thoroughly visitors covered the exhibition space (irrespective of their level of attentional engagement), the proportion of exhibits that visitors encountered in the gallery was calculated (Table 5.12). A visitor was deemed to have encountered an exhibit when they had passed within two metres of it and it could reasonably be expected to be in their general field of view.

<table>
<thead>
<tr>
<th>Exhibition</th>
<th>Proportion of Exhibits Encountered (% of total exhibits in gallery)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Aboriginal Cultures Gallery-1</td>
<td>62%</td>
</tr>
<tr>
<td>Pacific Cultures Gallery</td>
<td>77%</td>
</tr>
<tr>
<td>SA Biodiversity Gallery</td>
<td>73%</td>
</tr>
</tbody>
</table>

The difference in proportion of exhibits encountered in each gallery was significant by one-way ANOVA: $F(2,235) = 11.748$, $p<0.001$. Post-hoc tests (Tukey HSD) revealed a statistically significant difference between the Aboriginal-1 and both Biodiversity & Pacific that was significant at the $p=0.001$ level. This is consistent with visitors to Aboriginal-1 encountering fewer overall exhibits than the other two galleries. One possible explanation for this is that the central spine of Aboriginal-1 (Figure 5.12) has a channelling/funnelling effect (Roppola, 2012), drawing visitors into it and then making it less likely they will encounter exhibits on both sides of the gallery. This
behaviour can also be explained in terms of space syntax (Hillier & Tzortzi, 2011), in that the central corridor represents a highly integrated spine that attracts the majority of visitor traffic.

Figure 5.12. Floor plan of Aboriginal Gallery-1. The central spine that attracted the majority of visitor traffic is shown in red.

5.3.5.3 Visitor Behaviour: Summary

Visitors spent more time in Biodiversity Gallery compared to the other exhibitions. This difference remained statistically significant when differences in gallery size were taken into account. This increased dwell time did not necessarily lead to a higher average level of attentional engagement, although there was a tendency towards increased engagement if ignored exhibits are excluded. One possible explanation is the more meandering route of the gallery, meaning it takes longer to physically navigate than the other two. Another possibility is that visitors in this gallery spent more time on non-exhibit related activity. This gallery attracted a higher proportion of families, who generally were more frequently observed to undertake activities unrelated to exhibit content while in the galleries (e.g. re-tying a child’s shoelaces, disciplinary conversations, etc.).

Visitors to Aboriginal Gallery-1 encountered a lower proportion of the exhibits. However, this did not translate to a lower overall level of attentional engagement compared to the other two galleries. On the contrary, fewer exhibits were ignored. The physical layout of the gallery is such that visitors would need to double back on themselves to be able to encounter most of the exhibits, something that visitors have been consistently observed to be reluctant to do (Bitgood, 2006b, 2009a). This may explain the lower proportion of exhibits encountered.
Visitors to Pacific Gallery showed a lower overall level of attentional engagement. This may be related to the somewhat minimal interpretation offered in most parts of this exhibition – the observed decreasing pattern of attentional engagement may be due to there being fewer labels or other interpretive elements to hold visitor attention. Furthermore, as quite an open-plan gallery, visitors were more able to skim past large areas and appraise many exhibits from a distance, possibly giving a lower apparent level of engagement based on observable behaviour.

5.3.6 Relating Perceived Atmosphere and Observed Behaviour

To enable some preliminary analysis of the relationship between observable behaviour and self-report measures of Perceived Atmosphere and visitor experience, a small subset of visitors \(n = 60\) were both tracked and surveyed\(^50\). Visitors were unobtrusively tracked and timed from the point of entry into the exhibition. Upon exit from the exhibition gallery, they were approached and invited to complete a questionnaire. The demographic profile of this subset of participants was similar to that of the main sample. Practical constraints limited the sample size for this part of the study to 60 participants. Given this limited sample size, these results should be considered preliminary.

For initial comparison purposes, bivariate correlations between Perceived Atmosphere and affective and cognitive responses were repeated for this subset of participants (Table 5.13). There are some differences as compared to the full participant sample (Table 5.8). While the Vibrancy*Cognitive Engagement and Vibrancy*Affective Engagement correlations remain strong, and the Spatiality*Relaxation and Order*Affective Engagement correlations are similar in magnitude to the main sample, correlations between the other measures are generally weaker. Both strength and significance are lost on some relationships, particularly those with Cognitive Overload and Displeasure. This suggests that analyses based on this sample alone, particularly with respect to these measures, should be treated with caution.

\(^{50}\) This sample was included as part of the main survey sample and the tracking analyses reported above. Here they are treated as a separate sample.
Table 5.13. Correlations between Perceived Atmosphere and cognitive/affective measures in the subset of 60 visitors who were both tracked and surveyed. **denotes correlation is significant at the 0.01 level (2-tailed); *denotes correlation is significant at the 0.05 level (2-tailed). N.B. Correlations between all these items were significant at p<0.01 in the full N = 602 sample.

<table>
<thead>
<tr>
<th></th>
<th>Cognitive Engagement</th>
<th>Cognitive Overload</th>
<th>Affective Engagement</th>
<th>Relaxation</th>
<th>Displeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrancy</td>
<td>.71**</td>
<td>-.17</td>
<td>.58**</td>
<td>.16</td>
<td>.03</td>
</tr>
<tr>
<td>Order</td>
<td>.29*</td>
<td>-.29*</td>
<td>.40**</td>
<td>.27*</td>
<td>-.09</td>
</tr>
<tr>
<td>Spatiality</td>
<td>.27*</td>
<td>-.10</td>
<td>.21</td>
<td>.34**</td>
<td>-.31*</td>
</tr>
</tbody>
</table>

Of the atmospheric perception variables, only Vibrancy had significant correlations with any of the measures of attentional engagement (Table 5.14). While there were significant correlations between perceptions of Vibrancy and all measures of attentional engagement, there was no relationship between Vibrancy and the Proportion of Exhibits Encountered, an indicator of how much of the gallery was covered by the visitor’s route. This means that visitors who perceived an exhibition as being more Vibrant were more likely to spend more time in the exhibition and spend more time looking at or interacting with exhibits, but perceptions of Vibrancy did not affect their route through the exhibition (as measured by the number of exhibits encountered). Gallery layout, and the extent to which it channels visitors (as described in Section 2.5.4.3) appears to be more important for determining the visitor route than any of the atmospheric perception indicators identified in this study.

Table 5.14. Correlations between Vibrancy and attentional engagement measures. *denotes correlation is significant at the 0.05 level.

<table>
<thead>
<tr>
<th></th>
<th>Correlation with Vibrancy</th>
<th>p-value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwell Time (Partial correlation, controlling for gallery size)</td>
<td>.30</td>
<td>.02*</td>
</tr>
<tr>
<td>Average Level of Attentional Engagement</td>
<td>.37</td>
<td>.007*</td>
</tr>
<tr>
<td>Proportion of Exhibits Encountered</td>
<td>.02</td>
<td>.87</td>
</tr>
<tr>
<td>Proportion of Encountered Exhibits that were Attentively Engaged</td>
<td>.41</td>
<td>.002*</td>
</tr>
</tbody>
</table>
5.3.7 Comparing Self-Report and Observed Measures of Engagement

The relationship between observed measures of attentional engagement and the self-report measure of Cognitive Engagement was tested with bivariate correlations (Table 5.15). One-tailed tests of significance were used as there was an *a priori* prediction that the direction of the relationship between observed and self-report measures of engagement would be positive.

*Table 5.15. Bivariate correlations between Cognitive Engagement and observed measures of attentional engagement. * denotes correlation is significant at the 0.05 level.*

<table>
<thead>
<tr>
<th>Correlation with Cognitive Engagement</th>
<th>p-value (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwell Time (Partial correlation, controlling for gallery size)</td>
<td>.27</td>
</tr>
<tr>
<td>Average level of Attentional Engagement</td>
<td>.25</td>
</tr>
<tr>
<td>Proportion of Exhibits Encountered</td>
<td>.12</td>
</tr>
<tr>
<td>Proportion of Encountered Exhibits that were Attentively Engaged</td>
<td>.23</td>
</tr>
</tbody>
</table>

There was no correlation between Cognitive Engagement and the Proportion of Exhibits Encountered. This is consistent with the main observational study, in which the proportion of exhibits encountered was a poor indicator of overall observed levels of attentional engagement. However, there were statistically significant correlations between the self-report measure of Cognitive Engagement and Dwell Time, Average Level of Attentional Engagement and Proportion of Exhibits that were Attentively Engaged. However, the correlation coefficients are small (*r*<0.3). Thus, despite there being some broad patterns linking the two – for instance visitors to Pacific demonstrated the lowest level of engagement on both observed and self-report measures as shown in Sections 5.3.3.1 and 5.3.5.1 respectively – there is only a weak relationship between observed Attentional Engagement and self-report measures of Cognitive Engagement. This suggests that observable behaviour alone is at best only a moderate indicator of how cognitively engaged a visitor may consider themselves, at least by the measures used in this study. Such findings support the notion that visitors using “wide but shallow” visiting strategies (Rounds, 2004) find their experiences personally engaging and intellectually satisfying.

More strikingly, bivariate correlations revealed no relationship between observed measures of Attentional Engagement and Affective Engagement (Table 5.16). This suggests that Affective

---

51 This was a partial correlation taking gallery size as a covariate.
Engagement, while strongly correlated with Cognitive Engagement ($r = .77, p < 0.001$ for this subsample) itself has no relationship with the amount of time spent looking at exhibits, the main observation-based indicator of exhibit engagement used in this study. In this study and in the literature more generally (Bitgood, 2010; Serrell, 1998), time spent looking at exhibits is taken to be a function of attention. In at least some circumstances (particularly attention to text), attention and interest, an indicator of affective engagement\(^{52}\), are not necessarily related (Silvia, 2006). Again, this underscores the inherently subjective nature of experience, and demonstrates the limits of what can be inferred from visitors’ behaviour, at least those behaviours that are readily observable during unobtrusive tracking and timing studies.

*Table 5.16. Bivariate correlations between Affective Engagement and observed Attentional Engagement.*

<table>
<thead>
<tr>
<th>Correlation with Affective Engagement</th>
<th>$p$-value (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwell Time (Partial correlation, controlling for gallery size)</td>
<td>.09</td>
</tr>
<tr>
<td>Average Level of Attentional Engagement</td>
<td>.12</td>
</tr>
<tr>
<td>Proportion of Exhibits Encountered</td>
<td>-.08</td>
</tr>
<tr>
<td>Proportion of Encountered Exhibits that were Attentively Engaged</td>
<td>.14</td>
</tr>
</tbody>
</table>

Bivariate correlations were also calculated between Attentional Engagement and the 15 visitor experience dimensions of the Experience Measures checklist. There were small significant correlations with three of the dimensions: Togetherness, Physical Activity and Personal Growth (Table 5.17). The significance of these correlations is not clear, although it is intriguing to note that Attentional Engagement (an observed behavioural measure) correlates with Physical Activity (a self-report behavioural measure).

---

\(^{52}\) In this study, Interested is one of the items comprising the affective engagement summated scale.
Table 5.17. Bivariate correlations between experience dimensions and observed Attentional Engagement. Only correlations significant at the \( p = .05 \) level are shown. All \( p \)-values are 1-tailed.

<table>
<thead>
<tr>
<th></th>
<th>Togetherness</th>
<th>Physical Activity</th>
<th>Personal Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwell Time (Partial correlation, controlling for gallery size)</td>
<td>.24 ( p = .034 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Level of Attentional Engagement</td>
<td>\hspace{1em}</td>
<td>.27 ( p = .021 )</td>
<td>.26 ( p = .021 )</td>
</tr>
<tr>
<td>Proportion of Exhibits Encountered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of Encountered Exhibits that were Attentively Engaged</td>
<td>\hspace{1em}</td>
<td>.25 ( p = .026 )</td>
<td></td>
</tr>
</tbody>
</table>

It should be acknowledged that detailed analysis of Attentional Engagement was somewhat limited by a lack of precision in measurement. The literature generally categorises three main levels of exhibit engagement, albeit with differing definitions of what constitutes the three levels (Barrault & Pearson, 2010; Bitgood, 2011; Van Schijndel et al., 2010). However, over the course of data collection it became clear that recording at least one more level of engagement (such as stopping at an exhibit for at least 30 seconds as being coded as five, denoting Deep Engagement) would have provided a useful distinction. Since this category was not used consistently throughout the tracking process, it could not be included in the overall analysis. It may also have been instructive to analyse the total time spent attending to exhibits overall while in the gallery, rather than measuring it solely with respect to individual exhibits. Given these limitations in the way visitor behaviour was measured in this study, the results presented here are necessarily preliminary in nature.

5.4 “Environment Focused” Visitors – a Distinct Population

During piloting of the Perceived Atmosphere Instrument, conversations with participants indicated that some visitors may be inherently more interested in the exhibition environment than others. In order to explore this further, a question was added to the final questionnaire: “I don’t really pay attention to the exhibition environment – I just like to look at the exhibits” on a seven-point Likert scale ranging from Strongly Disagree (= 1) to Strongly Agree (= 7). The overall spread of responses

---

53 It should be noted that these models of visitor engagement have been developed primarily in the context of evaluating hands-on exhibits, where engagement is more readily translated into readily observable behaviours (e.g., starting the activity, completing the activity, repeating the activity, etc.). In the context of more traditional displays, there are fewer overt behaviours to indicate engagement. In many instances, time spent looking at a display may be the only observable indicator.

54 The coding protocol used was designed with the intent of evaluating and comparing the performance of specific exhibits, rather than the behaviour of individual visitors in a given gallery. The limitations of this approach with respect to the goals of this study became apparent during analysis.
is shown in Figure 5.13. On the basis of responses to this question, participants were divided into three categories:

- Environment Focused (EF, \( n = 194 \), or 32% of all responses to the item): respondents who scored 1 (Strongly Disagree) or 2 (Disagree)
- Neutral (N, \( n = 310 \), 52%): respondents who scored 3 (Slightly Disagree) to 5 (Slightly Agree)
- Not Environment Focused (NEF, \( n = 95 \), 16%): respondents who scored 6 (Agree) or 7 (Strongly Agree).

**Figure 5.13.** Histogram plot of Environment Focused (EF), Neutral (N), and Not Environment Focused (NEF) visitors based on response to the statement “I don’t really pay attention to the exhibition environment – I just like to look at the exhibits”.

There were no statistically significant differences across the groups according to age, visit history or visit group. Females were over-represented in the EF group (\( \chi^2 = 8.539, p = 0.014 \)), although interestingly Facilitators (who generally were more likely to be female) were less likely to be EF and more likely to be Neutral (\( \chi^2 = 21.058, p = 0.021 \)). This suggests that Non-Facilitator women are even more likely to be EF. In terms of exhibitions visited, EF visitors were over-represented in
Aboriginal Gallery (both floors) but under-represented in all the other galleries ($\chi^2 = 15.24$, $p = 0.018$).

### 5.4.1 Comparing Atmospheric Perceptions by Environment Focus

There were significant differences between EF visitors and other visitors on the Perceived Atmosphere dimensions, with EF visitors giving higher average scores overall (Table 5.18). EF visitors’ ratings of Vibrancy and Spatiality were significantly different from the other two groups as confirmed by ANOVA ($F(2,561) = 10.748$, $p < 0.001$ and $F(2,576) = 6.329$, $p = 0.002$ respectively) and post-hoc tests (Tukey’s HSD). There was also a significant difference on ratings of Order $F(2,577) = 9.943$, $p < 0.001$, although on post-hoc tests it was only Environment Focused and Neutral that were significantly different. There were no statistically significant differences between groups on ratings of Theatricality.

**Table 5.18. Perceived Atmosphere comparisons of EF, N and NEF visitors.**

<table>
<thead>
<tr>
<th>Environment Focused (EF)</th>
<th>Neutral (N)</th>
<th>Not Environment Focused (NEF)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Vibrancy</td>
<td>4.6</td>
<td>1.12</td>
</tr>
<tr>
<td>Spatiality</td>
<td>5.21</td>
<td>1.13</td>
</tr>
<tr>
<td>Order</td>
<td>5.41</td>
<td>1.06</td>
</tr>
<tr>
<td>Theatricality</td>
<td>4.1</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Two-way ANOVA confirmed there was no significant interaction between Environment Focus and Exhibition Gallery for any of the Perceived Atmosphere measures. The respective main effect sizes for each independent variable are summarised in Table 5.20. Environment Focus had a statistically significant main effect on each of the atmospheric dimensions, although the effect size was smaller than that of Exhibition Gallery for all except Order, for which there were no significant differences between galleries (as shown in Section 5.2.1.3 above). This suggests that while Environment Focus explains some of the variance in atmospheric perception, Exhibition Gallery remains a stronger predictor of Vibrancy, Spatiality and Theatricality.
Table 5.19 Summary of the significance and effect size of the main effects by two-way ANOVA. The Perceived Atmosphere dimensions were each used as dependent variables with Environment Focus (EF, N and NEF) and Exhibition Gallery (Aboriginal-G, Aboriginal-1, Pacific, Biodiversity) being the independent variables.

<table>
<thead>
<tr>
<th></th>
<th>Vibrancy</th>
<th>Spatiality</th>
<th>Order</th>
<th>Theatricality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment Focus</strong></td>
<td>p&lt;0.001</td>
<td>p = 0.008</td>
<td>p&lt;0.001</td>
<td>p = 0.030</td>
</tr>
<tr>
<td>Significance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect size (Partial $\eta^2$)</td>
<td>0.043</td>
<td>0.017</td>
<td>0.033</td>
<td>0.013</td>
</tr>
<tr>
<td><strong>Exhibition Gallery</strong></td>
<td>p&lt;0.001</td>
<td>p = 0.001</td>
<td>N.S.</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Significance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect size (Partial $\eta^2$)</td>
<td>0.076</td>
<td>0.030</td>
<td>N.A.</td>
<td>0.331</td>
</tr>
</tbody>
</table>

5.4.2 Relationship Between Perceived Atmosphere and Affective/Cognitive Responses for EF, N and NEF Visitors

Comparing correlations between Perceived Atmosphere, Affective and Cognitive Responses for EF, N, and NEF visitors supports the notion that the three groups are distinct populations with respect to how they perceive the exhibition environment and how this relates to their experience. For EF visitors, there were strong positive correlations between Cognitive Engagement and Vibrancy, Order and Spatiality (Table 5.20a), indicating that EF visitors felt more cognitively engaged in spaces they perceived to be more vibrant, spacious and ordered. On the other hand, for NEF visitors, the only strong correlation was Cognitive Engagement*Vibrancy. There was a weak but statistically significant correlation with Order ($r = .28$, $p = 0.008$) and no correlation with Spatiality for NEF visitors. This suggests that EF visitors are particularly sensitive to an exhibition’s spaciousness, and feel less cognitively engaged in less spacious environments. There were similar patterns when comparing the relationship between Perceived Atmosphere and Affective Engagement of the respective groups (Table 5.20b). EF visitors were also more Relaxed in spacious environments ($r = .53$, $p<0.001$) whereas there was no relationship between Spatiality and Relaxation in NEF visitors ($r = .16$, $p = 0.13$).

In addition to EF visitors reporting a stronger relationship between Perceived Atmosphere and affective/cognitive response, there is more inter-correlation between the response measures of EF visitors. For instance while there was a significant negative correlation between Cognitive Engagement and Cognitive Overload for all groups, this was stronger for EF visitors (Table 5.20a). In contrast, NEF visitors show weaker levels of correlation and fewer significant inter-correlations overall (Table 5.20a-c). In summary, it appears the experience of NEF visitors is less affected by
the exhibition environment, and that NEF visitors’ atmospheric perceptions, affective and cognitive responses are more independent of one another.

Table 5.20a. Bivariate correlations for Cognitive Engagement, comparing EF, NEF and N visitors. Significance values are 2-tailed. *denotes correlation is significant at the 0.05 level; ** denotes significance at the 0.001 level.

<table>
<thead>
<tr>
<th></th>
<th>Vibrancy</th>
<th>Order</th>
<th>Spatiality</th>
<th>Affective Engagement</th>
<th>Relaxation</th>
<th>Displeasure</th>
<th>Cognitive Overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Engagement (EF)</td>
<td>$r =$ .79**</td>
<td>.56**</td>
<td>.59**</td>
<td>.83**</td>
<td>.59**</td>
<td>-.43**</td>
<td>-.62**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Cognitive Engagement (N)</td>
<td>$r =$ .67**</td>
<td>.41**</td>
<td>.20**</td>
<td>.68**</td>
<td>.43**</td>
<td>-.40**</td>
<td>-.57**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Cognitive Engagement (NEF)</td>
<td>$r =$ .61**</td>
<td>.28**</td>
<td>.19</td>
<td>.63**</td>
<td>.20</td>
<td>-.17</td>
<td>-.30**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>.008</td>
<td>.079</td>
<td>&lt;.001</td>
<td>.061</td>
<td>.117</td>
<td>.003</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.20b. Bivariate correlations for Affective Engagement, comparing EF, NEF and N visitors. Significance values are 2-tailed. *denotes correlation is significant at the 0.05 level; ** denotes significance at the 0.001 level.

<table>
<thead>
<tr>
<th></th>
<th>Vibrancy</th>
<th>Order</th>
<th>Spatiality</th>
<th>Relaxation</th>
<th>Displeasure</th>
<th>Cognitive Engagement</th>
<th>Cognitive Overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective Engagement (EF)</td>
<td>$r =$ .72**</td>
<td>.49**</td>
<td>.51**</td>
<td>.68**</td>
<td>-.54**</td>
<td>.83**</td>
<td>-.58**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Affective Engagement (N)</td>
<td>$r =$ .56**</td>
<td>.39**</td>
<td>.24**</td>
<td>.59**</td>
<td>-.49**</td>
<td>.68**</td>
<td>-.45**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Affective Engagement (NEF)</td>
<td>$r =$ .37**</td>
<td>.28**</td>
<td>.17</td>
<td>.38**</td>
<td>-.25*</td>
<td>.63**</td>
<td>-.24*</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>.009</td>
<td>.107</td>
<td>&lt;.001</td>
<td>.020</td>
<td>&lt;.001</td>
<td>.020</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.20c. Bivariate correlations for Relaxation, comparing EF, NEF and N visitors. Significance values are 2-tailed. *denotes correlation is significant at the 0.05 level; ** denotes significance at the 0.001 level.

<table>
<thead>
<tr>
<th></th>
<th>Vibrancy</th>
<th>Order</th>
<th>Spatiality</th>
<th>Affective Engagement</th>
<th>Displeasure</th>
<th>Cognitive Engagement</th>
<th>Cognitive Overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation (EF)</td>
<td>$r =$ .47**</td>
<td>.42**</td>
<td>.53**</td>
<td>.68**</td>
<td>-.70**</td>
<td>.59**</td>
<td>-.46**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Relaxation (N)</td>
<td>$r =$ .31**</td>
<td>.33**</td>
<td>.33**</td>
<td>.59**</td>
<td>-.62**</td>
<td>.43**</td>
<td>-.42**</td>
</tr>
<tr>
<td>$p =$ &lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Relaxation (NEF)</td>
<td>$r =$ .05</td>
<td>.23*</td>
<td>.16</td>
<td>.38**</td>
<td>-.65**</td>
<td>.20</td>
<td>-.20</td>
</tr>
<tr>
<td>$p =$ .634</td>
<td>.035</td>
<td>.129</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>.061</td>
<td>.052</td>
<td></td>
</tr>
</tbody>
</table>
5.4.3 Comparing Experience Measures for EF, N and NEF Visitors

Comparison of the three groups’ responses to the Experience Measures adjective checklist suggests that EF visitors had a richer and more positive experience overall, with EF visitors reporting a higher than average score on all experience dimensions except Tension (Figure 5.14). In contrast, the experience of NEF visitors was below the mean for all dimensions except Autonomy, Physical Activity and Tension. However, not all these differences were statistically significant. The following dimensions showed statistically significant differences by one-way ANOVA:

- Attention $F(2,595)= 7.519$, $p = 0.001$, $\eta^2= 0.028$
- Aesthetic Appreciation $F(2,595)= 8.466$, $p < 0.001$, $\eta^2= 0.028$
- Excitement $F(2,595)= 5.888$, $p = 0.003$, $\eta^2= 0.019$
- Privilege $F(2,595)= 4.555$, $p = 0.011$, $\eta^2= 0.015$
- Compassion $F(2,595)= 3.669$, $p = 0.026$, $\eta^2= 0.012$
- Connection $F(2,595)= 4.699$, $p = 0.009$, $\eta^2= 0.016$
- Autonomy $F(2,595)= 3.178$, $p = 0.042$, $\eta^2= 0.011$

Thus it appears that EF visitors have a richer and more intense experience overall, with the exhibition environment playing a greater role in shaping that experience. Schreiber and Pekarik (2014) have described a cluster of visitors who report strong responses on all dimensions of the Satisfying Experiences framework, upon which the Experience Measures were initially based (Packer et al., 2013; Pekarik et al., 1999; Schreiber & Pekarik, 2014). However this cluster constituted only 3% of the sample (Schreiber & Pekarik, 2014), which is a much smaller proportion of visitors than proportion of visitors in the EF category (over 30%).
Figure 5.14. Visual comparison of the visitor experience dimensions of EF, N and NEF visitors.
5.4.4. Who are the Environment Focused Visitors?

While these results indicate marked differences between the experiences of visitors depending on their Environment Focus, the basis for this difference is open to conjecture. Female visitors (particularly Non-Facilitator females) were more likely to be EF, but besides this the groups were demographically similar. Facilitators were somewhat under-represented in the Environment Focused group, but there were no other marked relationships between Environment Focus and visit motivation. Although history of visiting SA Museum is comparable across the groups, it is possible that EF, N and NEF visitors differ on the basis of more general museum-going habits. Yellis (2010) has described a subset of visitors whom he called the “museum adept”. Museum adept visitors tend to report more vivid and emotionally rich experiences and assign considerable importance to the museum’s physical environment, including colour, spaciousness and attention to detail in presentation. However, such museum-adept visitors were described as being a “minority of a minority” of museum visitors (Yellis, 2010, p. 90), whereas in this study over 30% of visitors were categorised as EF\textsuperscript{55}. Thus while it would be reasonable to surmise that museum-adept visitors would be among the EF population, EF visitors would seem to be a broader category than the museum adept visitors described by Yellis.

Other factors that were beyond the scope of this study (e.g. interest in subject matter vs. interest in design or area of professional expertise) may be related to how influenced visitors feel by the exhibition environment. Prior expectations have been shown to be significant predictors of reported experience in museum exhibitions (Pekarik & Schreiber, 2012). In this context, self-reported interest in the exhibition environment could be interpreted as a manifestation of visitor expectations, with those visitors who expect to take an interest in the exhibition environment being those who are most affected by it. Similarly, frameworks for visitor preferences such as the IPOP model described in Section 2.16.2.2 (Pekarik et al., 2014) may help predict which visitors are more likely to focus on the exhibition environment. Visitors are fairly evenly distributed among the four IPOP categories; across an aggregated sample some 18% of visitors had an Idea preference, 18% People, 19% Object, 23% Physical, and 21% had no single preference (Pekarik et al., 2014). None of these map in any obvious way onto EF visitors, although there could possibly be a link between EF and the aesthetic preference of Object visitors or the emphasis on sensory experiences of Physical visitors.

\textsuperscript{55} The number of visitors who strongly disagreed with the defining statement was 49, or 8% of the total sample. This group, which could be denoted the Very Environment Focused, or VEF, did not appear to have marked differences from the broader EF sample in this study.
Another possible basis for the observed differences is the moderating role of personality. In the S-O-R model, personality factors such as arousal-seeking tendency moderate the emotional response to the environment (Mehrabian & Russell, 1974b). Arousal-seeking tendency is the preference for complex or novel environments (i.e., those rich in arousing stimuli) over those that are more calm or predictable. In a video simulation study, arousal-seeking tendency was found to increase the intensity of emotional response to arousing vs. non-arousing servicescapes (Lin & Worthley, 2012). The same study also investigated the personality dimensions of Openness and Extraversion, although no relationship with emotional response was found. However, the scope of the study was somewhat limited (video simulations of different hotel environments). Openness encompasses curiosity, receptiveness to new experiences, aesthetic sensitivity, emotional self-awareness and preference for novelty (García, Aluja, García, & Cuevas, 2005). This description is consistent with the more intense experience reported by EF visitors, and it is possible that EF visitors would score more highly on the Openness dimension than N or NEF visitors.

Further characterising EF and NEF visitors and relating them to personality factors or visitor typologies is beyond the scope of this study but nonetheless offers an interesting avenue for future research.
5.5 Summary of Findings from Phase 3

Using the results from 602 participants who completed the Atmosphere and Experience Questionnaire, this phase of the study has:

- identified four key dimensions of Perceived Atmosphere: Vibrancy, Spatiality, Order and Theatricality, and demonstrated that these dimensions provide a more nuanced perspective on the exhibition environment than simple expressions of preference
- related Perceived Atmosphere to the affective, cognitive and behavioural aspects of the visitor experience, demonstrating that: Vibrancy and Spatiality are predictors of Affective and Cognitive Engagement; Vibrancy is a predictor of Attentional Engagement; Spatiality is a predictor of Relaxation; and Order is negatively correlated with Cognitive Overload
- identified a subset of visitors for whom the exhibition environment is particularly salient – the Environment Focused visitors.

In addition, tracking and timing studies of 238 visitors identified patterns in visitor behaviour across three exhibition spaces that were broadly interpretable in light of the physical characteristics of each gallery. Furthermore, patterns of Attentional Engagement echoed participant behaviour observed during the accompanied visits in Phase 1 of this study, in particular the role of exhibit labelling in converting initial attention to deeper level engagement.

The following final chapter will integrate the results from both qualitative and quantitative phases of the study, relate them to relevant theory, and address the implications and limitations of the findings.
Chapter 6: Conclusions

6.1 Introduction – Overview of Research Presented in this Thesis

The overarching purpose of this study was to explore and analyse perceptions of the exhibition environment, and the role of this “Perceived Atmosphere” in the visitor experience. It has been informed by the literature in cultural tourism, museum studies, environmental psychology and retail atmospherics. A review of this literature as presented in Chapter 2 demonstrated a general recognition that the exhibition environment plays an important role in the overall way visitors experience and subsequently recall museums. However, it also revealed that empirical research directly addressing visitor perceptions of the exhibition environment is limited. It is this gap in the literature that this study set out to address.

Acknowledging the relatively early stage of theory development in this area, research followed a sequential mixed methods research protocol (Ivankova et al., 2006) as described in Chapter 3. Results of the qualitative and quantitative phases of the study were presented and discussed in Chapters 4 and 5 respectively. The initial qualitative phase of research underscored findings from previous studies that had demonstrated that the exhibition environment is an important aspect of the overall visitor experience. Results from the qualitative study were subsequently used to inform the development of a survey instrument for quantifying Perceived Atmosphere. In the final and largest stage of the study, this instrument was incorporated into a survey designed to explore the relationship between Perceived Atmosphere and self-reported measures of experience. Results from this survey were complemented by observational studies in the same galleries, to allow some preliminary insight into the relationship between Perceived Atmosphere and observable behaviour.

As described at the conclusion of the literature review, the research was guided by a museum atmospherics model, based upon Kotler’s (1974) model for atmospherics in the retail environment. Specifically, the study has concentrated on the relationship between Perceived Atmosphere and visitor responses in the cognitive, affective and behavioural domains. Based on the results arising from this research, the model has been modified from the museum atmospherics model presented in Figure 2.9 and updated in light of the results from this study (Figure 6.1). Perceived Atmosphere is a consequence of both the physical characteristics of the environment as well as personal goals and expectations of the visitor. In particular, self-reported interest in the exhibition environment increases the salience of Perceived Atmosphere and amplifies its effect on the visitor experience.
Perceived Atmosphere has been shown to comprise four main dimensions, three of which (Vibrancy, Spatiality and Order) influence the visitor experience on affective and cognitive levels. Vibrancy has the strongest influence on affective and cognitive engagement, as well as also having a detectable effect on visitor behaviour. Qualitative research offered some insight into the processes by which Perceived Atmosphere influences visitor responses, supporting the Attention, Message and Affect processes described by Kotler (1974). The significance, implications and limitations of this revised model will be discussed in greater depth throughout this chapter.

Figure 6.1. Revised Museum Atmospherics Model.
6.2 Summary of Key Findings

6.2.1 Introduction: Review of Research Aims

As set out in Chapter 1 of the thesis, this research was guided by three main aims:

- to explore visitors’ perceptions of exhibition environments
- to develop an instrument to measure Perceived Atmosphere and identify its underlying dimensions
- to characterise relationships between this Perceived Atmosphere and visitor experience, as measured through visitors’ self-report responses and observable behaviour.

The research program described briefly in Section 6.1 and in detail in Chapter 3 was developed in order to address these aims. To highlight the main results, the following sections present five key findings that emerged from this study.

6.2.2 Key Finding 1: Visitors Use Atmospheric Cues in the Exhibition Environment as Tools for Navigation and Meaning-making

Two distinct approaches were used to study visitor perceptions of the exhibition environment: a qualitative, exploratory study based on accompanied visits to exhibition galleries; and a quantitative study based on the Perceived Atmosphere Instrument developed as part of this research. Both qualitative and quantitative studies confirmed that how visitors perceive the exhibition environment influences their engagement with it. Accompanied visits offered an in-depth insight into how elements of the exhibition environment influence visitors’ experiences in both an overt interpretive sense as well as on a more tacit level. Visitors made use of atmospheric cues both to navigate the exhibition environment as well as to make sense of individual exhibits. Visitors were sensitive to the perceived spaciousness of gallery spaces, with lighting influencing both perceptions of space as well as the overall feel of the exhibition. These findings reinforce previous lighting studies (Custers et al., 2010) as well as provide evidence for Stenglin’s (2004, 2009) theory of lighting either binding or unbinding space. This research also demonstrated that display features which offered visual complexity while retaining an overall sense of organisation were likely to attract and hold visitor attention. These results confirm previous studies (Packer, 2008, 2014; Roppola, 2012; Schorch, 2013), and suggest considerations for exhibition design (Section 6.3.1). Where this research makes an original contribution is by combining such qualitative insights with quantitative analyses that further characterise how specific features of the exhibition environment relate to
various facets of the exhibition experience. Central to the generation of these novel insights is the development of the Perceived Atmosphere Instrument, which is discussed in the next section.

6.2.3 Key Finding 2: Perceived Atmosphere Comprises Four Dimensions: Vibrancy, Spatiality, Order and Theatricality

At the outset of the study, Perceived Atmosphere was hypothesised to comprise three main dimensions: Design Appearance, Spatiality and Information Rate. Guided by this hypothesis and drawing upon the qualitative research phase, literature review and a phase of piloting, a Perceived Atmosphere Instrument was developed based on 30 semantic differential items. Of these items, 22 were found to load significantly on one of four factors identified through exploratory factor analysis, and these were interpreted as Vibrancy, Spatiality, Order and Theatricality. The relationship between these factors and the hypothesised dimensions was shown in Figure 5.1. Briefly, Vibrancy encompasses several Design Appearance variables; Order incorporates elements of Information Rate; Theatricality comprises a mixture of Design Appearance and Information Rate; and Spatiality is essentially as hypothesised.

Three of the four emergent Perceived Atmosphere factors, Vibrancy, Spatiality and Order, reflect environmental concepts that have been identified elsewhere in the literature and are consistent with theories of environmental cognition and appraisal. These three dimensions proved useful in characterising different exhibition environments and relating specific aspects of Perceived Atmosphere with the visitor experience, as will be discussed further in Section 6.2.5 below. The fourth factor, Theatricality, has no clear parallel in the literature, and furthermore has no relationship with any measure of visitor experience used in this study. Rather than representing a meaningful latent construct of Perceived Atmosphere, the grouping of items into the Theatricality factor may be a consequence of co-varying features of the specific exhibition sites used in this study. For instance, the most traditional gallery was the only one with appreciable natural light levels. Such specific groupings may be masking more meaningful constructs that could be represented by these items. Further application of the Perceived Atmosphere Instrument in a wider variety of exhibition settings will be required to establish whether this is indeed the case, as well as to confirm the broader validity of the Vibrancy, Spatiality and Order dimensions.

Overall, this study has demonstrated that quantifying Perceived Atmosphere in an exhibition setting is technically feasible, theoretically coherent and capable of providing novel and useful insights into the environment-experience relationship.
6.2.4 Key Finding 3: The Perceived Atmosphere Instrument Can Be Used to Characterise Exhibition Environments

There were statistically significant differences between the exhibitions in this study with respect to perceptions of Vibrancy, Spatiality and Theatricality; all galleries in this study were perceived to be similarly Ordered. To represent this visually, each of the galleries has been plotted on a Vibrancy x Spatiality grid (Figure 6.2), since in this study Vibrancy and Spatiality emerged as the most significant Perceived Atmosphere dimensions with respect to predicting visitor experience. Such an approach provides a simple and novel way of characterising and comparing different exhibition environments at a glance, based on how they are perceived by visitors. Mapping exhibitions by their Vibrancy and Spatiality properties is not to discount the role of Order, which could be added as a third dimension to such plots as more data comes to light. All exhibitions in this study were perceived to be of moderate to high Order, and it may be the case that a perception of Order is an essential prerequisite for visitor engagement. Indeed, many ‘ideal’ exhibit attributes are related to clarity (Alt & Shaw, 1984).

As exhibitions have been benchmarked according to behavioural measures such as SRI and %DV (Serrell, 1998), the Perceived Atmosphere Instrument could be used to benchmark exhibitions based on their atmospheric characteristics. As the number of exhibitions that have been characterised by Perceived Atmosphere increases, so will the robustness of relating these characteristics to different aspects of the visitor experience.
Figure 6.2. Diagram mapping the four exhibitions according to their Vibrancy and Spatiality scores. The origin of each axis represents the mean score for the overall sample.

The focus of this research was on the relationship between Perceived Atmosphere and the visitor experience rather than a detailed analysis of the factors that can influence Perceived Atmosphere in a given setting. Nonetheless, this research has provided some preliminary insights into which environmental features are most important for shaping atmospheric perceptions in an exhibition setting.

The measure of Spatiality offered the most insights into the relationship between environmental properties and perceived atmosphere, since physical features such as gallery size and ceiling height were clearly definable for the spaces being studied. On this measure, the Perceived Atmosphere Instrument was capable of distinguishing between two gallery spaces of essentially identical content and design (Aboriginal-G and Aboriginal-1) when their Spatiality scores were compared by independent samples t-test. The main physical differences between these spaces is a lower ceiling clearance in Aboriginal-G, and differences in layout, such that visitors to Aboriginal-G tend to
move around the edges of the gallery, whereas in Aboriginal-1 the main visitor traffic is through the centre of the space. It is likely that these differences account for the lower perception of Spatiality in Aboriginal-G. Thus, reported measures of Spatiality can be predicted and explained based on known physical characteristics of the exhibition environment, supporting the validity of the Spatiality scale.

However, such physical differences were insufficient to explain the Spatiality perceptions of all galleries. In particular, the Pacific Gallery, the only gallery with appreciable levels of natural light and the gallery with the highest ceiling clearance, was not significantly different from Aboriginal-1 with respect to Spatiality. Thus it appears that it is not just the physical properties of the environment, but also the affordances of that space, reflected in terms such as isovist size, that inform perceptions of Spatiality.

It is also worth noting that in this study, visitors were asked to describe the environment they had just visited - they were not comparing different galleries with one another. Other studies on perceptions of spaciousness have been based on participants making direct comparisons between environments, usually as images or simulations (Stamps, 2010). It is possible that this method may reveal differences in spatial perceptions in finer detail. In contrast, when participants are rating only a single space, Spatiality scores may plateau once the perceived level of spaciousness reaches the point of “maximum utility” in terms of affordances of that space. This may account for the lack of Spatiality difference between Aboriginal-1 and the Pacific Gallery in this study.

6.2.5 Key Finding 4: The Atmospheric Dimensions of Vibrancy, Spatiality and Order are Predictors of Affective Engagement, Cognitive Engagement and Relaxation

Vibrancy, Spatiality and Order were all positively correlated with Affective and Cognitive Engagement as well as with Relaxation. They were negatively correlated with Displeasure and Cognitive Overload. Multiple regression analyses demonstrated that Vibrancy was the strongest independent predictor of both Affective and Cognitive Engagement. Spatiality was an independent predictor of Relaxation, and Order was a negative predictor of Cognitive Overload.

In terms of understanding the visitor experience, the dimensions of Vibrancy and Spatiality appear to be the most functionally significant. To illustrate this, both demonstrated and putative relationships between Vibrancy/Spatiality and different types of visitor experience are summarised visually in Figure 6.3.
Figure 6.3. Key relationships between the Perceived Atmosphere of Vibrancy and Spatiality and visitor experience. (N.B. Here the origin of the axes is taken to be the neutral score for each scale, and thus the quadrants of this diagram are not directly comparable to those in Figure 6.2 above.)

Vibrancy is the strongest predictor of both Cognitive and Affective engagement, therefore Engagement (shown in Figure 6.3 in green) is more likely in exhibits that are perceived to be more vibrant. Spatiality is not a strong independent predictor of Engagement, however given Spatiality’s relationship with Relaxation, it is possible that if Spatiality becomes too low, the exhibition environment may start to be perceived as tense or overwhelming (red region). It also follows that environments that are perceived to be more spacious will be more likely to be restorative (blue region). The optimal level of Vibrancy for restoration is not clear from this study, but based on the literature (Packer, 2014) it is hypothesised that a moderate level of Vibrancy will be restorative. It is possible that high Spatiality/low Vibrancy environments could also be restorative (shown in dotted lines in Figure 6.3), although this would need to be tested by research in settings that meet these criteria. Disengagement or boredom (purple region) is the most likely outcome from environments that are perceived to be low in both Vibrancy and Spatiality.
In terms of the exhibitions used in this study, the Biodiversity Gallery had the highest Vibrancy score ($M = 4.79$) and lowest Spatiality score ($M = 4.78$). This positions Biodiversity in the upper left of the green Engagement area of Figure 6.3. Indeed, visitors to Biodiversity reported the highest mean scores for Affective and Cognitive Engagement ($M = 5.02$ and $M = 5.16$ respectively), although the difference between these and the affective/cognitive scores of other galleries did not always reach statistical significance. The two Aboriginal galleries had moderate Vibrancy and moderate-high Spatiality scores, positioning them either in the lower right of the green area or the upper portion of the blue Restoration area. The Pacific gallery was the only gallery with a Vibrancy score below the neutral score of four ($M = 3.95$), likely positioning it within the lower portion of the blue area. However, evidence that the Aboriginal and Pacific exhibitions were considered restorative is equivocal. There was no statistically significant difference between galleries with respect to Relaxation, which is anticipated to be an indicator of restoration, although visitors to Aboriginal-1 reported the highest level of Peacefulness (another restoration indicator) in the Experience Measures checklist. With respect to the Pacific Gallery, the qualitative study revealed that visitors were divided: some found its traditional layout comforting, others found it off-putting (Section 4.4). In the larger quantitative study, such opposing views may have cancelled one another out somewhat. In any case, only a very small proportion of the visitors in this study had come to the museum seeking a restorative experience (7.5% were classified as Rechargers), so this particular sample may not be conducive to a detailed analysis of restorative environments in a museum context.

6.2.5.1 Vibrancy is a Predictor of Visitors’ Attentional Engagement

To supplement self-report measures, discreet tracking and timing was used to study visitor behaviour, specifically attentional engagement, in the galleries of interest. As well as tracking the overall route visitors took through the gallery, time spent at exhibits was recorded and coded as Attentional Engagement. This approach was able to provide an overall indication of visitor behaviour in each of the galleries of interest, and the results supported the qualitative and quantitative phases of the study in a general sense.

A subset of 60 of the tracked visitors completed the Atmosphere and Experience Questionnaire, allowing relationships between Perceived Atmosphere and Attentional Engagement to be explored. Vibrancy was the only atmospheric dimension shown to have any relationship to observed visitor behaviour, with Vibrancy being correlated with Dwell Time and other time-based indicators of Attentional Engagement derived from this observation protocol.
6.2.6 Key Finding 5: There is a Subset of Visitors, the Environment Focused Visitors, for Whom the Exhibition Environment is Particularly Salient

Perceived Atmosphere is not significantly influenced by visitor age, gender or frequency of visiting the museum. Nonetheless, both the qualitative and quantitative phases of research demonstrated that some visitors find the environment to be a more salient feature of the exhibition than others. In itself this is not a surprising finding, given that it reflects studies in retail environments in which shoppers with different motivations vary in the attention they give to the atmospheric dimensions of their experience (Gilboa & Vilnai-Yavetz, 2013). However, this study revealed evidence that attention to the environment may vary according to intrinsic visitor characteristics and not just prior motivation. For instance, the qualitative study was based on pre-arranged accompanied visits, so visit motivation in the usual sense was not applicable. Only a subset of these participants made unprompted reference to design features such as lighting, layout and colour during the accompanied visits, although all 13 were able to describe and reflect upon the different exhibition environments during the debrief interviews. Similarly, in the quantitative phase of the study, a subset of visitors were denoted as Environment Focused (EF) visitors based on disagreement with the statement “I don’t really pay attention to the exhibition environment – I just like to look at the exhibits”. As described in Section 5.6, there was a remarkable difference between EF visitors and others whose response to the same statement was either agreement or more equivocal. EF visitors were more sensitive to the exhibition environment, and there was a markedly stronger relationship between Perceived Atmosphere and the affective and cognitive responses of EF visitors. This was an unexpected finding, not anticipated at the outset of the study. It is not clear what distinguishes EF visitors from other visitors, although it could be that EF visitors have a different personality profile, or that they have specific prior interests or expectations of their museum experience that predispose them to be more responsive to the exhibition environment.

Although these possibilities are intriguing, it is also conceivable that the EF categorisation is at least partly a consequence of the research method itself. It has been shown previously that there are cultural differences with respect to how respondents complete Likert scales (particularly between Western and Asian cultures), although these differences do not necessarily have a significant bearing on the conclusions that can be drawn from such studies (Lee, Jones, Mineyama, & Zhang, 2002). In this research, participants were not asked to specify their cultural background although observations made during data collection suggest that the majority were from a Western cultural context. This suggests that cultural differences are not a significant factor in this instance. However, personality differences can also influence the way respondents complete surveys (Podsakoff, MacKenzie, & Podsakoff, 2012). It is possible that EF visitors have a tendency to respond at the
extreme ends of a Likert scale, and thus their reported stronger atmospheric perceptions and experiences are a consequence of this response style rather than their more sensitive perceptions and reactions to the exhibition environment. The pattern of responses tends to reduce the likelihood that EF visitors are simply an artefact of response bias. Nonetheless, excluding response bias should be a consideration in any further research.

6.3 Significance and Contribution of this Research

6.3.1 Practical and Methodological Applications

6.3.1.1 The Perceived Atmosphere Instrument as a Design and Evaluation Tool

The Perceived Atmosphere Instrument provides a new way for designers and researchers to investigate different exhibition environments from a visitor-centred perspective. The instrument is simple to administer and sufficiently brief to be able to be used in conjunction with other measures of interest. Perceived Atmosphere offers a way of relating observed physical characteristics of an exhibition gallery to what visitors notice and find salient about the environment. This can help inform and improve exhibition design by helping focus refurbishments and improvements in those areas that are most likely to have an impact on the visitor experience. Perceived Atmosphere may also be useful for evaluating alternative layouts within temporary exhibition galleries.

While Vibrancy, Spatiality and Order are concepts that are grounded in environmental psychology, they can be easily understood on an intuitive level by designers, educators, curators, audience advocates and others who are not necessarily acquainted with theories of psychology, linguistics or architecture. They therefore offer a contribution to the shared language that has been called for by exhibition planners (Macdonald, 2007). They represent tangible properties of an exhibition space that exhibition planners can aim for, and provide a means by which these properties can be discussed during the design process. Vibrancy in particular has been shown to be a predictor of both affective and cognitive engagement, and it helps build the case that creating a sense of activity in a space (through use of colour and incorporating a variety of display styles) is worth the extra effort and expenditure. Furthermore, unlike other concepts that have been proposed to inform a shared language, such as binding theory, Perceived Atmosphere dimensions are able to be measured. This helps close the loop between what a designer sets out to achieve and what the visitor ultimately experiences.
Plotting exhibition environments according to their predicted or observed Vibrancy, Spatiality and Order characteristics is a way that Perceived Atmosphere may be used as both a planning and evaluation tool. During the planning stages, different exhibition environments could be mapped in terms of what the desirable combinations of Vibrancy, Spatiality and Order would be, depending on the type of experience intended (e.g., Active Engagement, Restorative, Tense/Dramatic). As well as giving cues as to what design properties might lead to these outcomes, the resulting environments could be assessed by Perceived Atmosphere as a form of subsequent evaluation and ongoing refinement. Such an approach could also be used to ensure there is an appropriate balance of environments across a whole museum.

### 6.3.1.2 Implications for Exhibition Design

Both the qualitative phase of research and the study of the Perceived Atmosphere-visitor experience relationship have implications for designing spaces that optimise visitor comfort and affective/cognitive engagement. Preferred exhibition environments are those which are perceived as vibrant: rich in sensory stimuli, active, three-dimensional, colourful, dynamic and energetic. However, this must be balanced with an overarching sense of order that allows visitors to rapidly make sense of their environment (all exhibitions in this study had a mean Order score exceeding five, which is moderate-high on a maximum-seven scale). Some recommendations for exhibition design emerged from the qualitative research and were presented in Section 4.7.1. These were reinforced by the quantitative research, which demonstrated that the atmospheric properties of Vibrancy, Spatiality and Order all positively correlate with self-reported measures of Affective and Cognitive Engagement.

By the measures used in this study, high Vibrancy/high Spatiality environments are those which are most conducive to affective and cognitive engagement (Figure 6.3). This suggests exhibition design should make use of colour and a variety of displays to help attract attention as well as to conceptually organise the space. It also indicates that long sight lines can be advantageous in aiding visitors navigate the environment and stay in visual contact with their companions. Meanwhile, low Spatiality/high Vibrancy environments are likely to be tense and dramatic spaces. This may be desirable in certain circumstances, for instance to create a theatrical effect, but this research indicates that this combination should be used sparingly, where it can be balanced with more spacious areas that can restore a sense of ease in the environment. Low Vibrancy/high Spatiality environments may be most suitable for offering a space to recharge and refresh, for instance museum lobbies and gathering spaces. Low Vibrancy/low Spatiality spaces are likely to be
unattractive environments, but this could be used as a deliberate strategy to discourage visitors to dwell in certain areas (such as access corridors) for operational reasons.

6.3.2 Theoretical Contributions

6.3.2.1 Conceiving Atmospheres on a “Macro” Level

As was argued in Part 2 of the literature review, a limitation of existing atmospherics research is its emphasis on simulated environments and the study of isolated variables rather than exploration of the perceived atmosphere as a gestalt: “There is a need for a more ‘macro’ level theory that would explain how consumers process the entire atmosphere, which can often send competing or deviant signals, and form some evaluation of it” (Turley & Milliman, 2000, p. 208). It was in order to address this gap that Vogels developed the Atmosphere Metrics approach (Vogels, 2008b) upon which this study is based. This research has extended that approach and applied it to the museum context, providing a way of studying how the “competing or deviant signals” of the exhibition environment come together. For instance, the construct of Spatiality has revealed a tension in the Pacific Gallery between the physical spaciousness of the environment on the one hand, and the display density or sense of clutter on the other. Thus the Perceived Atmosphere dimensions offer a way of analysing how the various micro aspects of a given space come together in a macro or gestalt sense. This is not to suggest that the exhibit gestalt supplants the study of individual atmospheric variables or exhibit elements. Rather, Perceived Atmosphere offers a further level of analysis of the exhibition space, which can be used to complement and shed further light on such studies.

6.3.2.2 The Affordances of the Exhibition Environment

In studying how visitors perceive and respond to the exhibition environment, this research has demonstrated that exhibition environments are perceived both in terms of their physical properties as well as the affordances of that environment. This reflects an ecological view of environmental psychology as first described by Gibson (1977): Any given environment has multiple potential affordances; those perceived as being salient at any given time will depend on the specific goals of the perceiver. In an exhibition context, affordances can be considered to be the spatial complement of visitor motivations: Motivations inform visitor goals, which in turn shape the way a given space’s affordances will be perceived. This was demonstrated most strikingly in this study by the EF visitors, whose self-reported heightened interest in the exhibition environment appeared to make the environment a more significant aspect of the experience. More broadly, results from this study are consistent with cognitive appraisal theory, in particular goal congruence. Applying concepts of
affordances and cognitive appraisals to the study of exhibition environments allows research into the visitor-exhibition relationship to move beyond the notion that environments deemed to be pleasant are more attractive, and offers a theoretical basis for examining why a certain environment is considered pleasant.

6.3.2.3 Perceived Atmosphere and Museological Theory

This study reinforces and extends existing knowledge and theoretical conceptions of the relationship between visitors and the exhibition environment, in particular Stenglin’s binding theory (2004), Roppola’s semiotics-based theory (2012), Packer’s restoration criteria (2014) and the ‘spatial feeling’ described by Schorch (2013).

The empirical dimensions of Vibrancy and Spatiality share parallels with the ambience factors theorised by Stenglin (2004) as making an environment feel more or less bound. Bright or natural light, open spaces, cool colour schemes and hard finishes are presented as unbinders of space; low lighting, soft finishes, darker, warmer colour schemes and enclosed spaces are spatial binders. Such environmental features are also likely to influence perceptions of Vibrancy and Spatiality. The dimensions of Vibrancy and Spatiality offer some advantages over binding theory as a way of defining exhibition space: Firstly, having two dimensions allows a more detailed characterisation of spaces over the unidimensional spectrum of bound to unbound (as shown in Figure 2.3). For instance, both low Vibrancy/low Spatiality and high Vibrancy/low Spatiality environments could be classified as bound spaces according to the properties defined by Stenglin, but these spaces would have markedly different atmospheric characters. Furthermore, Binding remains a theoretical construct whereas Vibrancy and Spatiality can both be tested empirically in an exhibition setting.

The Perceived Atmosphere dimensions of Vibrancy, Spatiality and Order provide a more detailed environmental basis for the phenomena of resonating and channelling as characterised by Roppola (2012). There are parallels between the environmental features that make an environment more Vibrant and exhibit properties that bring a visitor into a resonant relationship. In the qualitative phase of research, participants used very similar language (i.e., feeling “drawn to” or “caught by” certain exhibits) as the visitors in Roppola’s study. Vibrancy thus gives another insight into exhibit-visitor resonance. Furthermore, Spatiality and Order together give an overall sense of the navigability and coherence of a space which are important predictors of channelling (Roppola, 2012).
6.4 Limitations and Directions for Future Research

This research must be interpreted in light of its limitations. These include the study site, the study sample, the inherent limitations of the research methods used and practical constraints. This section will address these limitations as well as propose future avenues for research.

With the exception of some piloting conducted in Melbourne Museum’s Wild! Gallery, this research was confined to a single study site. Furthermore, for practical reasons, the scope of this study was limited to four gallery spaces, two of which are essentially part of the same exhibition (Aboriginal-G and Aboriginal-1). While this has potential advantages in that it removes audience differences between museums as a potential confounding variable, it also means some results may be site-specific and not applicable to other settings. For instance, the dimension of Theatricality appears to be particular to the SA Museum rather than being a valid atmospheric dimension. Use of the Perceived Atmosphere Instrument across a wider range of sites may resolve the Theatricality factor, possibly revealing another Perceived Atmosphere dimension(s) with greater external validity. While there is sufficient theoretical justification to surmise that Vibrancy, Spatiality and Order will be replicated in other museum contexts, further use of the Perceived Atmosphere instrument in a wider variety of settings is required to confirm this.

The Phase 1 study is based on a relatively small sample size: 12 interviews with 13 participants. While this is not unusually small for a qualitative study, particularly one including think-aloud interviews (Hoppmann, 2007), results should be interpreted with this in mind. For this phase of research, participants were recruited through online survey and thus likely to be regular internet users; those without internet access are beyond the reach of such an approach. Accepting this limitation, the aim of the online recruitment was to select a diversity of participants based on age, gender, scientific background and design knowledge. However, it emerged that many of the participants had a high level of educational attainment, with several also in the process of completing higher degrees (questions about educational levels was not included in the survey). Social media users have been described as being more educated than the general population, although this may be shifting as social media use becomes more mainstream (Frandsen & Ferguson, 2014). As the qualitative study was exploratory and was not intended to be representative, this is not necessarily a substantial limitation. However it is possible that the way in which participants described their experiences differs from the population at large. Indeed, some of the terminology

56 Anecdotally, it appears that PhD candidates are more likely to complete and share fellow students’ questionnaires among their own online networks. Thus this phenomenon is likely to affect much social science research based on online surveys.
used by participants in the qualitative study appeared to be poorly understood by participants in the quantitative study, possibly due to variation in educational attainment.

In the main quantitative study, participants were randomly recruited in the exhibition galleries of SA Museum over a period spanning the first half of 2013, with the bulk of data collection being carried out over the month of March. This period is peak tourist season in Adelaide\textsuperscript{37}, so the participant sample may not be representative of visitors to SA Museum as whole. Furthermore, as outlined previously, families are under-represented in the sample as they were more likely to decline to participate. Approximately 50\% of the visitors approached agreed to participate and returned a survey. This is response rate is comparable to similar studies, although systematic differences between those who responded and those who refused cannot be excluded.

A methodological limitation of this study is its dependence on self-report measures for both Perceived Atmosphere and visitor experience, with both being based predominantly on Likert scales and semantic differentials (each as seven-point scales). This leads to a risk of method bias: observed relationships are inflated due to similarities in measurement method rather than reflecting true relationships in the concepts being measured. Other sources of method bias are question wording, proximity and context of individual items in a survey (Podsakoff et al., 2012). To some extent, these limitations have been mitigated through triangulations with other approaches such as qualitative interviews, visitor observation and the use of the Experience Measures checklist, which is a distinct type of self-report measure. Furthermore, researching visitors’ own perceptions and experiences necessarily depends on self-report measures of some description. To address potential method bias, future studies could incorporate different kinds of self-report measures, for instance a survey that includes open-ended questions for visitors to complete in their own words. However, this approach has the disadvantage of being more burdensome for participants to complete, along with being more time consuming and complex to analyse.

Practical constraints limited the number of visitors who were both tracked and surveyed. During tracking, visitor behaviour was coded in a more general sense rather than being documented in detail. Conclusions drawn from the tracking results are necessarily tentative although the results indicate areas that may prove fruitful for more detailed investigation using more sensitive measures of visitor behaviour. A further practical constraint was survey length. The survey was designed such that it took most participants 10-15 minutes to complete; this avoids placing an undue time burden

\textsuperscript{37} The Adelaide Festival of Arts and Adelaide Fringe run from late February-late March each year; both are large city-wide events that attract considerable numbers of domestic and international tourists.
on participants as well as increasing the response rate. However, this necessarily limits the number and scope of questions that may be included. In particular, since the focus of research was on Perceived Atmosphere and visitor responses, questions about prior knowledge and motivation for visiting were limited. Furthermore personality factors were beyond the scope of this research. This study has identified a subset of visitors, the Environment Focused visitors, who are more attuned to the exhibition environment and report a more intense experience overall. It is possible this relates to visitor characteristics that were not included in this particular survey; future studies could address this by relating Perceived Atmosphere to personality dimensions such as arousal seeking or openness, aesthetic sensibility, or level of prior design knowledge.

In developing the Perceived Atmosphere Instrument, this study placed a greater emphasis on exploration and description than explanation and prediction. Consequently, the Museum Atmospherics model presented in Figure 6.1 is primarily a descriptive model at this stage of its development. Thus while it relates general attributes of an environment (as represented by Vibrancy, Spatiality and Order) to certain types of visitor engagement in a general sense, it does not explain specific processes and causal relationships. Some of these processes may come to light with future research, although it should also be noted that Perceived Atmosphere has been designed to characterise and compare exhibitions that may be of very different style and content, reminiscent of the way Serrell’s (1998) SRI/%DV measures have been applied to a large number of different exhibitions. In so doing, breadth has been prioritised over depth. Nonetheless, when further specificity and depth is required, Perceived Atmosphere may usefully be used in concert with more detailed approaches that are relevant to specific exhibitions.

6.4.1 Future Research

The Museum Atmospherics model as shown in Figure 6.1 suggests three broad areas for future research:

1. More detailed investigation of the relationship between different exhibition environments/exhibit types and Perceived Atmosphere;
2. Research into how different visitor attributes may influence Perceived Atmosphere and in turn visitor experience;
3. Relating Perceived Atmosphere to a broader range of visitor outcomes.

As previously indicated, the utility of the Perceived Atmosphere Instrument will be enhanced by its use across a broader range of exhibitions and settings than was possible within the constraints of
this study. By increasing the number and variety of environments studied using Perceived Atmosphere, a more detailed understanding of the environment – experience relationship will likely come to light. All the exhibition spaces in this study were primarily object-led in nature, with relatively few immersive or interactive elements. Future research should aim to identify how different exhibit types may influence atmospheric perceptions: for instance dioramas, hand-on interactive exhibits, video installations and quantity of interpretive text.

Although basic visitor attributes such as gender, age and visitor history did not influence Perceived Atmosphere, it is possible that other visitor attributes such as motivation or personality factors may play a role. For instance, as discussed in Section 5.4, this study identified a distinct sub-population of visitors, the Environment Focused (EF) visitors. Constituting over 30% of the total visitor sample, this significant minority warrants future investigation. These visitors appear to be more sensitive to environmental cues, and exhibit a stronger relationship between Perceived Atmosphere and the visitor experience as measured in this study. Future research could identify whether visitor personality, prior motivation or knowledge are capable of predicting whether a visitor is likely to be EF. Similarly, follow-up qualitative interviews with EF visitors as well as visitors who are either Neutral (N) or Not Environment Focused (NEF) may offer interesting insights and points of comparison between the three groups.

Future studies may relate Perceived Atmosphere to a greater variety of visitor outcomes, either as self-report measures or observable behaviours. In particular, visitor behaviour was only explored in a limited sense in this study, and more sensitive measures of observable visitor behaviour and attention could be applied. Furthermore, comparison of spaces anticipated to have different combinations of Vibrancy, Spatiality and Order would be instructive. This study has demonstrated relationships between Vibrancy, Spatiality and the visitor experience, and suggested further hypothetical relationships. However, since all the exhibitions in this study had similar levels of Order, the extent to which Order could be studied as an atmospheric variable was limited. The role of Order in an exhibition setting may become more apparent if environments perceived to be lower in Order are studied.

The Perceived Atmosphere Instrument itself can be refined by further research. The factor structure identified in this study should be confirmed and refined through a Confirmatory Factor Analysis on an independent data set. This would help refine the problematic Theatricality factor, with a possible consequence being that the lighting, traditionality and variety items separate and load onto different factors (e.g. lighting forming part of the Spatiality factor as in the pilot study). Furthermore,
additional factors may come to light with a larger data set: For instance, important constructs such as Vibrancy may be found to comprise two or more sub-dimensions. In addition, items that were not found to load significantly only any of the four factors in this study (eight of the 30 semantic differential terms) may load onto the existing factors or form new ones, improving the overall factor structure and increasing the percentage of variance explained. Alternatively, if those items do not prove useful, other researchers may devise alternatives that improve the original Perceived Atmosphere Instrument.

6.5 Concluding Remarks: Returning to the Personal Narrative

As I look over the results of this study, I inevitably think back to my time as an exhibition planner and ask myself how this body of research would have informed my previous work. Firstly, it reassures me that all those discussions I had as part of a design team about layout, colour palettes and presentation weren’t esoteric debates with little overarching relevance — on the contrary, the exhibition space can be just as much of a communication medium as individual objects, exhibits or text. Therefore it deserves as much careful attention as any other aspect of the exhibition design. And although there is much about the exhibition environment that will inevitably be down to individual taste, disposition or motivation, overall perceptions of an exhibition atmosphere are not unfathomable — at least some aspects of it are measurable and interpretable, as this thesis has shown.

Had the Perceived Atmosphere Instrument existed on that “Day of 1000” 13 years ago, I would have had the means to answer some of the questions I had on that day and in my subsequent career. I imagine that the energy I felt would have translated to a sense of Vibrancy; I suspect there would have been variety in perceptions of Spatiality across the environment; I hope it would have seemed Ordered (but as one of the planners I can hardly be objective, particularly on that last point!).

This research was motivated by intellectual curiosity about the museum experience, but also by the desire to produce something that would be usable to inform the development of future exhibitions. In developing Perceived Atmosphere and studying its implications, I believe I have met this goal.
References


230


Appendix One: Phase 1 Participant Recruitment Questionnaire

1. <<First part of information sheet>>

   I am a Doctoral student at the University of Queensland researching how people perceive and respond to the environment in museum exhibitions. I am interested in how the exhibition environment may influence the visitor experience, both in the way that visitors describe their experiences and how visitors behave in the space (i.e., how long visitors stay in an exhibition and which parts of the exhibition environment they spend the most time in). The research is using a combination of qualitative methods (accompanied visits and follow-up interviews) and quantitative research using questionnaires.

   I am using this online survey to help me recruit a wide variety of people to assist me in my study – including people who visit museums a lot and people who never visit. It should take no more than about 5 – 10 minutes to complete. Please click yes if you are willing to continue to the survey.

   a. Yes
   b. No → Thank and close

2. Please indicate your age range

   a. Under 18 → Close This will lead to a closing statement “Thank you for your interest. However, this study is only open to participants over 18 years of age”
   b. 18-24
   c. 25-34
   d. 35-44
   e. 45-54
   f. 55-64
   g. 65+

3. Please indicate your gender

   a. Male
   b. Female

4. How often do you visit museums, where “museums” includes museums, art galleries and science centres?

   a. At least two or three times a year
   b. About every year or so
   c. About every 2-3 years
   d. Have not visited any in the past three years or more

5. When was the last time you visited the South Australian museum?

   a. Within the past year
   b. Within the past five years
   c. More than five years ago
   d. Have never visited
6. How would you rate your personal knowledge of **design**, including interior design, graphic design, and architecture?
   a. “Professional” level (e.g., holding a design-related qualification and/or working in the design industry)
   b. “Hobby” level (e.g., watching design-related TV programs or reading design magazines, but without any professional involvement)
   c. “Beginner” level (e.g., no particular knowledge or interest in design)

7. How would you rate your personal knowledge of **natural history and anthropology**?
   a. “Professional” level (e.g., holding a qualification in anthropology or the natural sciences, and/or working in this field)
   b. “Hobby” level (e.g., a general interest in nature and human cultures, watching nature programs and reading science magazines)
   c. “Beginner” level (e.g., no particular knowledge or interest in natural history or anthropology)

8. Based on responses to this survey, I will be inviting participants to allow me to accompany them to a visit to the South Australian museum.

*second part of information sheet*

If you agree to participate in this phase of the study, you will join me in visiting up to four exhibitions in the Museum. In each space, I will ask you to “think aloud” your visit, describing what you observe, what attracts your attention and what words you would use to describe the exhibition space we are in. This will be audio recorded and I will also take written notes for future reference. After the visits, we will have a brief follow-up interview to further discuss and reflect on the exhibition visits. This will also be audio recorded and written notes will be taken.

I imagine that the whole process will take approximately one hour. However, this is completely up to you and you can spend as little or as much time as you like participating in this study. Your involvement will be completely voluntary and you can decide to end your participation at any time. Regardless of the duration of your participation, you will receive a $15 gift voucher for the SA Museum shop as a token of appreciation for donating your time and insight to this study.

At no time during or after the survey will any individual response be identified. Your confidentiality is assured throughout the process. This research has been reviewed and approved by the University of Queensland, School of Tourism. If you have any further questions or concerns with this project, please feel free to contact me or my supervisor. Your help is greatly appreciated.

You are welcome to discuss your participation in this study with me (Tel 0404 634 765; email r.forrest1@uq.edu.au) or my academic advisor (Dr Jan Packer, Tel (07) 334 67789; email j.packer@uq.edu.au) or to impose conditions, or withdraw from the study at any time.

If you would like to speak to an officer of the University not involved in this study, you may contact Associate Professor Ian Patterson, Tel (07) 3381 1324; email ian.patterson@uq.edu.au.
Are you interested in participating in the accompanied visits stage of this study as described above?

(a) No → Thank and close
(b) Yes

9) Please provide details so that I can contact you to arrange a convenient time for the accompanied visit. These contact details will be kept confidential and will not be used for any other purpose.
   a) Email address:
   b) Telephone number:

10) Please indicate which days/times are more likely to be convenient for you
   a) Weekends
   b) Weekdays
   c) Mornings
   d) Afternoons

Many thanks for your interest in this project. I will contact you soon.
Appendix Two: Sample Debriefing Interview Transcript

Debrief Interview with “Robyn”, conducted 29th May 2012.

Me: OK, so just to recap, um, we started off in the Aboriginal Cultures Gallery, then the Pacific Cultures Gallery and then the Biodiversity Gallery. Um, how would you sort of um, compare or describe those three different environments?

ROBYN: Um, in . .well, I guess well not in terms of the content but how they, how the visitor will feel in them? [Me: yeah] Well I think that the Aborigine culture was the newest one because the displays were the best explained, um, if you don’t think of the screens, um in the biology section but um, I think that was actually the most interesting one because there is so much explained. So people can, um connect what they see with how they would xxx their own life and it would probably stick better in their own heads so, so I like it the most out of all. And probably second would come the biology and then eventually Pacific Cultures.

Me: Yep. Is that because the, you said the Pacific Cultures Gallery didn’t have a lot of explanation in it, is that, is that what you weren’t quite sure about or was there other things about that that you didn’t like so much?

ROBYN: Well, it, probably just also because it looks, although the roof was really, well it looked new, the the way of presenting it, I like big halls so that’s not the point but having it all on the walls and not having anything to walk around um, it looks boring eventually um, and then of course the missing information. [Me: Yep] So the combination of both.

Me: OK, so when you said it was boring was it because it was too much the same or, ?

ROBYN: Um.. well, basic- well I guess yes.

Me: OK. Hang on a sec. [recording paused due to b/g noise of group] OK recording again after that school group went past. Um, so . .

ROBYN: What I think what I like is if I’m having like small, not case but like intersections to separate topics um, but having an open hall, um just you skim over and see it’s all the same, so, um, that’s not really, well I don’t know [sigh] it looks like the old fashioned museum style and not the
modern museum style to me, and that’s why I think it, you have already this impression had, ‘oh no, they don’t teach me at all anything new’, so you probably don’t bother taking make it really interesting in there. [inaudible]

Me: Um you said that um, I think you commented that both the Aboriginal Gallery and the Biodiversity Gallery were both quite dark [ROBYN: yes] Um, what about the colour schemes in those areas? Was there anything about the colour schemes that sticks in your mind?

ROBYN: Um . . well, I guess it can’t be, it must have been pleasant because otherwise I probably have commented on it. It’s OK, it’s, it’s.

Me: It’s OK. Um, and when you, cause you said that when we were in the Biodiversity Gallery you were quite um, it was quite clear to you when we moved into the Marine Life area. [ROBYN: Yeah] So what was about where we were in? Does it- What did you see that made you think it was the marine life?

ROBYN: Well I think there the colour scheme changed. [Me: uh-huh] So previously it was rather reddish, probably cause of the um dioramas, but then afterwards it was all bluish. But I could not have seen the actually change from the desert to the forest area, there was nothing much of difference, to me.

Me: Mm-hmm. Um and you said that the dioramas, I think you said that they weren’t like a real, not a proper diorama. Er cause without the background or anything like that.

ROBYN: Well, the dioramas… a proper diorama should look different and all those people I know do not like the proper diorama um because it looks too old-fashioned . . .um, so, but the, if if they want to have a nature like situation, that wouldn’t- they didn’t have enough room so they have to put a lot of animals in one diorama I can understand that but, I think the most, annoying point for me is the missing background [Me: yep] Um so a diorama in terms what I know is you have, have the area where the animals are displayed and then y- it actually goes, over um in a curve to the background and then the colour scheme will, oh not the colour scheme but um, will have the impression that it’s it’s like you can see the horizon at the end. [Me: mm-hmm] And then you can’t
see, the edges of the walls but it’s all curved in. That’s what I like in a diorama [Me: uh-huh] but I don’t see it often.

Me: Yep OK. Um how do the spaces that you’ve been to today how do they compare to say other museums you’ve been to cause you said you’ve been to a few others in the past.

ROBYN: Yep. Um . . I like the one in the Aborigine culture the most it has, well um it has the right, distance between the displays, um, that you’re comfortable if there’s someone standing in front of one you can comfortably walk around um, so I felt comfortable there, it was definitely too open in the Pacific one and then for some reason not enough room in the Biodiversity [Me: mm-hmm] area. I felt, not that I felt um, claustrophobic but it was, was sometimes a little bit, well not enough room in this section. [Me: yeah, OK] . . and well, I haven’t been to other Aborigine art or culture exhibitions so far [laugh] so I can’t compare that one but I know that ideally I would have more, definitely much more room in the biodiversity. Want to pause? [Me yep] [Recording paused while group goes past]

Me: Recording again. Um so is there any sort of final observations or comments that you’d like to make?

ROBYN: Um, well I realise that I still have not seen all of these parts of the museum yeah so I’ll have to come back and take some time to go through it, once again um, and well, try to read all, well, there are certain things I’m interested in doing more information about other things, so yep, um . . that’s about it.

Me: OK, thank you very much. [recording stops]

*Duration of this section of interview: 7 mins 44 sec.*
Appendix Three: Atmosphere and Experience Questionnaire

(see overleaf)
Museum Experiences Survey

Participant Consent and Research Ethics Statement
This survey is part of a doctoral research project that has gained ethics approval from the School of Tourism at the University of Queensland. Your responses will remain completely anonymous. Further details of the study are given in the Participant Information Sheet provided. Thank you for agreeing to participate in this research. The survey will take approximately 10-15 minutes to complete. Remember your participation in this study is completely voluntary and you may withdraw at any stage.

Survey Instructions
For each question, please indicate your response by filling in the applicable circle as shown:

Choose the circle which is closest to your desired response – please do not put responses in intermediate positions between the circles.

If you make a mistake, put a cross through the incorrect response and fill in another circle:

Please note that there are questions on BOTH SIDES of the paper.
First, please consider your surroundings (the exhibition space, not the whole museum). Note your impressions of the exhibition ‘space’ and its features. Concentrate on the layout and general atmosphere of the space, not the specific content of individual exhibits.

Please describe the characteristics of this environment by choosing one of the circles between each word pair below. The more appropriate a certain word seems, the closer the circle you should choose. If you think neither of the words in a given pair applies, please choose the circle at the mid-point.

<table>
<thead>
<tr>
<th>Mid-point</th>
<th>Dark</th>
<th>Structured</th>
<th>Traditional</th>
<th>Spacious</th>
<th>Varied</th>
<th>Organised</th>
<th>Dynamic</th>
<th>Wide</th>
<th>Vibrant</th>
<th>Evenly lit</th>
<th>Hard</th>
<th>Linear</th>
<th>Warm</th>
<th>Ordinary</th>
<th>Flat</th>
<th>Open</th>
<th>Simple</th>
<th>Subdued</th>
<th>Flowing</th>
<th>Old</th>
<th>Hidden</th>
<th>Cluttered</th>
<th>Colourful</th>
<th>Dramatic</th>
<th>Active</th>
<th>Ordered</th>
<th>Cosy</th>
<th>Energetic</th>
<th>Symmetrical</th>
<th>Small scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td></td>
<td>Unstructured</td>
<td>Modern</td>
<td>Confined</td>
<td>Repetitive</td>
<td>Random</td>
<td>Static</td>
<td>Narrow</td>
<td>Dull</td>
<td>Targeted lighting</td>
<td>Soft</td>
<td>Winding</td>
<td>Cool</td>
<td>Striking</td>
<td>3-Dimensional</td>
<td>Enclosed</td>
<td>Complex</td>
<td>Bright</td>
<td>Discontinuous</td>
<td>New</td>
<td>Obvious</td>
<td>Uncluttered</td>
<td>Neutral</td>
<td>Plain</td>
<td>Passive</td>
<td>Jumbled</td>
<td>Formal</td>
<td>Serene</td>
<td>Asymmetrical</td>
<td>Large scale</td>
</tr>
</tbody>
</table>
Now consider the following statements. Indicate how much you agree with each of them by choosing the appropriate circle.

### It is enjoyable to spend time in this environment.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### When looking around this exhibition, I’m not sure where to start or where to go next.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### This exhibition’s design helps spark my interest.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### This environment really invites me to explore it.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### This environment engages all my senses.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### This exhibition’s design and layout help me make sense of what the exhibition is about.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### This exhibition provides enough options to choose from.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### It’s hard to focus on any one particular object or display because there is so much here.
### This exhibition is logically presented.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

### I had a worthwhile experience in this exhibition.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

### My attention was focused while in this exhibition.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

### I sometimes found myself so absorbed I lost track of time.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

### It takes a lot of effort to stay focused on this exhibition.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

### I don’t really pay attention to the exhibition environment – I just like to look at the exhibits.

<table>
<thead>
<tr>
<th>Disagree strongly</th>
<th>Disagree</th>
<th>Disagree slightly</th>
<th>Neither agree nor disagree</th>
<th>Agree slightly</th>
<th>Agree</th>
<th>Agree strongly</th>
</tr>
</thead>
</table>

---

Survey continues – please turn the page →
Please consider how being in this exhibition space makes you feel. Use the word pairs to describe how you think *this exhibition environment* might affect the way you feel.

For instance, for the first pair: *Less Interested - More Interested*. If you think this environment will make you feel much less Interested in looking at the exhibits, choose the circle closest to the left. If you think it will make you feel much more Interested in looking at the exhibits, choose the circle closest to the right. If you think it will have no effect at all on how Interested you feel in viewing the exhibits, choose the ‘Neutral’ circle in the middle.


*Survey continues – please turn the page ➔*
Please indicate which of the following words or phrases best describe what you experienced today in this exhibition (fill in all that you experienced more than you would in your everyday life):

**I felt:**
- Sociable
- Privileged
- Deep in thought
- Alert
- Honoured
- Active
- Thoughtful
- Refreshed
- Attentive
- Excited
- Concerned for nature
- Overloaded
- Connected spiritually
- Independent
- Energetic
- Concerned for others
- Reflective
- Reverent
- Relaxed
- Fascinated
- Mobile
- Amazed
- Stressed
- Connected spiritually
- Thoughtful
- Refreshed
- Attentive
- Excited
- Concerned for nature

**I experienced a sense of:**
- Fulfilment
- Nostalgia
- Respect
- Grandeur
- Wonder
- Choice
- Togetherness
- Beauty
- Community
- Companionship
- Connection to the past
- Accomplishment
- Worship
- Appreciation of objects
- Growth
- Deciding
- Fellowship
- Self-discovery
- Enjoyment
- Pondering
- Elation
- Sacredness
- Concentration
- Attachment
- Aesthetic appreciation
- Connection with nature
- Compassion
- Connection with objects
- Self-actualisation

**It engaged me:**
- Spiritually
- Physically
- Mentally

**It engaged my:**
- Senses
- Imagination
. Which of the following statements best describes the main purpose of your visit to the museum today? (Please choose ONE ONLY)

- To see things I have a particular interest in
- To satisfy a general interest or curiosity
- To take time out from the stresses of daily life
- To accompany my children/partner/friends
- Because it is one of the city’s main attractions

Please indicate your age range:

- 18-29
- 30-39
- 40-49
- 50-59
- 60+

Please indicate your gender:

- Male
- Female

How often do you visit this museum?

- This is my first ever visit to this museum
- This is my first visit in over 5 years
- I have visited this museum 1-2 times before in the past 5 years
- I have visited this museum 3-5 times before in the past 5 years
- I have visited this museum more than 5 times in the past 5 years

Approximately what time did you arrive at the museum today? ____________

Which of the following best describes who you are here with today?

- Alone
- With children/family (i.e., including at least one child aged under 16)
- With another adult/adult group (i.e., friends, relatives aged 16 and over, spouse)

Thank you for participating! Please return this survey to the researcher.
Appendix Four: Visitor Tracking Sheets

The following three pages show the gallery plans that were used to mark visitor patterns of visitor movement during the tracking and timing of visitors in Aboriginal Cultures, Pacific Cultures and Biodiversity Galleries respectively.
### AACG Level 1: Visitor Observation and Tracking Sheet

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Arrival</th>
<th>Time spent</th>
<th>Gender, Est Age</th>
<th>Group composition</th>
</tr>
</thead>
</table>

| 1    | 2               | 3          | 3a              | 4                 |
| 5    | 6               | 7          | 8               | 9                 |
| 10   | 11              | 12         | 13              | 14                |
| 15   | 16              | 17         | 18              | 19                |
| 20   | 21              | 22         | 23              |                   |
### Pacific Cultures Gallery – Visitor Observation and Tracking Sheet

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of Arrival</th>
<th>Time spent</th>
<th>Gender, Est Age</th>
<th>Group composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 – Milne Bay/Totems  
2 – PNG 1-2  
3 – PCG Graphic  
4 – 3 Women Display  
5 – PNG 3-5  
6 – Video 1  
7 – Vanuatu 1-2  
8 – Video 2  
9 – Spirits of Vanuatu  
10 – SAM/Pacific GP  
11 – New Caledonia  
12 – Lime spoons  
13 – PNG / NZ  
14 – Fiji 1-4  
15 – Video 3  
16 – Pac. Changes GP  
17 – Fiji 5-6  
18 - Fishing  
19 - Sulka  
20 – Play ppl power  
21 – New Ireland 1-2  
22 – New Britain 1-2  
23 – Solomon Is 1-2  
24 – Massim Hut  
25 – Kula Canoe  
26 – Treasures  
27 – Solomon Is 3  
28 – Manus Province  
29 – PNG 6-8  
30 – Tall display case
### SA Biodiversity Gallery: Visitor Observation and Tracking Sheet

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of Arrival</td>
</tr>
<tr>
<td>Time spent</td>
</tr>
<tr>
<td>Gender, Est Age</td>
</tr>
<tr>
<td>Group composition</td>
</tr>
</tbody>
</table>

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 28a | 28b | 29 | 30 | 31 | 32 | 32a | 33 | 34 | 35 | 36 |
Appendix Five: Participant Information and Consent Forms

(see overleaf)
Dear Respondent,

I am a Doctoral student at the University of Queensland researching how visitors perceive and respond to the museum exhibition environment. I am interested in how the exhibition environment may influence the visitor experience, both in the way that visitors describe their experiences and how visitors behave in the space (i.e., how long visitors stay in an exhibition and which parts of the exhibition environment they spend the most time in). The research is using a combination of qualitative methods (accompanied visits and follow-up interviews) and quantitative research using questionnaires.

If you agree to participate in this study, you will join me in visiting up to four exhibitions in the North Terrace precinct of Adelaide. In each space, I will ask you to “think aloud” your visit, describing what you observe, what attracts your attention and what words you would use to describe the exhibition space we are in. This will be audio recorded and I will also take written notes for future reference. After the visits, we will have be a brief follow-up interview to further discuss and reflect on the exhibition visits. This will also be audio recorded and written notes will be taken.

I imagine that the whole process will take approximately one hour. However, this is completely up to you and you can spend as little or as much time as you like participating in this study. Your involvement is completely voluntary and you can decide to end your participation at any time.

Regardless of the duration of your participation, you will receive a $15 gift voucher for the SA Museum shop as a token of appreciation for donating your time and insight to this study.

At no time during or after the survey will any individual response be identified. Your confidentiality is assured throughout the process. This research has been reviewed and approved by the University of Queensland, School of Tourism. If you have any further questions or concerns with this project, please feel free to contact me or my supervisor. Your help is greatly appreciated.

You are welcome to discuss your participation in this study with me (Tel 0404 634 765; email r.forrest1@uq.edu.au) or my academic advisor (Dr Jan Packer, Tel (07) 334 67789; email j.packer@uq.edu.au) or to impose conditions, or withdraw from the study at any time.

If you would like to speak to an officer of the University not involved in this study, you may contact Associate Professor Ian Patterson, Tel (07) 3381 1324; email ian.patterson@uq.edu.au.
PERSONAL INTERVIEW CONSENT FORM

Name of Project: Design Factors in the Museum Visitor Experience
Investigator: Ms Regan Forrest (PhD Candidate, University of Queensland)

Please read the points below and sign in the space below to provide your informed consent to participate in the accompanied visits and interview.

- You will not be identified in the study or final report. Quotations from interview transcripts, if used, will be attributed to a pseudonym such that your anonymity is maintained.
- Your responses will be confidential and any information provided will only be used for the purposes of this research.
- You are free to withdraw from the interview at any time without penalty.
- You agree to the audio recording of this interview.
- You will receive no financial benefits for your participation beyond receipt of a $15 gift voucher as described in the information sheet.

I __________________________________________ have read and understand the material provided in the information sheet and this informed consent sheet and agree to participate in this interview.

Signed ______________________

Date: ______________________
Dear Respondent,

I am a Doctoral student at the University of Queensland researching how visitors perceive and respond to the museum exhibition environment. I am interested in how the exhibition environment may influence the visitor experience, both in the way that visitors describe their experiences and how visitors behave in the space (i.e., how long visitors stay in an exhibition and which parts of the exhibition environment they spend the most time in). The research is using a combination of qualitative methods (accompanied visits and follow-up interviews) and quantitative research using questionnaires.

If you agree to participate in this study, please complete the attached questionnaire about your experience in the exhibition space you are currently in/have just departed. It will take you approximately 10-15 minutes to complete. No personal details will be collected as part of the survey so your responses will remain anonymous.

As a thank you for your participation you will receive a voucher for a free hot beverage at the Balaena Café in the South Australian Museum.

At no time during or after the survey will any individual response be identified. Your confidentiality is assured throughout the process. This research has been reviewed and approved by the University of Queensland, School of Tourism. If you have any further questions or concerns with this project, please feel free to contact me or my supervisor. Your help is greatly appreciated.

You are welcome to discuss your participation in this study with me (Tel 0404 634 765; email r.forrest1@uq.edu.au) or my academic advisor (Dr Jan Packer, Tel (07) 334 67789; email j.packer@uq.edu.au) or to impose conditions, or withdraw from the study at any time.

If you would like to speak to an officer of the University not involved in this study, you may contact Associate Professor Ian Patterson, Tel (07) 3381 1324; email ian.patterson@uq.edu.au.